Mental accounting and public choice

by

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A thesis submitted in partial fulfilment of the requirements for the degree of

Doctor of Philosophy in Behavioural Science

University of Warwick, Warwick Business School

April 2017

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Acknowledgements

First and foremost, I would like to express my deepest and most sincere thanks and appreciation to Professor Daniel Read who spent countless hours mentoring, advising and supporting me since the early days of my MSc dissertation project until the last days of my PhD journey. I honestly could not have hoped for a better supervisor, mentor and friend.

My utmost thanks and appreciation goes to Dr. Andrea Isoni whose suggestions, comments and feedback were critical in shaping this work and pushing it forward. I cannot express enough how grateful I am to have had Andrea as a supervisor.

I would also like to express my thanks in advance to my two examiners Professor Ivo Vlaev and Marc Scholten, Associate Professor with Habilitation. Their invaluable comments helped improve the quality of this work tremendously.

A special thanks to my parents Khalil and Nancy; to my lovely, wonderful and exceptional partner Ghina; and to my cousins and lifelong companions Adel and Salem, for their continuous support throughout this PhD journey. Your thoughts of encouragement and inspiration made it easier for me to endure some difficult times over the past four years.

Finally, I would like to express my sincere gratitude to Mr. Jim Roberts whose generous donation to the WBS Behavioural Science group helped fund my tuition and research. I would also like to express my gratitude to Professor Nick Chater who arranged for additional funding to cover a gap in my scholarship.

Declaration

This thesis is submitted to the University of Warwick in support of my application for the degree of Doctor of Philosophy. It has been composed by myself and has not been submitted in any previous application for any degree.

Abstract

Evidence from the consumer behaviour literature show that people like private costs to either precede or occur at the same time as the benefits. No one wants to pay for a vacation after it has become a memory, or a dishwasher after it has gone to the tip. Likewise, no one wants to work for a salary that has already been spent. It is likely that similar preferences exist for communal expenditures.

With this in mind, this thesis presents a series of studies into how ordinary citizens make (or want to make) communal financial decisions (i.e. cost-benefit trade-offs). The aim is to learn if people's communal preferences are similar to their personal preferences; and if the prospective double-entry mental accounting model (Prelec & Loewenstein, 1998) – a well-supported theory of individual preferences – can explain these communal preferences.

Eight studies (six communal and two personal) confirmed that people use similar mental rules to the ones prescribed by the double-entry model to make financial choices on a communal (and personal) level. That is, people prefer to have the communal costs to either precede or occur at the same time as the benefits; and when either is not possible, to minimise the temporal distance between the two. These preferences are observed for monetary gains and losses; for decisions that have a direct impact on the decision maker, or no impact at all; and for choices made between and within participants.

These findings provide valuable insights for policy makers who are keen to design public finance policies that are efficient and have public support.

1 CHAPTER ONE

Even the strongest opponents of public engagement in policy-making agree that public opinion matters. Especially in areas of great significance to citizens and households such as their taxes and government benefits (McCaffery & Baron, 2006). In fact, policy makers consistently respond to shifts in public opinion (e.g. Burstein, 2003; Stimson, MacKuen & Erikson, 1995; Wlezien, 2004), and in recent times have been trying to engage ordinary citizens in areas of policy making, through consultation and active participation (e.g. popular referenda, participatory budgeting, citizen representation on government commissions and panels). For instance, the Canadian Department of Finance has an online pre-budget consultation forum in which ordinary citizens share their opinions about various spending programmes before setting the country's annual budget[1]. Likewise, many UK cities and counties arrange annual budget consultations to get the opinions of residents on different spending programmes.

Particularly interesting is the rising popularity of *participatory budgeting*, a process in which ordinary citizens decide how to allocate part of their municipal or public budget across spending programmes (Shah, 2007; Tanaka, 2007). Participatory budgeting originated in Porto Alegre, Brazil in 1989, and has since spread to more than 100 European cities (Sintomer, Herzberg & Rocke, 2008) and1,500 localities around the world (Ganuza & Baiocchi, 2012). Most recently the city of New York[2]. Therefore, now more than ever, ordinary citizens in different parts of the world are taking active roles in deciding how and (possibly when) their taxes are spent, and government benefits distributed.

There are numerous benefits for engaging ordinary citizens in the process of setting municipal and public budgets, and more generally in deciding public finance policies. It improves accountability and transparency (Boulding and Wampler, 2010), increases trust in public institutions (Novy & Leubolt, 2005; Goldfrank, 2007), promotes better allocation of resources (Baiocchi 2003; Schneider & Goldfrank, 2002), and reduces tax evasion (Feld & Frey, 2007; Lamberton, 2013; Torgler & Schneider, 2009).

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[1] http://www.fin.gc.ca/n16/16-002-eng.asp
[2] http://pbnetwork.org.uk/67000-people-vote-in-pb-new-york-2016/

However, there are also risks. People regularly make decisions and choices (financial and otherwise) that deviate systematically from the ideal principles of rationality (Simon, 1955; Kahneman, 2003). Decades of experimental research in psychology, economics, cognitive and behavioural science have provided a long list of evidence showing that people are vulnerable to a wide range of biases (e.g. framing effect, anchoring, endowment effect, present-bias, projection bias), and often use heuristics (mental shortcuts) that lead to inconsistent judgements, decisions and choices (e.g. Bernatzi & Thaler, 2007; Gilovich, Griffin & Kahneman, 2002; Kahneman & Tversky, 1984; Tversky & Kahneman, 1975). This has prompted many to question the consistency of people's preferences on policy issues, especially those concerning public budgeting and public finance (e.g. Berinsky, 1999; Citrin, 1979; Jones, 1994). In fact, McCaffery and Baron (2006) documented several instances in which individuals revealed inconsistent judgments and evaluations of public finance systems (also Hill, 2010; McCaffery & Slemrod, 2006). For example, participants were more likely to prefer progressive tax rates (as opposed to flat or regressive ones) when the choices were framed as percentages rather than amounts (McCaffery & Baron, 2003); were more likely to prefer tax policies that were stated using a "bonus" frame as opposed to a "penalty" frame, even when the final outcome was the same (McCaffery & Baron, 2004a; analogous to the framing effect demonstrated by the "Asian disease problem" in Tversky & Kahneman, 1981); and revealed different preferences for levies labelled as "taxes" as opposed to "payments" across different spending programs – for some programs they revealed a preference for the tax label, for others the payment label (McCaffery & Baron, 2004b).

Biases and heuristics can be costly, especially now that ordinary citizens are becoming more involved in public finance decisions. But, they also present an opportunity for policy makers to design policies that are efficient and have public support. To that end, it is imperative for policy makers to understand people's preferences over public finance. In particular, preferences concerning the use of taxes or debt to pay for communal expenditure; and the distribution of shared benefits over time. For instance, would people support an increase in taxes or debt to pay for additional expenditure? And would the households of a community that is going to be affected by an adverse event prefer to receive compensation sooner or later? To illustrate the latter, the UK government has recently announced plans to create a shale wealth fund that will set

aside 10% of the tax proceeds from shale gas production to compensate communities where the gas wells are hosted. A consultation with affected individuals and local communities has been initiated to determine (among other things) the purpose of the fund, the amount of financial benefits received by households, and the distribution of these benefits over the lifetime of the project[3].

To learn about these preferences, one could use observational data such as surveys, polls, etc. (e.g. Hanson, 1998; Mueller, 1963; Soroka & Wlezien, 2005), or develop a normative model to predict them. However, both these approaches have limitations. Observational studies tend to be inconsistent, and are incapable of providing insights about the psychology of choice; while normative models assume that people are self-interested and rational.

In light of these limitations, and the absence of a descriptive public finance model to answer these questions, the alternative is to examine the existing psychological models of choice for similar decisions in the personal finance domain. In particular, decisions involving trade-offs between costs and benefits that will take place at different points in time. Such decisions have typically been discussed using a *mental accounting* framework, a set of cognitive operations used by individuals to organise, evaluate, and keep track of financial activities (Thaler, 1999).

Two psychological models related to mental accounting have been proposed to evaluate, explain and predict cost-benefit trade-offs of personal financial decisions: the hedonic editing hypothesis (Thaler, 1985, 1999), and the prospective double-entry mental accounting (henceforth "double-entry") model (Prelec & Loewenstein, 1998).

Thaler's (1985) hedonic editing hypothesis builds on the *value function* from prospect theory (Kahneman & Tversky, 1979) to explain and predict how people mentally integrate or segregate (i.e. edit) two or more financial outcomes, in order to optimise their hedonic wellbeing. The model suggests that people a) segregate multiple gains, b) integrate multiple losses, c) integrate small losses with lager gains, or large losses with slightly smaller gains (the "cancellation effect"), and d) segregate very small gains from large losses (the "silver lining" principle). It is not clear to what extent

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3 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/544241/shale_wealth_fund_final_pdf-a.pdf

people engage in hedonic editing (i.e. reframing of events) when making financial decisions. For instance, if gaining £100 then loosing £80 feels worse than gaining £20 (as the model predicts and empirically verified by Thaler, 1985), then individuals should theoretically be able to mentally reframe the former to look like the latter. This limitation has led Thaler (1999) to conclude that hedonic editing is theoretically appealing but descriptively cannot be correct (further limitations are discussed in Chapter 2).

Prelec and Loewenstein (1998) proposed a more elaborate model to analyse cost-benefit trade-offs. According to this model, the decision to make a purchase is a two-way hedonic interaction between the pain of paying and the pleasure of consumption. That is, thinking about the cost of a purchase invokes painful thoughts that can undermine the pleasure derived from consumption, while thinking about the benefits can buffer the pain incurred by the payments. As a result, the model predicts a strong *debt-aversion* defined as a preference to prepay for consumption, and to receive payments for work that has been performed. These predictions are built around three mental accounting rules: a) *prospective accounting* which describes how a sequence of consumption and payment episodes interact to determine a person's hedonic experience; b) *coupling*, which refers to the degree to which the payments bring to mind thoughts about the benefits of consumption, and vice versa; and c) *prorating* which assigns residual payments to residual consumption, and vice versa.

While mainly discussed in terms of purchase behaviour, Prelec and Loewenstein posited that the theory also applies to situations involving labour effort in exchange for earnings[4]. Studies exploring preferences for financing personal consumption have in general supported the predictions of the double-entry model (e.g. Ariely & Silva, 2002; Auh & Shih, 2006; Auh, Shih & Yoon, 2008; Hirst, Joyce, & Schadewald, 1994; Knutson et al., 2007; Patrick & Park, 2006; Prelec & Loewenstein, 1998; Soman & Gourville, 2001).

With this in mind, this thesis, presents a series of studies into how ordinary citizens make (or want to make) communal financial decisions. The aim is to learn whether their communal preferences are similar to the ones they would have if deciding for

[4] Such that negative payments refer to earnings, and negative consumption refers to work

themselves as individuals, and specifically ask if the double-entry model – a well-supported theory of individual preferences – can explain these communal preferences.

The remainder of the thesis is organised as follows:

Chapter 2 reviews evidence from the consumer behaviour literature concerning preferences for financing personal consumption, then formally presents the two mental accounting models discussed above.

Chapter 3 presents three studies that explore preferences for financing nonrecurring communal expenditure, using taxes or public debt. Specifically, these studies explore preferences for the timing of payments (losses) when the benefits from communal expenditure are either short-lived or long lasting; and when the long lasting benefits either accrue in the near or distant future.

Chapter 4, presents two studies that examine preferences for the timing of monetary gains and losses in exchange for communal services (i.e. cost-benefit trade-off) that could either take place in the near or distant future. The studies also compare trade-offs that have a direct impact on the decision maker, or no impact at all (i.e. decisions made on behalf of the decision maker's community, or other communities).

Chapter 5 presents three studies (two personal and one communal) designed to test preferences for the timing of monetary outcomes, for all possible combinations of cost-benefit sequences.. In addition, the chapter explores how people with different attitudes towards debt (elicited using a novel diagnostic tool developed by Scholten and colleagues) evaluate these cost-benefit trade-offs.

Finally, Chapter 6 concludes the thesis and provides direction for future research.

Taken together, these studies suggest that people prefer communal costs to either precede or occur at the same time as the benefits; and when either is not possible, to minimise the temporal distance between the two. These preferences are observed for monetary gains and losses; for decisions that have a direct impact on the decision maker, or no impact at all. These findings suggest that communal financial decisions are motivated by the same mental accounting rules that people use to make personal ones. In particular, the rules prescribed by the double-entry model (e.g. prospective

accounting / coupling). Therefore, providing a descriptive theory for policy makers to adhere to when designing public finance policies.

2 CHAPTER TWO

2.1 Preferences for financing private consumption

Studies exploring preferences for financing prospective consumption reveal a strong tendency among consumers to prepay for nondurable goods, and to temporally align the timing of payments with the benefits of durable ones (e.g. Auh & Shih, 2006; Auh, Shih & Yoon, 2008; Hirst, Joyce, & Schadewald, 1994; Patrick & Park, 2006; Prelec & Loewenstein, 1998).

For example, most of the participants (82%) in Hirst et al. (1994) were willing to borrow to pay for some furniture, but not for a two-week vacation. They were also more likely to accelerate the payment of an existing loan if the financed goods no longer provided any utility (e.g. a broken TV that can't be repaired), and more likely to incur additional costs to ensure that the duration of a loan does not exceed the useful life of a durable good.

Building on these findings, Prelec and Loewenstein (1998) investigated the interaction between preferences for the timing of payments and duration of consumption. They asked participants whether they prefer to prepay or delay the payments for: i) a one-week vacation, ii) some miscellaneous living expenses during a brief and fully anticipated period of unemployment, and iii) a washer-dryer. The majority said they would prefer to prepay for the nondurables, with 63% choosing so for the vacation, and 70% for the miscellaneous living expenses. In contrast, 76% chose to delay the payments for the durable washer-dryer.

Patrick and Park (2006) pointed out that only brief but highly enjoyable goods such as a vacation (i.e. nondurable hedonic good) would elicit a strong preference for prepayment. This hypothesis was tested in two studies. The first evaluated the separate effects of type (hedonic vs. utilitarian) and durability (durable vs. nondurable) of different products on the timing of payments[5], while the second evaluated the effects of consumption goal (hedonic vs. utilitarian) and durability (single-use vs. multiple-

[5] A one-week vacation (nondurable hedonic), a washer-dryer (durable utilitarian), pest-control services (nondurable utilitarian) and a home entertainment system (durable hedonic).

use) of a single product[6]. In both studies, participants revealed a higher tendency to prepay for the short-lived (nondurable or single-use) hedonic goods compared to the other type-durability combinations.

Finally, Auh and Shih (2006) and Auh, Shih and Yoon (2008) found that the pattern of payments and consumption episodes are also relevant in determining individual preferences for financing consumption. Both studies show that participants preferred constant payment streams to pay for goods that provide an ongoing constant stream of benefit, like furniture, but to accelerate the payments of highly depreciating goods like high-tech products even when the two streams of payments had the same net present value.

Taken all together, these studies reveal three stylised facts: a) people are strongly averse to the idea of using debt to pay for nondurable goods; b) they dislike paying for durable goods that no longer provide any benefits; and c) they prefer to match the pattern of payment and benefit streams of durable goods.

All three facts violate the predictions of the standard economic theory that decisions concerning the timing of payments should be *independent* of the type and durability of consumption, and that individuals should be making these decisions to minimise the net present value of costs. However, these facts can be accounted for by the hedonic editing hypothesis (as suggested by Hirst et al., 1994), and the double-entry model (as proposed by Prelec & Loewenstein, 1998).

2.2 The hedonic editing hypothesis

According to Thaler (1985), people evaluate the utility experienced from multiple monetary outcomes in a way that is consistent with the *value function* from prospect theory[7] (Kahneman & Tversky, 1979); and as a consequence, engage in what is referred to as *hedonic editing* – the act of integrating or segregating two or more financial outcomes to improve one's overall wellbeing. For instance, mentally

[6] Participants were told that they will be going on a one-week trip to Paris either for business or pleasure, and that they would be making the trip either once or three times.

[7] The value function has three distinctive features. One, reference dependence – prospects are assessed in terms of gains and losses relative to a reference point. Two, diminishing sensitivity – it is concave for gains and convex for losses producing an S-shaped curve. Three, loss aversion – it is steeper for losses than for gains.

integrating a £100 tax rebate with a £75 speeding ticket "as if" it was only a £25 tax rebate feels better since losses loom larger than gains (i.e. for any concave function of utility, $u(100) + u(-75) < u(25)$).

Specifically, the model makes predictions about preferences to integrate or segregate sequences of monetary outcomes x and y when: a) x and $y > 0$ (multiple gains); b) x and $y < 0$ (multiple losses); c) $x > 0$ and $y < 0$ such that $x + y > 0$ (mixed gain); and d) $x > 0$ and $y < 0$ such that $x + y < 0$ (mixed loss).

Therefore, given the shape of the value function, the model predicts a preference to: a) segregate multiple gains because of the concavity of the gains function; b) integrate multiple losses because of the convexity of the loss function; c) integrate large gains with smaller losses to offset loss aversion; and d) integrate large losses with slightly smaller gains (the "cancellation effect"), and to segregate large losses from very small gains (the "silver lining" principle).

These predictions are based on the assumptions that: a) outcomes are evaluated using the prospect theory value function; b) individuals are value maximisers who *actively* integrate and segregate outcomes to enhance their overall hedonic experience; c) mental integration is enabled by *temporal contiguity*, the association formed between two outcomes when these outcomes occur within a short period of time (Einhorn & Hogarth, 1986); and d) mental segregation is facilitated by *temporal separation*, the spacing of outcomes over time.

Assumptions c and d are particularly important for testing the predictions of the hedonic editing hypothesis as these are presumed to be the means by which individuals can reveal their preferences to integrate or segregate multiple outcomes (Thaler & Johnson, 1990; Linville & Fischer, 1991). Therefore, when segregation is preferred the decision maker will actively choose to temporally separate the financial outcomes, but when integration is preferred he or she will choose to experience these outcomes concurrently or within a short period of time.

Empirical tests by Thaler and Johnson (1990) supported the predictions of the model concerning a) the segregation of multiple gains, b) the integration of larger gains with smaller losses, c) the cancellation effect, and d) the silver lining principle. However, the tests also revealed a preference for the segregation of multiple losses. As a result, Thaler and Johnson proposed a quasi-hedonic editing hypothesis which takes into

account people's sensitivity to multiple losses experienced within a short period of time. In other words, the model assumes that individuals need some time to desensitise the pain of a loss before experiencing a subsequent one. This is consistent with the renewable resource model that Linville and Fischer (1991) proposed as an alternative to analyse similar decisions. According to the model, people have limited *gain-savouring* and *loss-buffering* resources that are depleted when someone experiences positive or negative events in close temporal proximity. However, these resources are naturally regenerated over time. As a result, the model predicts a preference to temporally separate outcomes consisting of multiple gains or multiple losses to replenish the depleted resources; and to integrate mixed outcomes because gains replenish the available loss-buffering resources.

So how can the hedonic editing hypothesis explain the financing preferences observed in the experimental studies mentioned above? Hirst et al. (1994), who used the model as a framework to make predictions about consumer borrowing decisions, assumed that payments for consumption purchased on credit are coded by consumers as losses, while benefits derived from consumption are coded as gains. Furthermore, they assumed that the experienced consumption utility from a voluntary purchase exceeds the disutility from the payments. Accordingly, Hirst el al. (1994) argued that any purchase made on credit resembled a mixed gain outcome. Consequently, they proposed, following the predictions of the HE hypotheses, that consumers favour financial choices that allow them to integrate the repayments with the consumption benefits.

Specifically, Hirst el al. (1994) predicted that consumers prefer to use credit to purchase durable goods since the disutility associated with the payments will be offset by the consumption utility; and savings to pay for nondurable ones because purchasing nondurables on credit implies that payments will be experienced in the absence of any benefits. They also predicted a preference to accelerate payments of highly depreciating goods since the larger earlier payments are offset by the high upfront consumption utility. Lastly, they predicted a preference to fully repay loans of goods that no longer provided any utility in order to mentally close that account.

While Hirst et al.'s intuition concerning people's financial preferences was sound, their utilisation of the hedonic editing hypothesis as model to predict these preferences

has three major shortcomings. One, there is some question as to whether payments given up in exchange for consumption are perceived as losses, since money is typically held to achieve that purpose (Novemsky & Kahneman, 2005). Novemsky and Kahneman (2005) used Kahneman, Knetch and Thaler's (1990) endowment paradigm[8] to show that the willingness of buyers to pay (WTP) for a given good is equivalent to the minimum amount of money choosers prefer in lieu of receiving that good, but significantly less than the amount of money that sellers were willing to accept (WTA) to give it up (i.e. Buyers' WTP = Choosers' Choice Equivalence < Sellers' WTA).

In addition, their study revealed that the willingness of risky buyers' to pay for a gamble that gives them an opportunity to keep their money and receive the good was significantly lower than that of riskless buyers. That is, in contrast to riskless buyers, risky buyers experienced loss aversion for the money they were giving up. Conversely, risky sellers' prices - those who agreed to enter a gamble for an opportunity to retain the good and gain an amount of money - did not differ from riskless ones (i.e. both groups experienced similar magnitudes of loss aversion).

Two, the hedonic editing hypothesis does not take into account preferences for sequences of outcomes. In fact, the model predicts that someone who prefers to receive £20 instead of receiving £100 then loosing £80, will also prefer £20 to loosing £80 then receiving £100. However, Ross and Simonson (1991) who studied these types of choices found a preference for integration when the gain preceded the loss, but a preference for segregation when the loss preceded the gain – an outcome they referred to as a "preference for happy endings". More recently, Hoelzl, Kamleitner and Kirchler (2011) investigated whether the sequence of a loan repayment plan (falling, constant or rising) mattered when financing products with an ongoing utility stream (e.g. a car). There findings revealed a stronger preference for the falling and constant profiles even when the rising profile was financially superior. In other words, participants preferred the improving sequence to the declining one – a preference that

[8] The original endowment effect study had three conditions: seller, buyers and choosers. The sellers were endowed with a good (e.g. a mug) then were asked how much money they were willing to accept to give up that good. The buyers were asked how much they were willing to pay to receive the same good. Finally, the choosers were given the opportunity to select between receiving a sum of money and the good.

has been widely documented in the intertemporal choice literature (e.g. Ariely, 1998; Chapman, 1996, 2000; Haisley & Loewenstein, 2011; Loewenstein & Prelec, 1991, 1993; Loewenstein & Sicherman, 1991; Read and Powell, 2002; Read & Scholten, 2012; Varey & Kahneman, 1992), and possibly explains why consumers strongly prefer to prepay for nondurable consumption.

Such preferences are motivated by several psychological mechanisms including the recency effect (Miller and Campbell, 1959), savouring and dread (Loewenstein, 1987), adaptation and loss aversion (Helson, 1964; Kahneman & Tversky, 1979), and the closely related contrast effects (Tversky & Griffin, 1991).

For instance, the recency effect theory posits that individuals are more likely to overweight the final outcome when forming an overall evaluation of an experience. Therefore, an experience ending with the most favourable outcome will often be judged more positively than one in which the favourable outcome takes place earlier in time.

Savouring and dread offers an alternative explanation for the preference of improving outcomes. According to this theory, individuals derive utility from anticipating pleasurable experiences (savouring), and disutility from anticipating painful ones (dread). As a result, individuals will expedite painful experiences to minimise (or avoid) dread, and delay the pleasurable experiences to savour the moment.

The adaptation-level and loss aversion theory suggests that people adapt to the most recent level of stimuli they experience, and evaluate new stimuli relative to their adaptation level. Therefore, improving sequences are comprised of positive departures from one's adaptation level (gains), while declining sequences consist of negative departures (losses). Given that losses loom larger than equivalent gains, positive departures should be preferred to negative ones, thereby favouring improving sequences of outcomes over time.

Finally, the contrast theory postulates that the attractiveness of an outcome is often determined in comparison with a former one, in which the latter serves as a reference point. Therefore, having an inferior outcome prior to a superior one, enhances the attractiveness of the latter. Hence the preference for improving sequences.

Three, the model does not factor in *temporal discounting*, the effect of time delay on the subjective value attributed to an outcome that will take place in the future. The latter is a key component in any financial decision.

All these issues and others, have been addressed by Prelec and Loewenstein's (1998) double-entry model; which is why this thesis is mainly based on testing the predictions of the double-entry model.

2.3 The prospective double-entry mental accounting model

According to Prelec and Loewenstein (1998), people experience a pain of paying when making a purchase. This pain constitutes an additional cost to the price of a purchase, and weakens the pleasure derived from consumption. It also plays a vital role in self-regulating consumption behaviour to prevent a person from spending compulsively (Prelec & Loewenstein, 1998; Kivetz, 1999). Evidence of this "pain" has recently been documented in studies using functional magnetic resonance imaging.. For instance, Knutson et al. (2007) found that activation in the insula, a region associated with the imagination of pain, was significantly greater with products that participants refused to purchase.

To account for the pain of paying, Prelec and Loewenstein (1998) proposed a double-entry model as an alternative to the standard economic model. According to this model, the decision to make a purchase is a two-way hedonic interaction between the pain of paying and the pleasure of consumption. That is, thinking about the costs of a purchase invokes painful thoughts that attenuate the pleasure of consumption, while thinking about the benefits alleviates the pain of paying. This idea was formally presented using two equations that reflect the anticipated utility from consumption (1), and disutility from the associated payments (2):

Consumption experience: $$\sum_{b\geq 0}(1 \pm \mu)\delta_b(u_b - \lambda\hat{p}_b) \qquad (1)$$

whereby, u_b is the experienced utility when consumption is free, $\hat{p}_b$ is the imputed cost attenuating the pleasure of consumption, λ is a parameter reflecting the marginal utility of money based on an individual's financial situation, μ is a loss aversion parameter and δ is a discount factor.

Payment experience: $$\sum_{c\geq 0}(1 \pm \mu)\,\rho_c(\hat{u}_c - \lambda p_c) \qquad (2)$$

whereby λp_c is the experienced disutility from the payments if there were no associated benefits, $\hat{u}_c$ is the imputed benefit that buffers the pain of paying and ρ is a discount factor.

Accordingly, the model predicts a preference to prepay for consumption since the pain experienced from prepaid consumption is moderated by the anticipated pleasure of consumption, while consumption is enjoyed as if it were free ($\hat{p}_b = 0$). In contrast, postpaying for consumption is hedonically unpleasant since the pain from the anticipated payments diminishes the experienced pleasure of consumption, while the deferred payments feel as a pure loss ($\hat{u}_c = 0$).

These predictions are built around three mental accounting rules: a) *prospective accounting*, b) *coupling*, and c) *prorating*.

Prospective accounting - is a rule that recognises future payments and writes-off past ones. Figure 2.1 illustrates the relationship between the timing of payments and the imputed cost of consumption. Past payments have lower imputed costs than future payments, and more so when consumption is paid for far in advance (point "A"). The imputed costs are highest when payments are due straight after consumption (point "C"), but decline gradually as the payments are deferred into the distant future because of temporal discounting (point "D"). For analytical convenience Prelec and Loewenstein (1998) approximated the relationship in Figure 2.1 using a step function (dotted line in the figure). Therefore from a modelling perspective, past payments have zero impact on prospective consumption (i.e. deleted from the mental accounting system); while future payments have the same impact irrespective of their time.

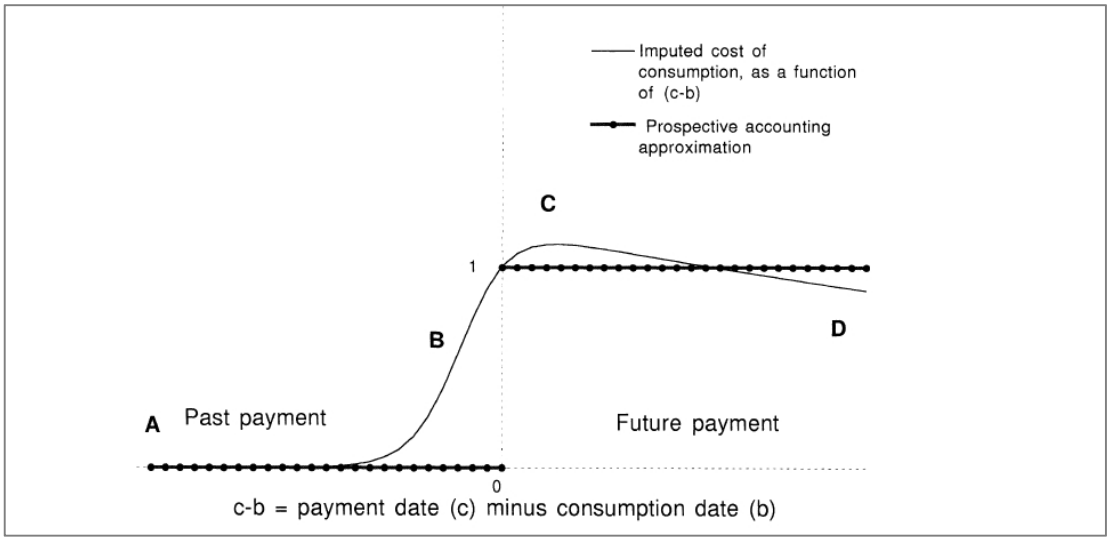

Figure 2.1 – The impact of payment timing on the imputed cost of consumption (as depicted in PL)

Gourville and Soman (1998) provided evidence supporting the payment depreciation observed for points "A" and "B" in Figure 2.1. In one of their studies, participants who paid for a basketball game tickets six month in advance were significantly *less* likely to drive 60 miles in a snowstorm to attend the game compared to those who paid one day in advance, but were as likely to do so compared to those who obtained the tickets for free. Likewise, participants in Henderson and Peterson (1992) who lost a $10 theatre ticket several days in advance were more likely to purchase a new ticket compared to those who lost it shortly before attending the play. Finally, a significant portion of seasoned wine drinkers [students] in Shafir and Thaler (2006) indicated that a prepaid case of wine [concert ticket] would feel "as if" it costs nothing when consumed in the distant future.

Coupling - refers to the mental association between payments and consumption. It is the degree to which consumption triggers thoughts about the payments, and vice versa. It is characterised in the model by two coefficients α and β which signify the strength (from 0 to 1) and the direction of mental association (α: from consumption to payments; β: from payments to consumption) – see functional form in equations (3) and (4) below. Specifically, α refers to the degree to which the pleasure of consumption is attenuated by thinking about the associated payments, while β refers to the degree to which the pain of paying is buffered by thinking about the consumption.

The strength and direction of this mental association varies depending on the timing of payments and consumption. For instance, prepaying for consumption weakens α (attenuation) and strengthens β (buffering) since paying in advance strongly couples the payments to the benefits, but decouples the benefits from the payments at the time of consumption. In contrast, postpaying for consumption strengthens α and weakens β. Therefore, a prepaid taxi service, for instance, should be preferable to a metered one because it has a low cost to benefit association (i.e. low α, high β), while a service that is paid far in the future should be the least preferred since it has a low benefit to cost association (i.e. high α, low β).

In addition to temporal proximity, the strength of payment-consumption association is also influenced by the complexity of a transaction (e.g. bundled vs. unbundled products; Soman & Gourville, 2001), the payment method (e.g. cash vs. credit card; Ariely & Silva, 2002; Prelec & Simester, 2001) and by individual differences ('tightwads' vs. 'spendthrifts'; Rick, Cryder & Loewenstein, 2008). For instance, bundling several items into one package weakens the association between the payments and any specific consumption episode (e.g. annual gym memberships vs. single-entry payments, all-inclusive holidays vs. pay-as-you-consume holidays). Likewise, paying for purchases with a credit card as opposed to cash weakens the association between consumption and payments, most likely because the outflow of money is less salient at the time of purchase (Soman 2001; Thaler, 1999).

Prorating – is a rule that assigns residual payments to residual consumption, and vice versa. Therefore, given a sequence of future payments {p_1 = £10, p_2 = £20, p_3 = £30 and p_4 = £40, at t = 1, 2, 3 and 4 periods, respectively} and five prospective consumption episodes bestowing 1 utility each, then the prorated imputed cost for each consumption episode at t_0 is (£10 + £20 + £30 + £40) / 5 = £20, and the prorated imputed benefit of say, payment "p_3", is (1 + 1 + 1 + 1 + 1) * £30 / (£10 + £20 + £30 + £40) = 1.5 units of utility.

These imputations will change as the residual consumption and payments decline over time (i.e. as the consumption and payment episodes are dropped from the mental accounting system).

In formal terms, combining the three mental accounting rules results in an:

Imputed cost: $$\hat{p}_b = \alpha(\frac{u_b}{\sum_{t\geq b} u_t}) \sum_{t\geq b} p_t \quad (3)$$

whereby $\sum_{t\geq b} p_t$ is the total outstanding payments at time *b* prorated over the residual consumption utility ($\frac{u_b}{\sum_{t\geq b} u_t}$) and adjusted downwards by the coupling coefficient α, such that $0 < \alpha \leq 1$.

Imputed benefit: $$\hat{u}_c = \beta(\frac{p_c}{\sum_{t\geq c} p_t}) \sum_{t\geq c} u_t \quad (4)$$

whereby $\sum_{t\geq c} u_t$ is the total consumption utility remaining at time *c* prorated over the outstanding payments ($\frac{p_c}{\sum_{t\geq c} p_t}$) and adjusted downwards by the coupling coefficient β, such that $0 < \beta \leq 1$

Substituting *(3)* in *(1)* and *(4)* in *(2)*:

Consumption experience: $$\sum_{b\geq 0} (1 \pm \mu)\, \delta_b (u_b - \lambda\alpha(\frac{u_b}{\sum_{t\geq b} u_t}) \sum_{t\geq b} p_t) \quad (5)$$

Payment experience: $$\sum_{c\geq 0} (1 \pm \mu)\, \rho_c (\beta \left(\frac{p_c}{\sum_{t\geq c} p_t}\right) \sum_{t\geq c} u_t - \lambda p_c) \quad (6)$$

Figure 2.2 plots the consumption and payment experiences of a durable good when the payments slightly precede the benefits[9]. The upper left panel plots the consumption utility when the durable good is acquired for free, while the one below it plots the disutility from eight instalments to be paid for the durable. The upper and lower panels to the right plot the imputed costs and benefits, respectively. Merging the panels on the left with the ones on right provides the overall consumption and payment experiences.

During the initial phase of ownership, the mental burden of carrying so much debt reduces some of the enjoyment from the consumption experience. However, as the payments are settled, the experienced utility from consumption gradually increases and eventually reaches its peak when the debt is paid off. Meanwhile, the disutility from the payments starts high, but diminishes over time as the remaining payments

[9] The figure has been reproduced from Prelec and Loewenstein (1998) by applying equations (5) and (6) using the following assumptions: $\delta_b = \rho_c = 1$ (i.e. no discounting), $\mu = 0$ (i.e. no loss aversion), $\lambda = 1$, and $\alpha = \beta = 0.4$

are offset by the residual consumption utility. So much so, that the final payment generates a positive emotion reflecting the joy of having the debt finally paid off.

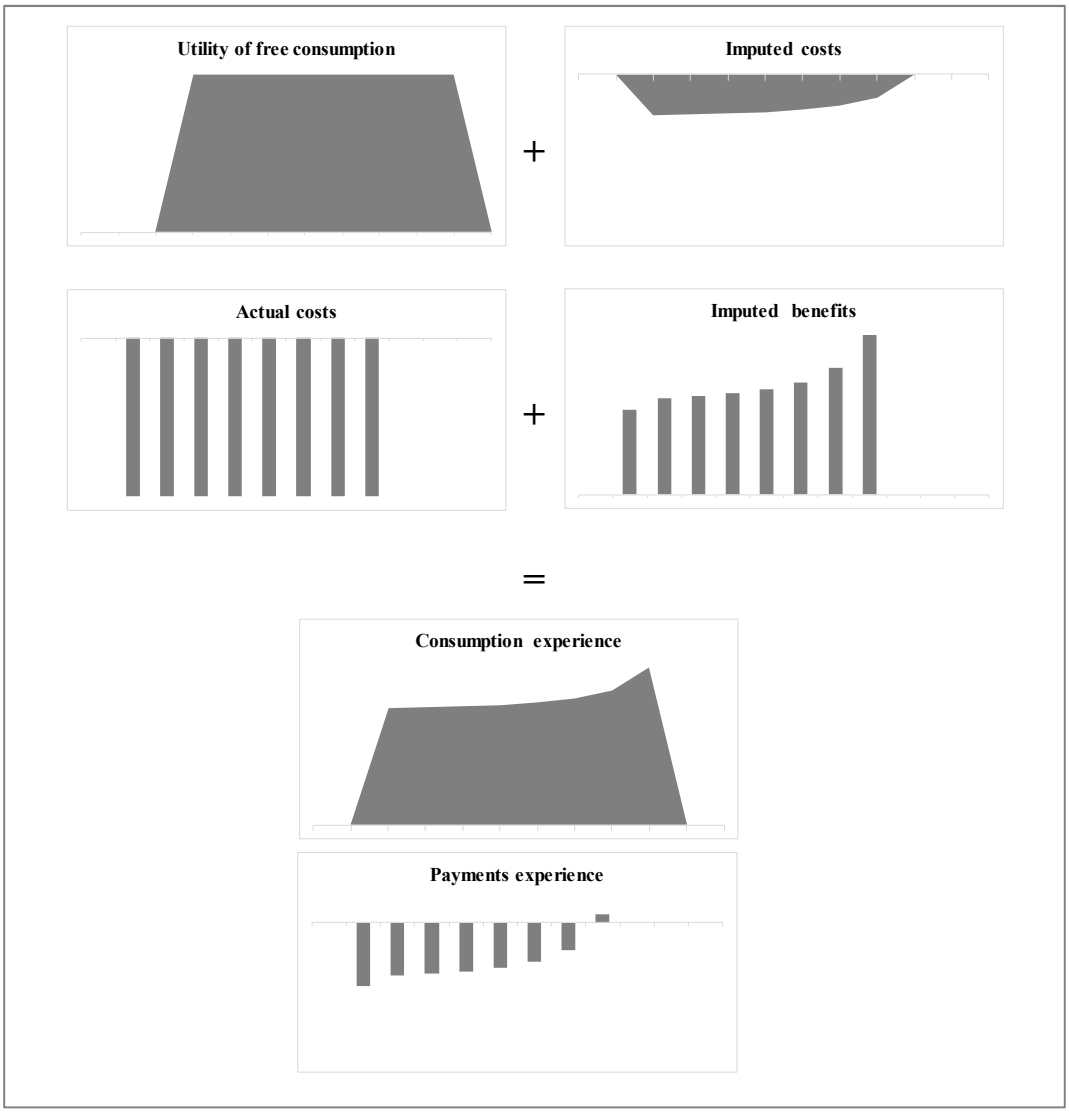

Figure 2.2 – Experienced consumption and payments

2.3.1 The effects of duration and period of consumption

While Prelec and Loewenstein's (1998) hypothesise that there will always be hedonic benefits derived from prepayment (as shown in Figure 2.2), the magnitude of these benefits will vary depending on the duration consumption (i.e. short-lived vs. long-lived goods).

That is, long-lived (durable) goods are less likely to elicit a preference for prepayment compared to nondurable ones, because a) the disutility from deferred payments will be offset by the residual consumption utility, and b) the hedonic benefits from prepayment are unlikely to be large enough to offset motives that favour deferring the

payments (e.g. temporal discounting, insurance against negative product experiences - see section 2.3.2 for more details). In contrast, short-lived goods are more likely to elicit a preference for prepayment since there is no residual consumption utility to offset the deferred payments[10].

In fact, evidence from several studies exploring preferences for the timing of payments, along with observations from real-life settings, show that individuals often prefer to defer the payments of durable goods like a washer-dryer (e.g. Hirst et al., 1994; Prelec and Loewenstein, 1998; Patrick & Park, 2006). However, as soon as the durable goods cease to provide any utility, the individual will choose to close that account by paying back any outstanding amount. For example, participants in one of the studies conducted by Hirst el al. (1994) were less likely to carry a loan for a broken item compared to a fully functional one.

This suggests that the period of consumption plays a key role when deciding how long to defer the payments of durable goods. Figure 2.3 simulates the consumption and payment experiences for a durable good using three financing strategies[11]: a) prepaid durable (savings); b) leased durable, and c) postpaid durable (credit). Accordingly, of the three financing strategies, prepayment provides the optimal hedonic experience, followed by leasing, then consumption on credit.

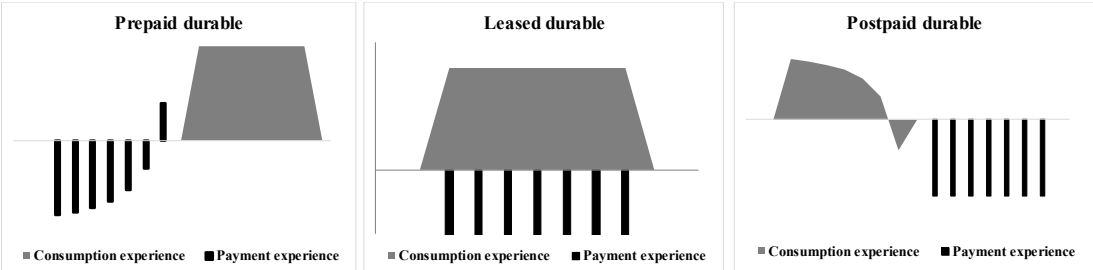

Figure 2.3 – Payment-consumption experience for three financing strategies

[10] The evidence suggests that most people will prefer to prepay for short-lived hedonic goods (e.g. a vacation) because they want to enjoy these goods debt-free. However, this preference is not as robust for short-lived utilitarian goods. For instance, while Prelec and Loewenstein (1998) reported a stronger preference to prepay for miscellaneous living expenses during a short period of anticipated unemployment, Patrick and Park (2006) found a higher tendency to defer the payments of a business trip to Paris, and for a pest-control service.

[11] The figures were produced applying equations (5) and (6) using the following assumption: $\delta_b = \rho_c = 1$ (i.e. no discounting), $\mu = 0$ (i.e. no loss aversion), $\lambda = 1$, and $\alpha = \beta = 0.4$. Strategies (a) and (c) also apply in the context of nondurable consumption.

Prepaid durable – The disutility experienced from the payments in the prepaid durable good scenario (refer to the left panel of Figure 2.3) is initially high, however, this disutility gradually diminishes and eventually turns positive as the payments recede into the past. Furthermore, since there are no payments to worry once the durable has been paid off, consumption can be enjoyed as if it were free. Therefore, providing the highest consumption utility possible.

Postpaid durable – In contrast, the utility experienced from consumption in the postpaid durable scenario (refer to right panel of Figure 2.3) starts off relatively high, but rapidly declines before turning negative as the looming reality of having to repay the debt becomes inevitable. Besides, the disutility from the payments is experienced in full as it cannot be buffered by benefits that have already been consumed.

Leased durable – The leasing strategy provides a middle ground between a prepaid and postpaid durable. While the utility from consumption is not as high as the one experienced in the prepaid durable scenario, it remains positive throughout the consumption period. Meanwhile, the disutility from the payments is offset by the residual consumption utility, thus resulting in payments that feel less onerous in comparison with the postpaid durable scenario.

2.3.2 Motives for deferring the payments of durables

There are several reasons for people to defer the payments of durable consumption. One, the lack of immediate financial resources (i.e. liquidity constraint), especially when a large upfront payment is required. Two, *resource slack* (Zauberman & Lynch, 2005), the belief that one will be in a better financial position in the future to pay off their debts. Three, *opportunity cost*, whereby money available today can be invested to earn more money in the future, which can ultimately be used to cover the payments of the leased durable.

Four, reassurance against negative consumption experiences. Deferring the payments of durables gives people the feeling that they have some leverage over the seller in case they need to negotiate an exchange or a refund if the purchased item is defective or unsatisfactory. A sort of insurance policy against negative product-related experiences (Patrick & Park, 2006).

Five, to simplify financial decisions. Heath and Fennema (1996) argue that making financial decisions is easier when people can align the timing of payments to the period of consumption, since it allows them to explicitly compare the marginal costs and benefits of that consumption. They even argue that people will actively attempt to mentally depreciate the costs over the period of consumption even when physical integration is not possible (e.g. large upfront payments). For instance, an individual who is deciding whether to replace a durable item might use mental depreciation to determine if they "got their money's worth". Furthermore, aligning the costs and benefits makes it easier for individuals to track their expenses for budgeting purposes (Heath & Soll, 1996).

2.3.3 Temporal discounting

In addition to the type, durability and period of consumption, the preference to prepay for consumption is often diminished by temporal discounting. Discounting means that lower weights are assigned to future payments, making these payments seem less onerous. The degree of discounting varies from one person to the other depending on how impatient that person is, such that more impatience implies higher discounting. Accordingly, when impatience is high and the hedonic benefit from prepayment is low, the preference to prepay for consumption will reverse into a preference to pay later.

3 CHAPTER THREE

3.1 Introduction

Policy makers often have to decide between borrowing or increasing taxes to pay for additional expenditure. Ideally, these decisions should follow the guidelines of rational financial principles to achieve *fiscal efficiency* - the optimal allocation of resources over time and projects. However, they also have to consider the preferences of citizens if they wish to maintain credibility (and popularity), even if these preferences are not in line with the ideal practices. It is vital, therefore, that these policy makers know about these preferences, so they can either accommodate them or communicate to the public the need to do things differently.

Consequently, this chapter examines the preferences of UK residents for using taxes or debt to pay for nonrecurring communal expenditure – whereby debt is construed as a preference to defer taxes. In particular, it examines preferences for the timing of tax payments for different types of communal projects. To illustrate, imagine that you live in a city which is about to celebrate its bicentennial. Two major celebrations are being considered:

- Celebration 1: A fireworks display on the bicentennial weekend that will last approximately 30 minutes.
- Celebration 2: A monument in the city square that will be uncovered on the bicentennial weekend, and will last another 200 years.

Regardless of the chosen celebration, each household in the city will have to pay a one-time surcharge of £5. Should the £5 surcharge be paid before or after the bicentennial weekend? From a normative perspective, the nature and duration of the celebration does not matter. The decision maker should choose the financing strategy that minimises the present value of payments, which in this case means deferring the £5 surcharge. However, in many cases people dislike paying for communal benefits that have already been consumed. For instance, the residents of Montreal, Canada complained for 30 years about paying a "special Olympic tax" to service $1.5 billion of debt used to pay for the 1976 summer Olympic Games[12]. Likewise, the residents of

[12] http://edition.cnn.com/2012/07/19/world/canada-montreal-olympic-legacy/index.html

Sheffield, UK, continue to express their discontent at having to pay £25 million a year until 2024, to service the debt used for financing the 1991 World Student Games[13].

To my knowledge, no descriptive model has been proposed yet to deal specifically with people's preferences for financing nonrecurring public expenditure. Therefore, I propose that the model developed by Prelec and Loewenstein (1998) to think about similar decisions made on a personal level is appropriate for this context. This is because the characteristics of private and communal consumption can be very similar. For instance, the duration of communal consumption, like the private one, can be short-lived or long-lived, with benefits that can be hedonic or utilitarian. A public fireworks display, for example, offers a short-lived hedonic experience; while a recycling centre provides long lasting utilitarian benefits. In addition, both private and communal consumption may provide immediate or deferred benefits.

Recall that, according to the double-entry model, individuals will always derive hedonic benefits from prepaying for consumption, but the magnitude of these benefits vary according to the type and duration of consumption. As a result, the preference for prepayment will vary accordingly.

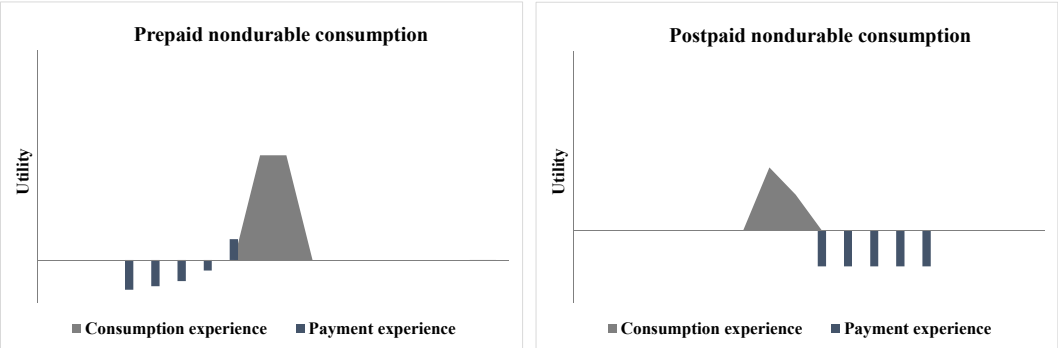

Figure 3.1 – Prepaid versus postpaid nondurable consumption

Figure 3.1 compares the consumption and payment experiences of prepaid and postpaid *nondurable* consumption by applying equations *(5)* and *(6)* from section 3 in Chapter 2. It is evident that the overall hedonic experience is far better when the nondurable good is prepaid since a) the disutility associated with the payments is buffered by positive thoughts about the prospective consumption benefits, and b) consumption is unencumbered by negative thoughts about these payments. As a result,

[13] http://www.bbc.co.uk/news/uk-england-south-yorkshire-14134973

people generally prefer to prepay for nondurable consumption, especially when it is hedonic (refer to section 2.3.1 of Chapter 2 for details).

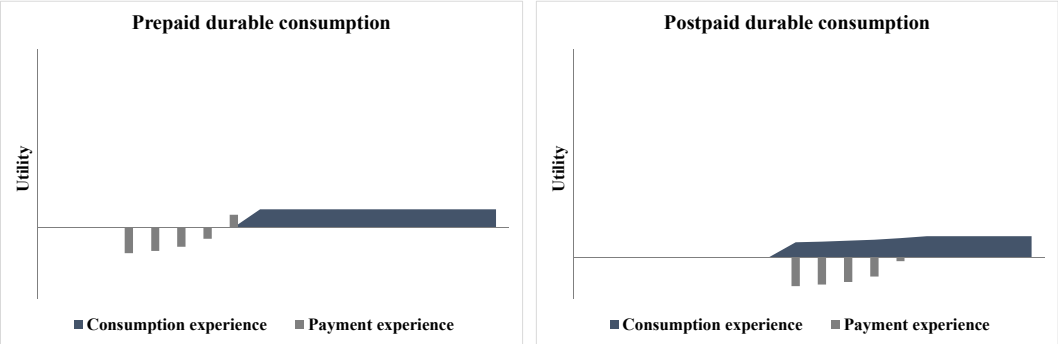

Figure 3.2 – Prepaid versus leased durable consumption

Figure 3.2, on the other hand, compares the consumption and payment experiences of prepaid and leased *durable* consumption. It shows that deferring the payments does not have a strong adverse effect on the overall experience. This is because the disutility from the later payments is offset by the residual consumption utility. In addition, even though prepaying for the durable enhances the consumption experience, this added benefit is not large enough to offset the opposing effect of discounting, or other factors (e.g. opportunity costs – refer to section 2.3.2 in Chapter 2). Accordingly, people in general are more inclined to defer the payments of durable consumption, regardless of whether these benefits are hedonic or utilitarian.

Evidence from studies exploring preferences for the timing of payments in the context of private consumption revealed a stronger preference to prepay for nondurable goods (especially hedonic ones, e.g. Patrick & Park, 2006), and to defer the payments of durable ones. The studies in this chapter extend the analysis to the domain of *communal consumption*.

Study 1 utilised an experimental design similar to the one used by Patrick & Park (2006), but in the context of communal consumption. That is, the study explored preferences for the timing of payments for public projects that varied by *duration* (short-lived vs. long-lived) and *type of benefits* (hedonic vs. utilitarian). The communal domain differs from the private one in two key aspects: a) the benefits are shared between the members of a community, therefore are not experienced the same way as private ones; and b) the payments made in exchange for communal benefits

are involuntary, therefore are generally more painful than voluntary ones (Sussman & Olivola, 2011) and are associated with lower levels of satisfaction (Lamberton, 2013).

Study 2 explored preferences for the timing of payments by manipulating the *durability of benefits* derived from a *short-lived* communal project. Therefore, in some cases the benefits from the project were framed as having a long term impact on the affected community, while in other cases the benefits were not mentioned at all. Specifically, this study aimed to test whether having long term benefits can moderate the preference to prepay for short-lived projects. Especially since there is conflicting evidence in the private consumption literature as to whether people prefer to prepay or postpay for nondurable goods that offer long term benefits (e.g. a one-week seminar).

Finally, Study 3 explored these preferences by manipulating the *consumption period* of a *long-lasting* project. Consumption period refers to intervals of equal consumption durations taking place at different points in time. Therefore, in some cases the long-lasting project was implemented in the near future, while in other cases it was implemented in a more distant one. Studies exploring preferences for the timing of payments of durable goods, typically manipulated the consumption duration (e.g. Hirst et al., 1994) or the pattern of utility streams (e.g. Hoelzl et al., 2011), but not the period of consumption. The latter is key aspect for public expenditure since many investments have deferred rather than instantaneous benefits.

In addition to the above, all three studies employed a unique elicitation method consisting of multiple binary choices with *sooner and later payments*, such that the later payments were either smaller than, equal to, or larger than the sooner ones. In contrast, previous studies either used a one-choice equal payments method (Prelec & Loewenstein, 1998), or a Likert scale method (Patrick & Park, 2006).

The multiple binary choice method has several advantages. One, it elicits preferences at different levels of interest rates. Two, it allows for testing the consistency of responses at the individual level. Three, it facilitates the examination of different patterns of individual preferences. Therefore, providing a robust measure of preferences.

3.2 Study 1

Study 1 explores preferences for the timing of payments of four communal projects that vary by duration (short-lived vs. long-lived) and type (hedonic vs. utilitarian). Accordingly, some projects have a short life lasting for a few days, while others have a long life lasting for years. In addition, some projects have stronger hedonic attributes, while others have stronger utilitarian ones.

Following the predictions of the double-entry model, it is hypothesised that:

H1: short-lived projects will elicit a stronger preference for prepayment than long-lived ones

Furthermore, following Patrick and Park's (2006) proposition that only emotionally charged nondurable goods, like vacations, would elicit a strong preference to pay in advance, it is hypothesised that:

H2: there will be a stronger preference to prepay for the short-lived hedonic projects than short-lived utilitarian ones

While Prelec and Loewenstein (1998) implicitly suggested that people are more likely to prepay for nondurable hedonic goods, their model does not support prediction H2 as it is oblivious to the source of utility (i.e. whether it is derived from hedonic or utilitarian consumption).

Participants

A sample of 327 UK residents recruited using Bilendi[14] completed the online survey. The data from 19 participants were excluded because of careless responding determined by the following criteria: switching back and forth between options two standard deviations more than the average, or completing the study two standard deviations faster than the average natural log of completion time. Participants were on average 47 years old, with 40% holding a university degree, 57% in full-time or part-time employment and 53% being females. The median completion time of the survey

[14] A market research company based in the UK – *http://www.bilendi.co.uk*

was 6 minutes. Participants who successfully completed the survey were rewarded with loyalty points that could be exchanged for products of their liking.

Design and procedure

Participants were presented with a scenario about a UK city that was planning to increase temporary spending to help promote the wellbeing of young residents. The idea being that spending public funds to improve the wellbeing of young residents should be perceived favourably by most participants. The introduction to the scenario read as follows: *"In the following questions you will be asked to state your preference for choices a city council can take when funding spending plans. In every case, the options involve funding the plan by temporarily increasing costs to the taxpayer in the form of a "surcharge." This surcharge can come earlier or later. The surcharge will be specified in terms of average cost per household per quarter. The actual cost any household will pay will depend on their circumstances, such as their ability to pay."*

Following the introduction, each participant was then randomly assigned to one of the 2 (*project duration*: short-lived vs. long-lived) x 2 (*type of benefits*: hedonic vs. utilitarian) conditions. The projects were selected based on the following criteria. One, to satisfy Dhar and Wertenbroch's (2000) definition of a hedonic and utilitarian experience[15]. As a result, two themes were used: sporting activities (hedonic) and academic ones (utilitarian). Two, ensure that the durability of benefits derived from the projects overlap as much as possible with duration, such that the short-lived projects have nondurable benefits, while the long-lived projects have durable ones. This is a key point since duration and durability can sometimes be confounded. Especially for nondurable utilitarian goods. For instance, a one-week seminar is a short-lived good with potential long term benefits. The four projects are listed in Table 3.1.

[15] Dhar and Wertenbroch (2000) defined hedonic goods as "ones whose consumption is primarily characterized by an affective and sensory experience of aesthetic or sensual pleasure, fantasy, and fun" (e.g. vacation, sports car, luxury watch). In contrast, utilitarian goods are defined as "ones whose consumption is more cognitively driven, instrumental and goal oriented and accomplishes a functional or practical task" (e.g. furniture, a seminar, laptop for work)

Table 3.1 – Between-participants design for Study 1

		Duration	
		Short-lived	Long-lived
Type of benefits	Hedonic	*hosting a 3-day national sports competition for the youth*	*a sports and leisure centre for the youth*
	Utilitarian	*hosting a 3-day national science fair for the youth*	*a learning facility for the youth*

Once assigned to a condition, participants were then directed to a new page with additional information particular to that condition. An example of the short-lived utilitarian project condition is provided in Figure 3.3 below. The other conditions are reproduced in Appendix A.

In an effort to promote the well-being of young people living in the city, City A is planning to host the UK Young Scientists and Engineers Fair - a three day science, technology and engineering fair for the youth - in January 2015.

To pay for this additional expenditure, the city will be introducing a temporary quarterly surcharge for a period of one year. The surcharge will be paid by every household in the city.

Two options are currently being considered for this surcharge:

Option 1: Implement the surcharge from Jan 2014 to Dec 2014, before the event takes place.

Option 2: Implement the surcharge from Jan 2015 to Dec 2015, after the event has taken place.

To decide which of the two options to implement, the City Council has agreed to hold a citywide referendum to vote on the matter.

In the following questions you will see choices between possible pairs of surcharges. In each choice, one surcharge represents Option 1, the other represents Option 2.

Imagine that you are a local spokesperson who can influence the results of this referendum. For each choice, indicate the option that you would recommend the households to vote for, if that choice was the one they actually faced.

○ **£3.00 quarterly per household from Jan 2014 to Dec 2014, before the event takes place**

○ **£3.25 quarterly per household from Jan 2015 to Dec 2015, after the event has taken place**

Figure 3.3 – Short-lived utilitarian project condition

To emphasise the communal nature of the decision, participants were asked to imagine that they were local spokespeople who can influence the outcome of a citywide referendum initiated to vote for the two options presented in Figure 3.3, and accordingly to choose the option they would recommend the households of the city to vote for.

Preferences for the timing of payments were elicited using 10 binary choices with a fixed time delay (t = 1 year). Each choice consisted of an earlier surcharge paid quarterly from January to December 2014, and a later surcharge from January to December 2015. Four of these surcharges were smaller later payments ($x_{(t1,t2)} > x_{(t2,t3)}$), one had similar payments ($x_{(t1,t2)} = x_{(t2,t3)}$), and the remaining five were larger later payments ($x_{(t1,t2)} < x_{(t2,t3)}$). This elicitation method differs from the one-choice equal payments procedure (e.g. £200 sooner or later) used by Hirst et al. (1994) and Prelec and Loewenstein (1998), and the Likert scale method used by Patrick and Park (2006); and was particularly designed to test the robustness of the hypothesised effects at different levels of interest rates. For instance, a stronger preference to prepay for the short-lived projects when the interest rates are negative would indicate that people are willing to pay more taxes today to avoid public debt.

The amounts of the earlier surcharges ranged from £2 to £6, and increased in increments of £0.5. The later surcharges were computed using interest rates that ranged between *-28.7%* and *22.3%*. The amounts and discount rates were chosen to ensure that the later surcharge does not exceed £10. The choices were presented in random order and on separate screens to minimise carryover effects.

Table 3.2 presents the amounts and discount rates used. Note that the items labelled -4 to +5 represent the levels of interest rates used in ascending order. Therefore, items -4 to -1 refer to the smaller later payments, item 0 refers to the equal earlier and later payment, and items 1 to 5 refer to the larger later payments. Henceforth, these labels are used to refer to the corresponding interest rate.

Table 3.2 – Price list for Study 1

Levels of interest rates	Earlier	Implied interest rates	Later
-4	£6.00	-28.8%	4.50
-3	£3.50	-15.4%	3.00
-2	£2.00	-13.4%	1.75
-1	£4.00	-6.5%	3.75
0	£4.50	0.0%	4.50
1	£5.50	4.4%	5.75
2	£3.00	8.0%	3.25
3	£6.50	14.3%	7.50
4	£2.50	18.2%	3.00
5	£5.00	22.3%	6.25

Results

Manipulation check

To assess the perceived durability of benefits from the four projects, participants indicated how strongly they agreed with the following statement: "*City A's spending plans will create long term benefits for the city and its residents".* Responses were given on a five-point scale ranging from 'strongly disagree' to 'strongly agree'. The long-lived projects were expected to elicit a higher rating on the 5-point scale, and indeed they did. Participants assigned to the long-lived projects conditions were more likely to agree with the statement than those assigned to the short-lived ones (M_{LL} = 3.31 vs. M_{SL} = 3.05, $t(306) = 2.54$, $p = .012$).

Main analysis

Preferences for the timing of payments were measured using repeated binary outcomes. Consequently, a generalized estimating equation (GEE) model (Liang & Zeger, 1986; Hardin, 2005) with a logit link function was used to analyse the data.

GEEs are generalised linear models (GLM) that take into account the correlation of residual errors within-participants in repeated measures designs. These models do not make any assumptions about the *normality* and *independence* of residual errors, and as such can accommodate different types of distributions (e.g. Gaussian, Binomial, Poisson, etc.). As a result, they are well suited for analysing repeated measures data with binary, ordinal or count outcomes[16]. In contrast, a GLM such as a logistic regression is preconditioned by the assumption that the observed residual errors are independent, while a marginal model such as a repeated measures ANOVA is preconditioned by the assumption that these errors are normally distributed.

One of the main features of GEE models is that they do not require the specification of a distribution, but only of the first two moments: i) the relationship between the outcome variable and predictors, through a link function[17], and ii) between the mean

[16] GEE models can also be used to analyse continuous outcomes

[17] A link function describes the linear relationship between the response variable and the model predictors. For instance, a logit link function provides an estimate of the odds ratio of a binary outcome.

and variance, through a correlation structure[18]. Though, the consistency of the model estimates relies on the accuracy of the first moment only. That is, if the specified link function accurately describes the relation between the outcome and predictors, then the estimated parameters will be consistent even if the correlation structure is misspecified (Agresti, 2013). This is a significant advantage for GEE models over generalised linear mixed models (GLMM) which are sensitive to the specification of correlation structures. In addition, GEEs are computationally less demanding than GLMMs (i.e. they are usually much faster to run).

Just like any other statistical model, GEEs have some limitations. First, standard errors may underestimate the true ones if the sample size is small. Two, the lack of a likelihood function means that GEEs cannot be used to compare models or test a model's goodness-of-fit.

Accordingly, the following reported statistical results were carried out using a GEE model with the *level of interest rates*, *duration* and *type of benefits* as predictors; *gender, age, education, employment, household income* and *having children* as covariates; and the *timing of payments* (earlier or later) as the outcome. The data were analysed by computing the mean proportion of participants choosing the later payments.

Figure 3.4 summarises the main results. The panel on the left displays the breakdown of the duration and interest rates factors, while the one on the right displays the breakdown of the duration and type of benefits factors.

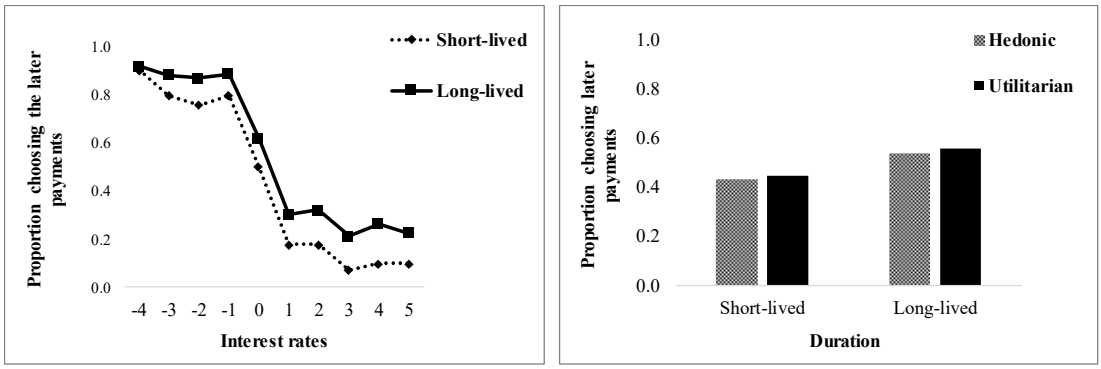

Figure 3.4 –Duration & Interest rates (left panel) / Duration & Type of benefits (right panel)

[18] Correct specification of a correlation structure allows the model to be computationally more efficient. Common correlation structures include: a) Independent, b) exchangeable, c) Autoregressive and d) unstructured.

As shown in Figure 3.4, two factors influenced preferences for the timing of payments. One, participants were highly sensitive to the changes in interest rates, choosing the later payments when the interest rates were negative (M = .85) and the earlier ones when these rates were positive (M = .19). In other words, they were strongly inclined to choose the smaller payments. Interestingly, a large proportion (~ 45%) preferred the earlier payments when the interest rate was zero, revealing an aversion to the deferred losses when the earlier and later payments were equal (e.g. Yates & Watts, 1975).

Two, as predicted, there was a significant project duration effect (χ^2 (1, 308) = 20.2, p < .001). Participants were more likely to choose the later payments for the long-lived projects than the short-lived ones (M_{LL} = .55 vs M_{SL} = .44). In fact, on average, they were more likely to prepay for the short-lived projects, and to pay later for the long-lived ones.

Interestingly, the duration effect persisted across all levels of interest rates, even when these rates were negative (all the observed differences, with the exception of level -4, were significant at the 5% level). That is, more participants preferred to pay the larger sooner surcharge when the projects were short-lived. In addition, Figure 3.4 shows that the duration effect strengthened as the interest rates increased. However, this increase was not substantial enough. There was no evidence of a duration by levels of interest rates interaction (χ^2 (9, 308) = 10.1, p = .335).

Finally, there was no evidence that the type of benefits derived from the projects had any impact on the timing of payments (χ^2 (1, 308) = .328, p = .567). Participants were equally likely to choose the later payments for the hedonic and utilitarian projects (M_H = .48 vs M_U = .50). Furthermore, there was no evidence of a duration by type of benefits interaction (χ^2 (1, 308) = .004, p = .953). That is, participants were equally likely to prepay for the short-lived projects (M_H = .43 vs. M_U = .45), and to pay later for the long-lived ones (M_H = .54 vs. M_U = .56) regardless of the type of benefit derived from these projects. Therefore, contrary to hypothesis H2, there was no evidence that participants treated the short-lived hedonic and utilitarian projects differently.

Other factors

In addition to the above, the GEE analysis revealed a significant effect for having children (χ^2 (1, 308) = 5.47, p = .019). Participants who reported having children were in general more likely to choose the earlier payments than those who did not (M_C = .47 vs M_{NC} = .54). This was true for both the short-lived (M_c = .42 vs M_{NC} = .47) and long-lived (M_C = .52 vs M_{NC} = .61) projects. It is likely that participants with children had a stronger motive to prepay for the projects, because they wanted to ensure that the projects are funded and/or wanted to enjoy the consumption debt-free. After all, it is their children who were going to benefit from these projects.

Discussion

As expected, there was a robust project duration effect on the timing of payments. This was evidenced by a stronger preference to prepay for the short-lived projects, and to pay later for the long lived ones. In fact, this preference persisted even when it was financially more expensive to prepay for the short-lived project (i.e. when the interest rates were negative), or to pay later for the long-lived ones (i.e. when the rates were positive).

However, contrary to the evidence from the private goods literature (e.g. Patrick & Park, 2006), preferences for the timing of payments were *not* influenced by the type of benefits derived from the projects[19]. There are two likely explanations for this result. One, it is possible that participants did not distinguish between the hedonic and utilitarian projects as there was no measure to control for the perceived ratings of these projects on the hedonic / utilitarian dimensions. Two, the benefits from communal consumption are shared between members of a community, therefore, are unlikely to trigger the same level of pleasurable anticipation (Loewenstein, 1987) that some types of private goods do (e.g. vacation). As a result, the distinction between hedonic and utilitarian benefits becomes weaker. Interestingly, this implies that the observed preferences to prepay for short-lived communal projects were more likely to have been motivated by the desire to minimise the pain (disutility) associated with the prospective tax payments as opposed to enhancing the pleasure of consumption.

[19] Results are consistent with the predictions of the double-entry model since the model does not distinguish between hedonic and utilitarian benefits

Especially, since the decision maker will probably be making these tax payments, but not necessarily enjoying the benefits.

With this in mind, the following study explores whether having a short-lived communal project with potential long-term benefits to the entire community would moderate the preference to prepay for the project.

3.3 Study 2

People are more likely to defer the payments of consumption if this consumption has long term benefits that offsets the pain of paying. This is clearly evidenced by their preference to lease durable goods, and to postpay for some types of nondurable utilitarian goods. For instance, most participants in Patrick and Park (2006) preferred to pay later for a business trip to Paris, but sooner for a vacation; arguably because the business trip is consumed to achieve a functional purpose with potential long term benefits. It is therefore possible that thinking about these prospective long-term benefits moderated the disutility associated with the deferred payments. In contrast, the vacation is typically consumed to be enjoyed, and most likely triggered anticipal thoughts of enjoyment.

Accordingly, this study explores the preference to prepay for a short-lived communal project by manipulating the *durability of benefits* derived from this project. Therefore, in some cases the benefits from the project were framed as having a long term impact on the affected community, while in other cases the benefits were not mentioned at all.

H3: short-lived projects which trigger thoughts about the prospective long-term benefits are likely to elicit a stronger preference for the later payments

In addition, the study explores whether raising awareness about the city's need to borrow if the residents decide to defer the payments has any impact on the decision to pay sooner or later for the project. For instance, there is evidence suggesting that labelling or framing a contract as a "loan" triggers a stronger aversion to debt in comparison with financially similar contracts (Caetano et al., 2011). Accordingly, making the debt salient should elicit a stronger preference for the earlier payments.

Participants

A sample of 326 UK residents recruited through Bilendi completed the online survey. The data from 21 participants were excluded because of careless responding, using the same criteria from Study 1. Participants were on average 47 years old, with 50% holding a university degree, 58% in fulltime or part-time employment, and 55% being females. The median completion time was 8 minutes. Participants who successfully completed the survey were rewarded with loyalty points that could be exchanged for products of their liking.

Design and procedure

Following a brief introduction to the survey, participants were randomly assigned to one of the 2 (*durability of benefits:* no frame vs. long-term frame) x 2 (*salience of debt:* salient vs. non-salient) conditions. Table 3.3 summarises the four conditions.

Table 3.3 – Between-participants design for Study 2

		Salience of debt	
		Non-salient	Salient
Durability of benefits frame	No frame	Short-lived project with no benefits or debt framing	Short-lived project with no benefits frame but the government must borrow to defer the implementation of the surcharge
	Long-term frame	Short-lived project with long-term benefits frame	Short-lived project with long-term benefits frame and the government must borrow to defer the implementation of the surcharge

Half the participants were asked to imagine that a UK city will be hosting a major international sporting event for student athletes from 1 to 14 July 2019, and that the event is expected to attract more than 5,000 athletes from 100 countries. As a result, hosting the games would require significant investment on infrastructure, sporting facilities, venues, housing and security (the *"no frame"* condition). The other half were presented with the same information, but were additionally told that "*the event will generate long term benefits for the city by creating jobs, enhancing economic activity, promoting business and tourism, and developing sporting facilities that can be used by upcoming local athletes*" (the *"long-term benefits"* frame condition).

Following the scenario introduction, participants were directed to a new page with additional information particular to the condition they were assigned to. Figure 3.5 provides an example. Note that the framing of Option 2 was manipulated between participants to reflect the salience of debt. Therefore, half the participants were told the city will *borrow to pay for the expenditure* before levying the surcharge (the *"salient debt"* condition), while the other half were only told about the surcharge (the *"non-salient debt"* condition). An example of the non-salient debt condition is reproduced in Appendix B.

To pay for this expenditure, the City Council will be introducing a temporary annual surcharge for a period of 5 years. The surcharge will be paid by every household in the city.

Two options are currently being considered for this surcharge:

Option 1: Implement the surcharge from July 2014 to June 2019, before the games take place.

Option 2: Borrow to pay for the expenditure and implement the surcharge from July 2019 to June 2024, after the games have taken place.

To decide which of the two options to implement, the City Council has agreed to hold a citywide referendum to vote on the matter.

In the following questions you will see choices between possible pairs of surcharges. In each choice, one surcharge represents Option 1, the other represents Option 2.

Imagine that you are a local spokesperson who can influence the results of this referendum. For each choice, indicate the option that you would recommend the households to vote for, if that choice was the one they actually faced.

- **£13.00 annually per household from July 2014 to June 2019, before the games take place**
- **£13.00 annually per household from July 2019 to June 2024, after the games have taken place**

Figure 3.5 – Salient debt condition

As in Study 1, to emphasise the communal nature of the decision, participants were asked to imagine that they were local spokespeople who can influence the outcome of a citywide referendum initiated to vote for the two options. As a result, they should choose the option that they would recommend the households to vote for.

Preferences for the timing of payments were elicited using the same method from Study 1. Accordingly, each participant was presented with 10 pairs of possible surcharges. Each pair consisted of an earlier surcharge paid annually from July 2014 to June 2019, and a later surcharge paid from July 2019 to June 2024. Four of these consisted of smaller later payments, one had similar payments, and the remaining 5 consisted of larger later payments. The earlier surcharges ranged between £10 and £14 per year. The later surcharges were computed by compounding the earlier surcharges

over a period of 5 years, using interest rates that ranged between ~ *-5.5%* and *5.1%*[20]. Note that these rates were significantly lower than the ones used in Study 1 because the amounts were larger and the time delay longer. All the choice options were presented in random order and on separate screens to minimise carryover effects. A list of the amounts and discount rates used in the study is shown in Table 3.4.

Table 3.4 – Price list for Study 2

Levels of interest rates	Earlier	Implied interest rates	Later
-4	13.5	-5.5%	10.25
-3	10.5	-4.2%	8.50
-2	14	-2.7%	12.25
-1	11.5	-1.3%	10.75
0	13	0.0%	13.00
1	12	1.2%	12.75
2	12.5	2.3%	14.00
3	10	3.2%	11.75
4	11	4.5%	13.75
5	14.5	5.1%	18.75

Results

Manipulation check

To assess the *perceived durability of benefits*, participants indicated how strongly they agreed with the following statement: "*hosting the World Student Games will create long term benefits for the city and its residents"*. Responses were given on a five-point scale ranging from 'strongly disagree' to 'strongly agree'. Participants assigned to the *long-term frame* condition were marginally more likely to agree with the statement than those assigned to the no frame condition (M_{LL} = 3.18 vs. M_{SL} = 2.94, $t(305)$ = 1.96, p = .05). However, these results underestimate the difference between the short-term and long-term conditions due to the non-normality of the data (a visual inspection of the data revealed that the distribution of each condition was negatively skewed)[21].

[20] The initial rates ranged between -5% and 5%. However, these rates changed slightly after rounding the later surcharge to the nearest £0.25.

[21] The Kolmogorov-Smirnov test of normality for both the short-term and long-term projects was highly significant (p < .001). Therefore, the alternative hypothesis that the data is non-normal cannot be rejected.

Clustering participants according to their response to the statement revealed no significant differences in the number of those who disagreed (N = 50), those who were indifferent (N = 52) and those who agreed (N = 51) in the no frame condition (χ^2 (2, 153) = .039, p = .981). In contrast, there were twice as many participants who agreed (N = 70) than disagreed (N = 36), and 46 that claimed indifference in the long term frame condition (χ^2 (2, 152) = 12.0, p = .002). Therefore, indicating that the manipulation was in fact successful.

Main analysis

All reported statistical results were carried out using a GEE model with a logit link function, with the *level of interest rates*, *durability of benefits frame*, and *salience of debt* as predictors; *gender, age, education, employment, household income* and *having children* as covariates; and the *timing of payments* (earlier or later) as the outcome. The data were analysed by computing the mean proportion of participants choosing the later payments.

Figure 3.6 summarises the main results. The panel on the left shows the breakdown of the durability of benefits and interest rates factors, while the one on the right shows the durability of benefits by salience of debt interaction.

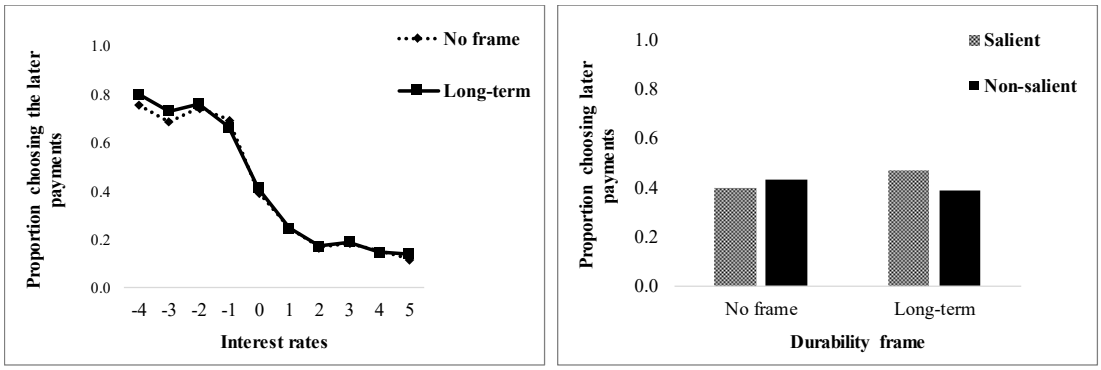

Figure 3.6 – Durability & Interest rates (left panel) / Durability & Debt salience (right panel)

As shown by Figure 3.6 (refer to the left panel), there was no evidence of any difference between the no frame and long-term frame conditions. Participants were overall equally inclined to *prepay* for the project regardless of how the benefits were framed (M_{NF} = .41 vs. M_{LTF} = .42). They were also equally inclined to prepay for the project when the debt was salient and non-salient (M_S = .42 vs. M_{NS} = .40).

However, these results were qualified with a durability of benefits frame by salience of debt interaction (χ^2 (1, 305) = 4.42, p = .035). According to Figure 3.6 (refer to the right panel), participants assigned to the no frame condition were slightly *more* likely to prepay for the project when the debt was salient ($M_{salient}$ = .40 vs $M_{non\text{-}salient}$ = .43). In contrast, those assigned to the long-term frame were *less* likely to do so when the debt was salient ($M_{salient}$ = .47 vs. $M_{non\text{-}salient}$ = .38).

Discussion

There was no indication that having prospective long term benefits moderated the preference to prepay for the short-lived project, indicating (as in Study 1) that the duration of the project matters for the timing of payments.

In addition, raising awareness about the government's need to borrow (if the surcharge is deferred), did *not* trigger a stronger preference for prepayment in general. On the contrary, it actually moderated the preference to prepay for the project when the long-term benefits were highlighted. It is possible that some participants thought it would be reasonable for the city to borrow if the project is going to generate long term benefits.

3.4 Study 3

So far, Studies 1 and 2 provided evidence that people have a stronger preference to prepay for short-lived projects, and to pay later for long-lived ones. However, in many instances, public investments in durable projects take a while before generating tangible benefits. This study explores such instances. That is, it examines the preferences of UK residents for the timing of payments when the benefits from a long lasting communal project materialise in the near or distant future.

According to the double-entry model, consumers will delay the payments for a durable good as long as the residual consumption utility offsets the disutility from these payments. This implies that consumers will favour payment schemes that allow them to align the timing of payments to the period of consumption (the "*alignment effect"*). In fact, Hirst el al. (1994), who explored outcome contiguity in consumer borrowing

decisions, found that participants were willing to pay a premium in order to match the duration of a loan to the life of the underlying asset.

H4: deferring the consumption benefits of a long lasting project will elicit a stronger preference for the later payments.

As in Study 2, this study also tests whether increasing awareness about the need to borrow in order to defer the tax payments has any impact on the decision to pay sooner or later for the expenditure.

Participants

A sample of 229 UK residents recruited through Bilendi completed the online survey. The data from 15 participants were excluded because of careless responding, using the same criteria from Study 1. Participants were on average 47 years old, with 40% holding a university degree and 58% being females. The median completion time was 9 minutes. Participants who successfully completed the survey were rewarded with loyalty points that could be exchanged for products of their liking.

Design and procedure

Participants were presented with a scenario about a new technology the government is planning to introduce to reduce carbon emissions from coal-fired power plants. The introduction to the scenario read as follows:

"*Over the coming years, the UK will be investing in energy technology to ensure its energy security and reduce the looming threat of global climate change. Coal-fired power plants in the UK will be using a technology called Combined Heat and Power (CHP). CHP integrates the production of usable heat and power (electricity) in a single highly efficient process to reduce carbon emissions by 30%.*

In the following questions, you will be asked to state your preference for options the government can take to pay for CHP. The options involve temporarily increasing costs to the taxpayer in the form of a surcharge. This surcharge can come earlier or later. The surcharge will be specified in terms of average cost per person per year. The actual cost any individual will pay will depend on their personal circumstances."

Each participant was then randomly assigned to one of the 2 (*CHP implementation period:* early vs. delayed) x 2 (*salience of debt:* salient vs. non-salient) conditions. Half the participants were told that the CHP technology will be implemented during the years 2015 to 2030, while the other half were told that it would be implemented during the years 2030 to 2045. Likewise, half were told that the government must borrow to pay for implementing the CHP technology if the surcharge is delayed (the *"salient debt"* condition), while the other half were told nothing.

Table 3.5 - Between-participants design for Study 3

		Salience of debt	
		Non-salient	Salient
CHP implementation period	Early	*Implementation period: 2015 to 2030*	*Implementation period: 2015 to 2030 and the government must borrow if the surcharge is delayed*
	Delayed	*Implementation period: 2030 to 2045*	*Implementation period: 2030 to 2045 and the government must borrow if the surcharge is delayed*

Following that, participants were directed to a new page with additional information particular to the condition they were assigned to. Figure 3.7 provides an example of the delayed CHP implementation period when debt is salient. The remaining three conditions are reproduced in Appendix C.

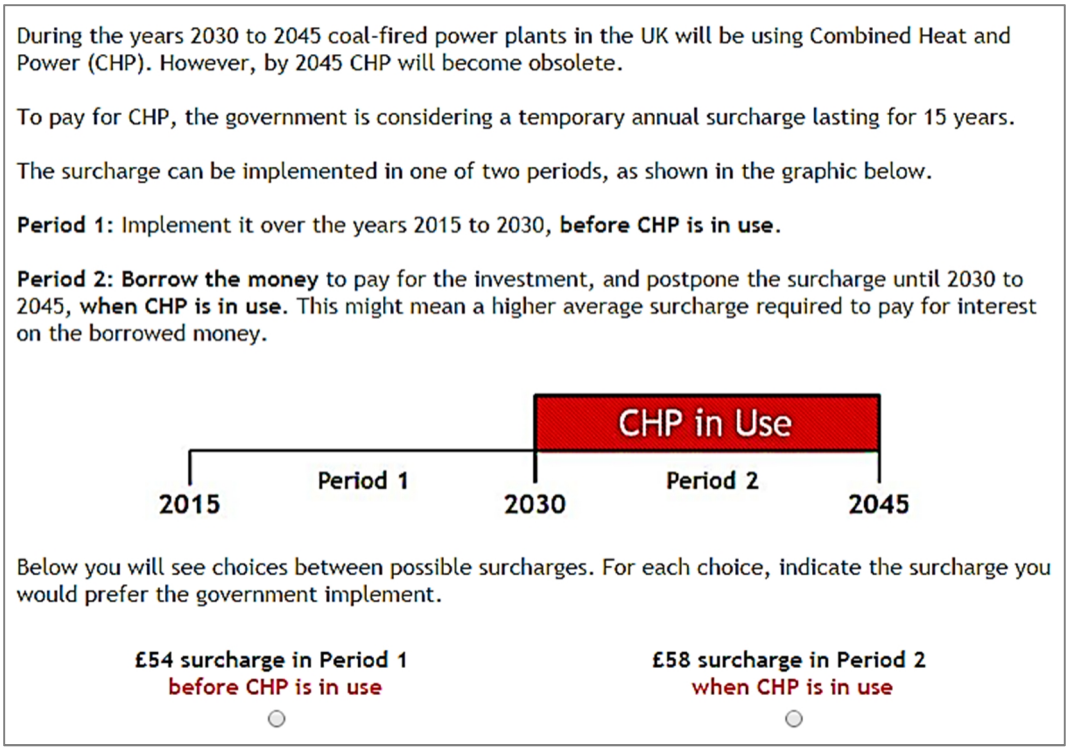

Figure 3.7 – Delayed CHP period and debt is salient condition

Preferences for the timing of payments were elicited using the same method from Study 1 and 2. Accordingly, each participant was presented with 14 pairs of possible surcharges. Each pair consisted of an earlier surcharge paid annually between the years 2015 to 2030, and a later surcharge paid between the years 2030 and 2045. Two of these surcharges consisted of smaller later payments, one had similar payments, and the remaining 11 consisted of larger later payments. The earlier surcharges ranged between £40 and £60 per year. The later surcharges were computed by compounding the earlier surcharges over a period of 15 years, using interest rates that ranged between ~ *-1%* and *5%*. As in Study 2, the rates were significantly lower than the ones used in Study 1 since the amounts were larger and the time delay much longer. Given the context of the scenario (i.e. taxation), we wanted to maintain a reasonable surcharge below £100. All the choice options were presented in random order and on separate screens to minimise carryover effects. A list of the amounts and discount rates used in the study is presented in Table 3.6.

Table 3.6 – Price list for Study 3

Levels of interest rates	Earlier	Implied interest rates	Later
-2	53	-0.94%	46
-1	42	-0.49%	39
0	57	0.00%	57
1	54	0.48%	58
2	45	0.96%	52
3	48	1.38%	59
4	56	1.77%	73
5	58	2.23%	81
6	55	2.66%	82
7	52	3.12%	83
8	43	3.53%	73
9	46	4.01%	84
10	44	4.47%	86
11	47	4.90%	98

Following the experimental task, participants completed an intertemporal choice task that measured their preferences for small monetary gains. The task was adapted from Kirby (2009), and consisted of 12 pairs of smaller sooner and larger later outcomes. In addition, participants completed Frederick's (2005) 3-item cognitive reflection test (CRT), a measure designed to test an individual's ability to carefully reflect on his or her responses by inhibiting incorrect but seemingly accurate answers.

CRT scores have been shown to correlate positively with intertemporal preferences for monetary gains, such that people who score higher on the CRT are also more likely to wait longer for larger later monetary rewards (Frederick, 2005; Hardisty & Weber, 2009). In fact, participants who achieved a higher CRT score in this study were also more likely to choose the larger later receipts in the intertemporal choice task ($\rho = .28$, $p < .001$). Accordingly, the two measures were used as proxies to identify whether impatience could explain some of the variability in preferences for the timing payments. Specifically, whether impatience is likely to elicit a stronger preference for the later payments.

Results

All reported statistical results were carried out using a GEE model with a logit link function, with *interest rates*, *period of CHP implementation* and *salience of debt* as

predictors; *gender, age, education, employment, intertemporal preferences* and *cognitive reflection* as covariates, and the timing of payments (earlier or later) as the outcome. The data were analysed by computing the mean proportion of participants choosing the later payments.

Figure 3.8 summarises the main results. The panel on the left displays the breakdown of the period of CHP implementation and interest rates factors, while the one on the right displays the period of CHP implementation by salience of debt interaction.

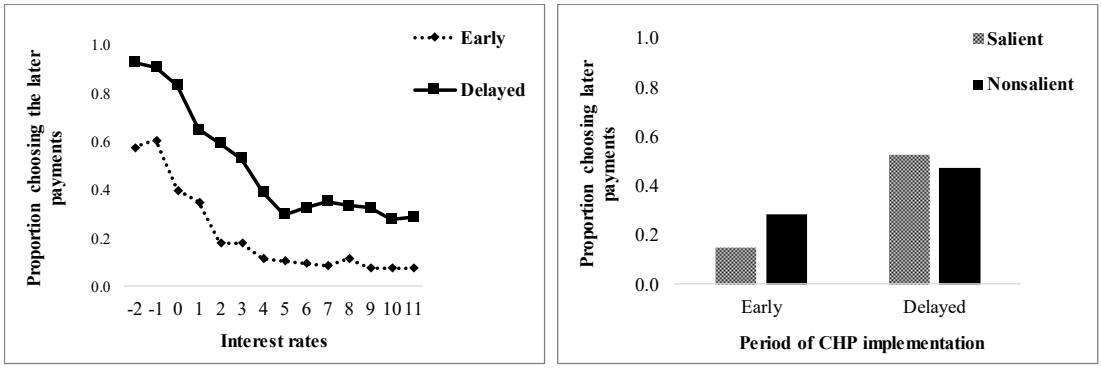

Figure 3.8 – Period & Interest rates (left panel) / Period & Debt salience (right panel)

Preferences for the timing of payments were highly influenced by the period of CHP implementation (χ^2 (1, 214) = 40.50, $p < .001$). Overall, participants were much more likely to choose the later payments when the implementation period was delayed (M_E = .22 vs. M_D = .50). This preference was most evident when the interest rate was zero (M_E = .40 vs. M_D = .83), but also persisted when the rates were negative (M_E = .59 vs. M_D = .91) or positive (M_E = .13 vs. M_D = .39) - all pairwise comparisons were significant at the 1% level. In other words, there was a strong preference to align the timing of payments with the period of CHP implementation, even when it was financially more expensive to do so.

This preference for alignment was reinforced when the need for the government to borrow was made salient. According to Figure 3.8 (refer to the right panel), participants assigned to the early implementation period were less likely to choose the later payments when the debt was salient (as opposed to non-salient). Conversely, those assigned to the delayed period were more likely to choose the later payments when the debt was salient. This was evidence with a significant interaction between the period of CHP implementation and the salience of debt (χ^2 (1, 214) = 7.84, p =

.005). A pairwise comparisons test of the salience factor confirmed that the observed difference between the salient and non-salient conditions was significant when the implementation period was early (p = .027), but not when it was delayed (p = .348).

Other factors

In addition to above, the regression analysis revealed a significant effect of age (χ^2 (1, 214) = 4.65, p = .031) and gender (χ^2 (1, 214) = 4.36, p = .037). In general, the older participants were more likely to choose the later payments than younger ones. Similarly, men were more likely to choose the later payments than women (M_{men} = .41 vs. M_{women} = .32). None of the other factors we tested reached levels of significance.

Interestingly, there was no evidence that impatience, measured using cognitive reflection or the intertemporal choice task, was predictive of the timing of payments. The former result is consistent with Hardisty and Weber (2009) who found no relationship between CRT scores and discounting of losses in monetary and nonmonetary domains.

Discussion

As predicted, there was a stronger preference for the earlier payments when the communal project was implemented in the near future, and the later ones when implementation was deferred (i.e. a preference for temporal alignment). This was true even when temporal alignment resulted in additional costs. For instance, the early implementation period elicited a stronger preference for the earlier payments even when these payments were larger than the later ones (i.e. when the interest rates were negative). Likewise, the delayed implementation period elicited a stronger preference for the later payments even when these payments were larger than the earlier one (i.e. when the interest rates were positive). Therefore, in line with Hirst et al. (1994), we find that participants were willing to pay a significant premium to have the payments aligned with the consumption period.

In addition to that, making participants aware that the government must borrow to defer the tax payments induced a stronger preference for the earlier payments when the period of implementation was early, but not when the period of implementation

was delayed. In fact, it made no difference whether the debt was salient or non-salient when the period of CHP implementation was delayed.

There are several reasons why people might want to temporally align their tax payments to the period of project implementation even when it is more costly. For instance, it could be lack of trust in the authorities, or feelings of uncertainty about issues like cost overruns and on-time delivery of the project. Such reasons could prompt members of the public to opt for a deferred payment scheme to insure themselves against such uncertainties. However, if these were the primary or sole motives of participants, then there should have been no significant differences observed between the early and delayed implementation periods. After all, delaying the payments in both scenarios would eliminate any uncertainty concerning the projects. It is more likely that these preferences were motivated by an aversion to post-consumption payments (as predicted by the double-entry model); and strengthened by the desire to achieve fairness and intergenerational equity (Tobin, 1974; Kotlikoff, 2002). In the sense that those who are enjoying the benefits of communal expenditure should be the ones paying for it. This would explain the strong aversion to debt observed when borrowing was salient and the period of CHP implementation was early.

3.5 General discussion

It is vital for policy makers to understand the financing preferences of ordinary citizens when making decisions about funding different types of spending programmes, today and in the future. It is equally important for policy makers to understand the psychology behind these preferences. The research in this chapter provides insights about such preferences in two cases, when funding: a) communal projects that differ in their longevity (e.g. have a short life like the Olympic Games or a long lasting one like public infrastructure), and b) long-lived projects with benefits accruing in the near or distant future.

The evidence from three studies show that people in general dislike post-consumption payments even when it is explicitly cheaper to pay later. Instead, they choose to prefund short-lived projects by raising taxes (Studies 1 and 2), and to align their tax payments with the consumption period of long-lived ones (Study 3). That is, they prefer to tax-finance benefits accruing in the near future, and debt-finance the ones

that are further deferred. The former preference is even more robust when people are made aware that the government must borrow to defer the tax payments.

These findings suggest that decisions concerning the timing of payments for communal consumption are motivated by the same mental accounting rules people use to make personal financial decisions. In particular, the ones prescribed by the double-entry model (e.g. prospective accounting / coupling). Therefore, providing a descriptive theory for policy makers to adhere to when designing public finance policies. The double-entry model, for instance, would strongly support an application of the "golden rule", a fiscal policy guideline which prescribes that government use tax revenues to pay for current expenditure, and debt to finance capital investments with deferred benefits (Bassetto & Sargent, 2006). One of the key advantages of the golden rule is that it promotes intergenerational equity such that each generation pays for its own public expenditure (which is precisely what ordinary UK citizens want - refer to Study 3 for supporting evidence). Interestingly, this policy was adopted by the UK government in 1998, but later abandoned in the wake of the 2007 financial crisis[22].

In addition, the results of this chapter call for the *temporal hypothecation* (earmarking) of taxes. Hypothecation in general refers to the concept of earmarking tax revenues from a single or multiple sources to a specific spending programme (Wilkinson, 1994). For instance, the gasoline tax in the US is earmarked towards funding of transport infrastructure. Likewise, the TV licence fee in the UK is used to pay for public broadcasting. The proposed "temporal hypothecation" would work in a similar manner to the normal hypothecation process, but in addition to earmarking across spending programmes, taxes would also be earmarked over time. That is, if a municipality must borrow to invest in a recycling facility that will start operating in five years' time, then this municipality should introduce a "green tax" in five years to pay back the debt.

Limitations

One, preferences were elicited using imaginary scenarios with hypothetical choices. It is possible that different choice patterns would emerge if taxpayers were to make the same decisions about real spending programs. For instance, they may reveal more

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[22] http://www.telegraph.co.uk/finance/financialcrisis/3267763/Gordon-Brown-signals-that-golden-rule-on-borrowing-is-to-be-scrapped

tolerance towards using public debt (as some normative models would predict, e.g. Alesina & Tabellini, 1990). Even so, previous research comparing temporal discounting of real and hypothetical monetary outcomes found no systematic differences between the two (Johnson & Bickel, 2002, Madden et al., 2004). In addition, the evidence presented in this chapter is supported by real-life observations (e.g. the 1976 Montreal Olympics, the 1991 World Student Games – refer to the introduction of this chapter for more details).

Two, none of the studies controlled for the decision maker's attitude towards the particular spending program. However, preferences for the timing of tax payments are likely to vary depending on the decision maker's approval of the underlying spending program. For instance, Study 1 revealed a stronger preference among participants with children to prepay for projects that benefited the youth. Therefore, suggesting that having a positive attitude towards a spending program might moderate tax aversion, and the preference to pay sooner. In fact, this would be consistent with Lamberton, De Neve and Norton (2016) who found that eliciting taxpayer preferences on government spending increases tax compliance.

Prelude to Chapter 4

The double-entry model was developed as a theory to analyse payment-consumption trade-offs, and has been applied mainly in that domain (e.g. Lambrecht & Skiera, 2006; Patrick & Park, 2006; Schulz et al., 2015; Soman, 2001). Despite that, Prelec and Loewenstein (1998) implied to the possibility of applying their model to situations involving paid work (refer to footnote 16 in the PL paper). With this in mind, Chapter 4 extends the current investigation to the domain of financial gains. That is, the chapter explores whether preferences for timing of monetary gains, in a social context, are influenced by the timing of nonmonetary costs in the same way that the timing of monetary losses are influenced by nonmonetary benefits.

3.6 Appendix A – Study 1

A. Long-lived utilitarian project condition

In an effort to promote the well-being of young people living in the city, City A is planning to develop the learning facilities available to the youth at its central library by January 2015.

To pay for this additional expenditure, the City Council will be introducing a temporary quarterly surcharge for a period of one year. The surcharge will be paid by every household in the city.

Two options are currently being considered for this surcharge:

Option 1: Implement the surcharge from Jan 2014 to Dec 2014, before the development of the learning facilities.

Option 2: Implement the surcharge from Jan 2015 to Dec 2015, after the development of the learning facilities.

To decide which of the two options to implement, the City Council has agreed to hold a citywide referendum to vote on the matter.

In the following questions you will see choices between possible pairs of surcharges. In each choice, one surcharge represents Option 1, the other represents Option 2.

Imagine that you are a local spokesperson who can influence the results of this referendum. For each choice, indicate the option that you would recommend the households to vote for, if that choice was the one they actually faced.

- ○ **£3.00 quarterly per household from Jan 2014 to Dec 2014, before the development of the facilities**
- ○ **£3.25 quarterly per household from Jan 2015 to Dec 2015, after the development of the facilities**

B. Long-lived hedonic project condition

In an effort to promote the well-being of young people living in the city, City A is planning to develop a multi-purpose sports and leisure centre for the youth by January 2015.

To pay for this additional expenditure, the city will be introducing a temporary quarterly surcharge for a period of one year. The surcharge will be paid by every household in the city.

Two options are currently being considered for this surcharge:

Period 1: Implement the surcharge from Jan 2014 to Dec 2014, before the development of the centre.

Period 2: Implement the surcharge from Jan 2015 to Dec 2015, after the development of the centre.

To decide which of the two options to implement, the City Council has agreed to hold a citywide referendum to vote on the matter.

In the following questions you will see choices between possible pairs of surcharges. In each choice, one surcharge represents Option 1, the other represents Option 2.

Imagine that you are a local spokesperson who can influence the results of this referendum. For each choice, indicate the option that you would recommend the households to vote for, if that choice was the one they actually faced.

- ○ **£2.00 quarterly per household from Jan 2014 to Dec 2014, before the development of the centre**
- ○ **£1.75 quarterly per household from Jan 2015 to Dec 2015, after the development of the centre**

C. Short-lived hedonic project condition

In an effort to promote the well-being of young people living in the city, City A is planning to host a three day national sports competition for the youth in January 2015.

To pay for this additional expenditure, the city will be introducing a temporary quarterly surcharge for a period of one year. The surcharge will be paid by every household in the city.

Two options are currently being considered for this surcharge:

Option 1: Implement the surcharge from Jan 2014 to Dec 2014, before the event takes place.

Option 2: Implement the surcharge from Jan 2015 to Dec 2015, after the event has taken place.

To decide which of the two options to implement, the City Council has agreed to hold a citywide referendum to vote on the matter.

In the following questions you will see choices between possible pairs of surcharges. In each choice, one surcharge represents Option 1, the other represents Option 2.

Imagine that you are a local spokesperson who can influence the results of this referendum. For each choice, indicate the option that you would recommend the households to vote for, if that choice was the one they actually faced.

- ○ **£6.00 quarterly per household from Jan 2014 to Dec 2014, before the event takes place**
- ○ **£4.50 quarterly per household from Jan 2015 to Dec 2015, after the event has taken place**

3.7 Appendix B – Study 2

A. Debt non-salient condition

To pay for this investment, the City Council will be introducing a temporary annual surcharge for a period of 5 years. The surcharge will be paid by every household in the city.

Two options are currently being considered for this surcharge:

Option 1: Implement the surcharge from July 2014 to June 2019, before the games take place.

Option 2: Implement the surcharge from July 2019 to June 2024, after the games have taken place.

To decide which of the two options to implement, the City Council has agreed to hold a citywide referendum to vote on the matter.

In the following questions you will see choices between possible pairs of surcharges. In each choice, one surcharge represents Option 1, the other represents Option 2.

Imagine that you are a local spokesperson who can influence the results of this referendum. For each choice, indicate the option that you would recommend the households to vote for, if that choice was the one they actually faced.

- ○ **£13.00 annually per household from July 2014 to June 2019, before the games take place**
- ○ **£13.00 annually per household from July 2019 to June 2024, after the games have taken place**

3.8 Appendix C – Study 3

A. Early implementation – debt non-salient condition

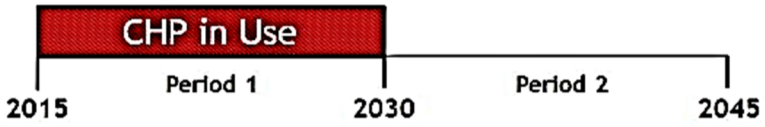
During the years 2015 to 2030 coal-fired power plants in the UK will be using Combined Heat and Power (CHP). However, by 2030 CHP will become obsolete.

To pay for CHP, the government is considering a temporary annual surcharge lasting for 15 years.

The surcharge can be implemented in one of two periods, as shown in the graphic below.

Period 1: Implement it over the years 2015 to 2030, **when CHP is in use**.

Period 2: Postpone the surcharge until 2030 to 2045, **when CHP is no longer in use**. This might mean a higher average surcharge.



Below you will see choices between possible surcharges. For each choice, indicate the surcharge you would prefer the government implement.

£57 surcharge in Period 1 when CHP is in use	**£57 surcharge in Period 2 when CHP is no longer in use**
○	○

B. Delayed implementation – debt non-salient condition

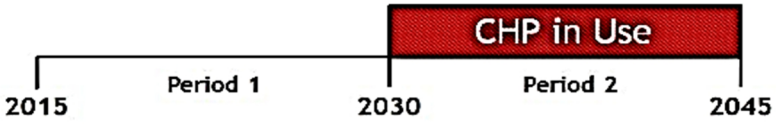
During the years 2030 to 2045 coal-fired power plants in the UK will be using Combined Heat and Power (CHP). However, by 2045 CHP will become obsolete.

To pay for CHP, the government is considering a temporary annual surcharge lasting for 15 years.

The surcharge can be implemented in one of two periods, as shown in the graphic below.

Period 1: Implement it over the years 2015 to 2030, **before CHP is in use**.

Period 2: Postpone the surcharge until 2030 to 2045, **when CHP is in use**. This might mean a higher average surcharge



Below you will see choices between possible surcharges. For each choice, indicate the surcharge you would prefer the government implement.

£47 surcharge in Period 1 before CHP is in use	**£98 surcharge in Period 2 when CHP is in use**
○	○

C. *Early implementation – debt salient condition*

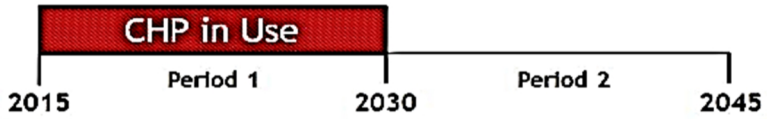
During the years 2015 to 2030 coal-fired power plants in the UK will be using Combined Heat and Power (CHP). However, by 2030 CHP will become obsolete.

To pay for CHP, the government is considering a temporary annual surcharge lasting for 15 years.

The surcharge can be implemented in one of two periods, as shown in the graphic below.

Period 1: Implement it over the years 2015 to 2030, **when CHP is in use**.

Period 2: **Borrow the money** to pay for the investment, and postpone the surcharge until 2030 to 2045, **when CHP is no longer in use**. This might mean a higher average surcharge required to pay for interest on the borrowed money.



Below you will see choices between possible surcharges. For each choice, indicate the surcharge you would prefer the government implement.

£53 surcharge in Period 1 when CHP is in use	**£46 surcharge in Period 2 when CHP is no longer in use**
○	○

4 CHAPTER FOUR

Chapter three investigated the preferences of UK residents for the timing of tax payments in the context of communal spending. In general, there was a stronger preference to prepay for the short-lived communal projects (*a duration effect*), and to align the timing of payments with the consumption period of the long-lived ones (*an alignment effect*). This chapter extends this investigation to the domain of financial gains. Specifically, the chapter explores people's preferences for the timing of monetary benefits when making decisions on behalf of a community that is providing a communal service to a neighbouring community, and vice versa for monetary losses. This chapter extends the research investigating cost-benefit associations in the private goods domain in three ways. One, preferences for both monetary gains and losses were examined using the same context and framework. The one and only study that examined preferences for both monetary gains and losses (Prelec & Loewenstein, 1998) did so using different contexts. Two, these preferences were elicited for social (communal) rather than personal goods. Three, these preferences were tested for decisions that people make for themselves versus others (i.e. decisions that have a direct impact on the decision maker, or no impact at all).

4.1 Introduction

Even though Prelec and Loewenstein (1998) mainly discussed their double-entry model in the context of payments in exchange for consumption, evidence from their research suggests that the model is also applicable to situations involving earnings in exchange for future work. For instance, most their participants declined the opportunity to receive an advance payment, choosing to have their earnings once the work has been completed. For example, in one scenario, 57% preferred to collect $200 per months for six months after an intensive weekend of work (brief task); while in another scenario, 76% preferred the later earning in exchange for a few hours of work each weekend for the next six months (long task).

From a hedonic perspective, getting paid in advance can be just as painful as deferring the payments for consumption. This is because the experienced pleasure from the advance earnings is likely to be attenuated by thoughts about the prospective work, while the disutility from work is unlikely to be buffered by memories of earnings that

have already been collected (and most likely consumed). In fact, Gourville and Soman (1998) argue that the utility of benefits collected in advance (e.g. earnings) could depreciate with the passage of time to the point that an upcoming payment (e.g. work) will feel as a pure loss (a reverse process to payment depreciation which they referred to as *benefit depreciation*). This, according to Gourville and Soman, is because people adapt to the acquisition of a benefit and eventually incorporate it in their wealth - i.e. their status quo financial state (e.g. Kahneman, Knetsch, and Thaler 1991). This led Kamleitner and Hoelzl (2009) to conclude that the association between earnings and work is not stable over time, and is likely to be stronger when the two are temporally close.

While the latter is not explicitly addressed by the double-entry model, it is likely that the relation between the imputed benefit of earnings and the timing of work is similar to the one between the imputed cost of consumption and timing of payments depicted in Figure 2.1 in Chapter 2. That is, past earnings have lower imputed benefits than future ones, and more so when these earnings are received far in advance (point "A" in Figure 4.1). These benefits are highest when the earnings are collected immediately after the work has been completed (point "C"), but decline gradually as the earnings are deferred into the distant future because of temporal discounting (point "D").

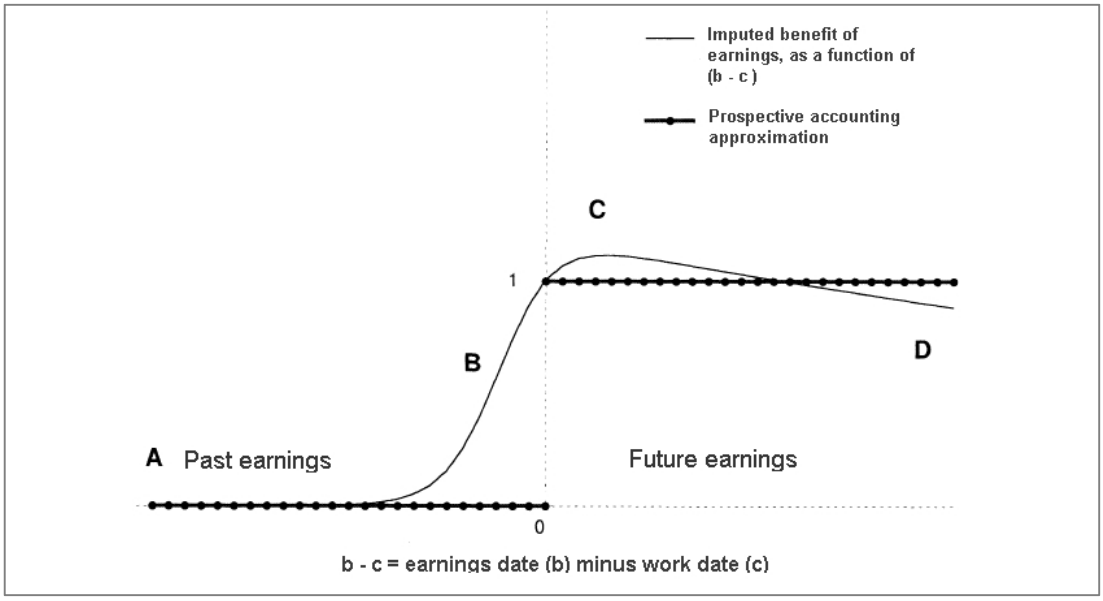


Figure 4.1 - The impact of timing of work on the imputed benefit of earnings

Siemens (2007) provided evidence supporting the benefit depreciation observed in Figure 4.1, by manipulating the time-delay between the receipt of a show-up fee

(benefit) and the completion of a tedious task (a long and boring survey). Participants who got paid the show-up fee at t = three-days, one-week or two-weeks *prior* to the task, perceived the task to be *less satisfying* and the show-up fee to be more *unfair* than those who got paid on the day of the experiment. Participants also reported lower intentions to complete the task.

4.2 Experimental framework

This chapter has three purposes. One, to investigate whether manipulating the timing of a long lasting communal service would influence preferences for the timing of monetary gains the same way it does for losses. That is, whether there will be a preference to align the timing of monetary gains with the period of nonmonetary costs (*the alignment effect*). Two, to test whether the alignment effect observed for monetary losses in Study 3 of Chapter 3 is as robust for shorter durations. Three, to examine whether people make similar financial decisions for themselves and others.

These preferences were examined in two studies whereby two neighbouring counties, a Buyer County and a Seller County, enter into a binding contract that enables the former to use the recycling facilities of the latter for a specific period. In return, the Buyer County would pay the Seller County periodically for providing these services. Therefore, one county was making payments in exchange for receiving temporary recycling services (the "monetary losses" condition), while the other county was receiving payments in exchange for providing these services (the "monetary gains" condition).

The alignment effect was tested by manipulating the period in which the services were being exchanged (early vs. delayed). Therefore, in one condition these services were exchanged in the near future (t_1, t_2), while in the other condition they were exchanged in a more distant one (t_2, t_3). Table 4.1 summarises the four conditions.

Table 4.1 – Between-participants design

		Period of services exchange	
		Early	Delayed
Sign of the outcomes	Monetary Gains (Seller County)	Recycling services provided between t_1 and t_2	Recycling services provided between t_2 and t_3
	Monetary Losses (Buyer County)	Recycling services used between t_1 and t_2	Recycling services used between t_2 and t_3

Preferences for the timing of monetary outcomes are measured using a binary choice task with a fixed time delay (t = 2 years). Accordingly, each choice consists of an earlier amount x_t and a later amount x_{t+2}. As in Chapter 3, the amounts varied from one choice to the other such that the earlier amounts are either larger than the later amounts ($x_t > x_{t+2}$ – negative interest rates), equal to the later amounts ($x_t = x_{t+2}$ – no interest rates), or smaller than the later amounts ($x_t < x_{t+2}$ – positive interest rates).

The earlier amounts are always exchanged between t_1 and t_2, while the later ones are exchanged between t_2 and t_3. Figure 4.2 provides a graphical representation of the task. The upper panel illustrates the condition in which the services are exchanged in the near future (t_1, t_2), while the bottom panel displays the condition in which the services are exchanged in a more distant one (t_2, t_3).

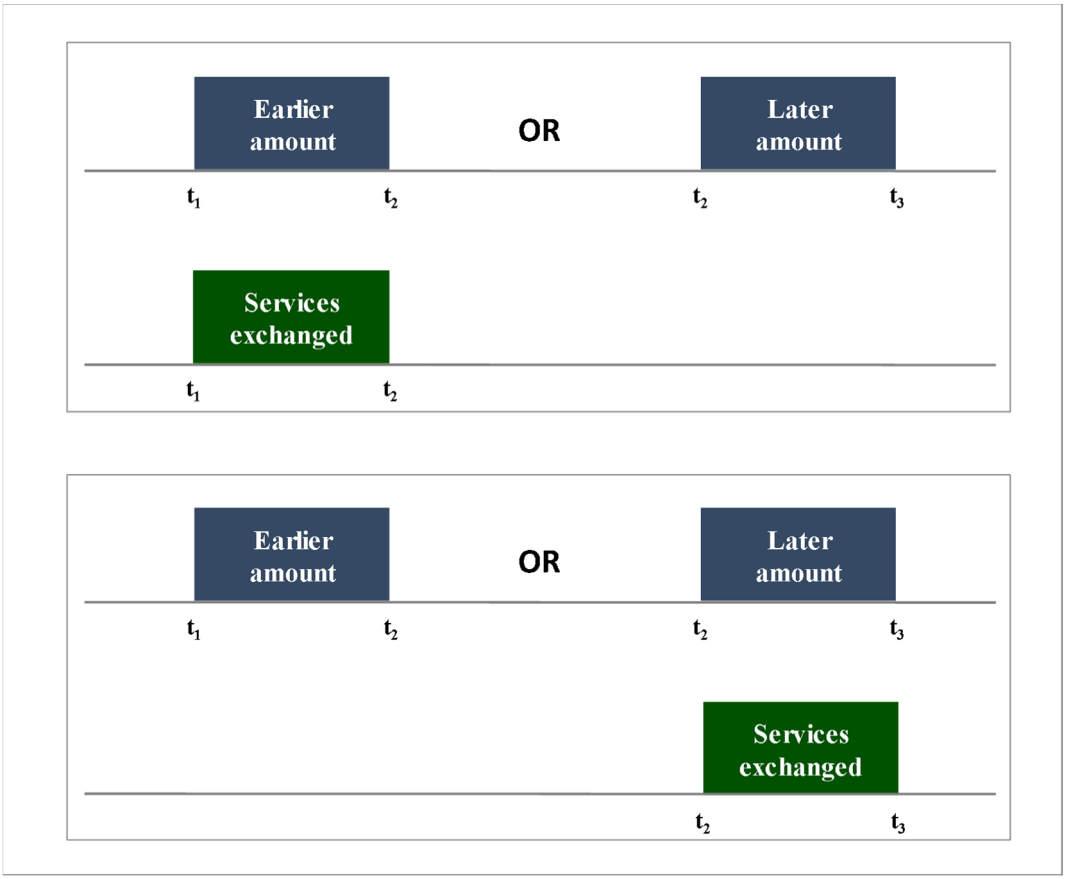


Figure 4.2 – Experimental task

4.3 Predictions

Monetary losses

From a financial (rational) perspective, preferences for the timing of losses *should not* be influenced by the timing of services. Instead, the decision maker should choose the outcome which minimise the present value of the losses. Therefore, he or she will *delay* these losses unless the interest rates exceed the marginal cost of money (Fisher, 1930).

From a mental accounting perspective, however, the period of services (benefits) can matter. Recall that, according to the double-entry model, people have a strong aversion to post-consumption payments because they dislike being in debt for consumption that has already been consumed. Consequently, the model predicts a preference to a) prepay for short-lived consumption, and b) to align the timing of payments with the period of durable consumption.

Therefore, deferring the payments when the community is receiving the benefits between t_1 and t_2, will be hedonically unpleasant for a person who makes financial choices as stated by the model. In contrast, deferring these payments when the community is using the facilities between t_2 and t_3 has very little hedonic cost since the disutility of the payments will be offset by the consumption benefits.

H1a: exchanging the services between t_2 and t_3 will elicit a stronger preference for the later losses compared to t_1 and t_2.

Monetary gains

Financial rationality prescribes that preferences for the timing of monetary gains should not be influenced by the timing of services, and that a rational decision maker should choose the outcomes that maximise the present value of the financial gains. Accordingly, he or she will *expedite* these gains unless interest rates exceed the marginal cost of money.

However, like monetary losses, from a mental accounting perspective the period of services (nonmonetary costs) can also matter. In fact, Prelec and Loewesntein argue that the implications of the double-entry model for situations involving nonmonetary costs such as work are complementary to ones from the nonmonetary benefits domain. As a result, the model predicts a strong aversion to the collection of earnings in advance - for the reasons mentioned in section 4.1.

Therefore, from the perspectives of the decision maker who makes financial choices as predicted by the model, the county providing the services between t_2 and t_3 will not want to collect the earlier gains because this would leave it indebted to the neighbouring county (i.e. hedonically costly). In contrast, expediting the monetary gains when the services are provided between t_1 and t_2 has very little hedonic costs (if any) since the disutility from providing the services will be offset by the utility from the earnings.

H1b: exchanging the services between t_1 and t_2 will elicit a stronger preference for the earlier gains compared to t_2 and t_3.

Gain-loss asymmetry

In addition to the period of services, preferences for the timing of monetary outcomes – be it gains or losses – are also influenced by temporal discounting. Discounting assigns lower weights to future outcomes, making the later losses seem less onerous, and the later gains less appealing. As a result, discounting moderates the preference to prepay for consumption, and in some cases reverses it to a preference for the later payments (losses). Likewise, it moderates the preference to collect earnings in arrears, and in some cases reverses it to a preference for the earlier receipts (gains).

Much of the past research on temporal preferences has shown that implied discount rates are lower for losses than for gains (e.g. Benzion, Rapoport & Yagil, 1989; Loewenstein, 1988; Mitchell & Wilson, 2010; Murphy, Vuchinich, & Simpson, 2001; Myerson, Baumann & Green, 2016) – an anomaly that has been referred to as the sign effect (Thaler, 1981) or gain-loss asymmetry (Loewenstein & Prelec, 1992).

For instance, Thaler (1981) asked participants to specify the amount of money they were willing to accept [pay] if a $15 or $250 reward [fine] was delayed by a period of 3 months, 1 year or 3 years. In all six cases, participants demanded a larger amount of money to delay the reward compared to what they were willing to pay to delay the fine, thereby revealing a lower implied discount rate for losses than for gains. In one case, for example, participants demanded $60 to delay the $15 reward by one year (an implied discount rate equivalent to 300%), but were only willing to pay $20 to delay the $15 fine for the same amount of time (an implied discount rate equivalent to 33.3%). Using a similar but more controlled setup, Benzion et al. (1989) asked participants to specify the amount *$y* that they were willing to accept [pay] to postpone the receipt [payment] of *$x = 40, 200, 1000 and 5000* for a period t = 0.5, 1, 2 and 4 years. On average, participants discounted the monetary gains more than the losses irrespective of the magnitude or outcomes and time delay. Similar findings were also reported by Murphy et al. (2001) using a binary choice titration method. Accordingly, participants made repetitive choices between monotonically increasing smaller sooner amounts and a fixed larger later amount ($500 for gains, -$500 for losses), delayed by a period t = 1 week, 1 month, 6 months, and 1, 3, 5, 10 and 25 years. Overall, the implied rates were significantly higher for gains than losses, especially for longer time delays.

Neural and behavioural evidence from Tanaka el al. (2014) suggests that the gain-loss asymmetry is caused by differential treatment of the losses triggered by *loss aversion* (Kahneman & Tversky, 1979; Scholten & Read, 2010); and *debt aversion* (Loewenstein, 1987; Loewenstein & Thaler, 1989) [23,24]. Loss aversion refers to the sensitivity that people exhibit for losses compared to equivalent gains. In money terms, the pain of paying £10 exceeds the joy of receiving £10. Accordingly, the experienced pain (disutility) from an increase in the magnitude of a payment exceeds the joy (utility) of a similar increase from an equivalent receipt (i.e. the disutility from paying £110 in on year instead of £100 today exceeds the utility of receiving £110 in on year instead of £100 today). As a result, people are more sensitive to changes for losses than gains (i.e. discount gains more than losses).

On the other hand, debt aversion refers to the tendency to resolve aversive outcomes (losses) sooner rather than later. For instance, half the participants in Yates & Watts (1975) preferred to pay $1 or $2 sooner rather than later when the payment was delayed by t = 15, 35 or 75 days. Similar results were reported Hardisty et al. (2013) and Mitchell and Wilson (2010) using larger (but hypothetical) payments (e.g. $10 and $100), and Harris (2012) using nonmonetary aversive outcomes (e.g. a bee sting). This preference – especially for nonmonetary outcomes -- is the result of an additional source of disutility caused by dread from the anticipation of the aversive outcomes (Loewenstein, 1987).

H2: all else being equal, there should be a stronger preference for the earlier gains than later losses, especially when the interest rates are positive.

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[23] The authors found no evidence of differences in discount rates between participants who exhibited the gain-loss asymmetry and those who did not when choosing between an earlier or later monetary gains.

[24] On a neural level, there were significant group differences in brain activity in both the striatum and insula for losses, but not for gains. Participants who displayed the gain-loss asymmetry revealed positive delay correlation in the striatum (i.e. due to deferral aversion) and positive magnitude correlation in the insula (i.e. due to loss aversion) when choosing between an earlier or later monetary loss.

4.4 Study 1

Participants

A sample of 345 UK residents recruited through Bilendi completed the online survey. The data from 21 participants were excluded because of careless responding, determined by the following criteria: switching back and forth between options two standard deviations more than the average, or completing the study two standard deviations faster than the average natural log of completion time. Participants were on average 34 years old, with 47% holding a university degree, 70% in full-time or part-time employment and 62% being females. The study was part of a larger survey including other unrelated studies. The median completion time of the survey was 10 minutes. Participants who successfully completed the survey were rewarded with loyalty points that could be exchanged for products of their liking.

Design and procedure

Participants were presented with a scenario about two counties that were about to enter a binding contract to exchange recycling services. They were asked to identify with one of these counties. This county was either making payments in exchange for temporarily having a portion of their household waste recycled by the other county (the "monetary losses" condition), or receiving payments for temporarily recycling a portion of the household waste of the other county (the "monetary gains" condition).

Participants were told that they were hired by this county to recommend a suitable payment plan to emphasise the communal nature of the decision, and to motivate thoughts about the financial rather than the hedonic aspects of the decision. For instance, Kray (2000) found that participants were more likely to recommend a high paying but unfulfilling job to a stranger (financial), even when they prefer the low paying but self-fulfilling job themselves (hedonic).

The introduction to the scenario read as follows: **"***With the country running out of landfill sites to dispose of household waste, every county in the UK will be required to reduce the amount of waste it sends to landfill by 30% before 2015 [2017]. To help achieve this goal, the government is initiating a nationwide recycling programme that*

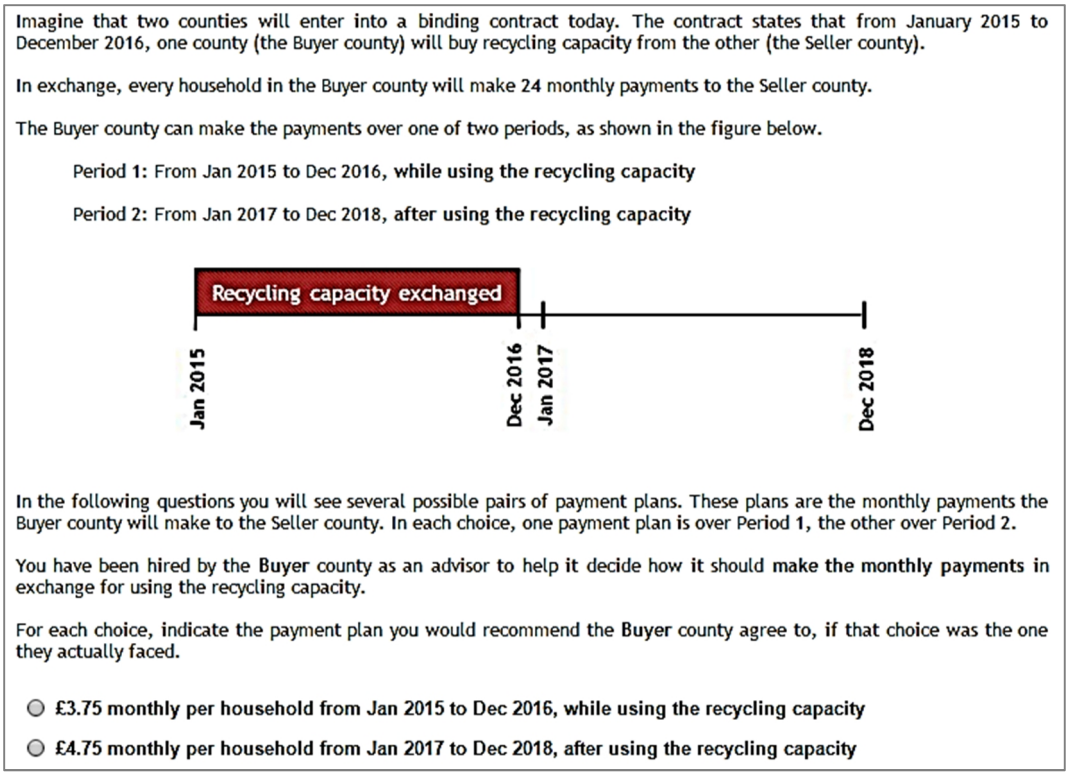
involves building additional household recycling centres in every county in the UK. Meanwhile, counties that don't have enough recycling facilities to meet the government's target by 2015 [2017], will need to buy additional recycling capacity from counties that can sell it".

Each participant was then randomly assigned to one of the 2 (*sign of the monetary outcome:* gains vs. losses) x 2 (*period of recycling services:* early vs. delayed) conditions. Therefore, half the participants were allocated to a buying county, the other half to a selling county. Likewise, half the participants were told that the services will be exchanged between January 2015 and December 2016, while the other half were told that the exchange will take place between January 2017 and December 2018.

Table 4.2 – Between-participants design for Study 1

		Period of recycling services	
		Early	Delayed
Sign	Gains	County selling recycling services between Jan 2015 and Dec 2016	County selling recycling services between Jan 2017 and Dec 2018
	Losses	County buying recycling services between Jan 2015 and Dec 2016	County buying recycling services between Jan 2017 and Dec 2018

Once assigned to a condition, participants were directed to a new page with additional information particular to that condition. Figure 4.3 shows an example of a county that is buying recycling services between January 2015 and December 2016.



Imagine that two counties will enter into a binding contract today. The contract states that from January 2015 to December 2016, one county (the Buyer county) will buy recycling capacity from the other (the Seller county).

In exchange, every household in the Buyer county will make 24 monthly payments to the Seller county.

The Buyer county can make the payments over one of two periods, as shown in the figure below.

Period 1: From Jan 2015 to Dec 2016, **while using the recycling capacity**

Period 2: From Jan 2017 to Dec 2018, **after using the recycling capacity**

In the following questions you will see several possible pairs of payment plans. These plans are the monthly payments the Buyer county will make to the Seller county. In each choice, one payment plan is over Period 1, the other over Period 2.

You have been hired by the Buyer county as an advisor to help it decide how it should make the monthly payments in exchange for using the recycling capacity.

For each choice, indicate the payment plan you would recommend the Buyer county agree to, if that choice was the one they actually faced.

- ○ **£3.75 monthly per household from Jan 2015 to Dec 2016, while using the recycling capacity**
- ○ **£4.75 monthly per household from Jan 2017 to Dec 2018, after using the recycling capacity**

Figure 4.3 - Example of a county buying recycling services in the early period

Each participant was presented with seven pairs of possible payment plans using the general procedure already established in this thesis. Three of these plans had smaller later amounts, one plan had equal amounts, and three had larger later amounts. The earlier amounts ranged between £3 and £6 per month. Later amounts were computed by compounding the earlier amounts over a period of two years using interest rates that ranged from *-12.7%* to *12.5%*. All pairs of payment plans were presented randomly and on separate screens to minimise carryover effects. Table 4.3 presents the amounts and interest rates used.

Table 4.3 – Price list for Study 1

Interest rate levels	x_t	Implied interest rates	x_{t+2}
-3	5.25	-12.7%	4.00
-2	3.00	-8.7%	2.50
-1	3.75	-3.4%	3.50
0	6.00	0.0%	6.00
1	4.25	2.9%	4.50
2	5.00	7.2%	5.75
3	3.75	12.5%	4.75

Results

All reported statistical results were carried out using a GEE model with a logit link function, with *interest rates*, *sign of the outcomes* and *period of recycling services* as predictors of the *timing of monetary outcomes* (earlier or later). The results were analysed by calculating the proportion of participants choosing the *earlier* gains and *later* losses.

A. The alignment effect

Figure 4.4 displays the observed mean proportions choosing the earlier gains (refer to the left panel) and later losses (refer to the right panel) when the period of recycling services was either early or delayed.

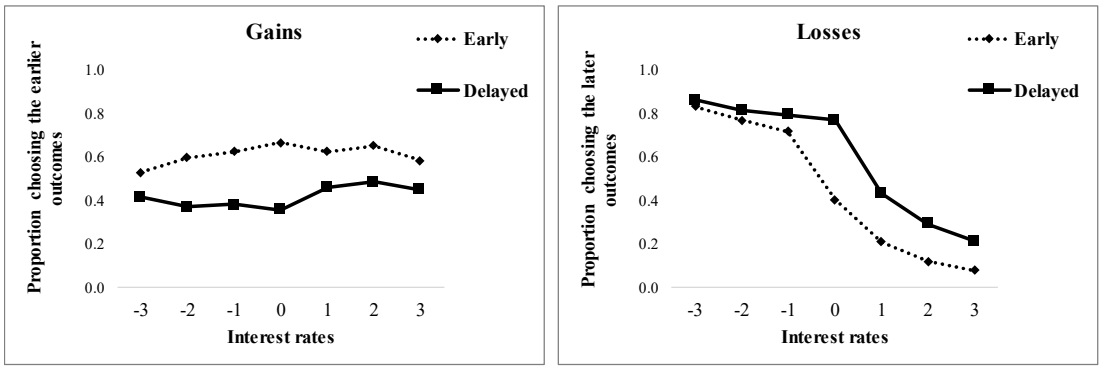


Figure 4.4 – Period x Interest rates interaction

On average, participants were more likely to choose the earlier outcomes (gains and losses) when the services were early, and the later ones when these services were delayed (proportion choosing the earlier gains: M_E = .61 vs. M_D = .42; proportion choosing the later losses: M_E = .45 vs. M_D = .60). Therefore, were strongly inclined to align the timing of monetary outcomes with the period of recycling services (i.e. an alignment effect).

The strength of this effect, however, varied depending on the sign of these outcomes and the level of interest rates. For gains, it was highly evident when the interest rate was zero (M_E = .66 vs. M_D = .36, $p < .001$, $d = .31$) but less so when the rates were negative (M_E = .58 vs. M_D = .39, $p < .005$, $d = .19$) or positive (M_E = .62 vs. M_D = .46, $p < .005$, $d = .15$). For losses, this preference was highly evident when the interest rate was zero (M_E = .40 vs. M_D = .77, *diff* = .36, $p < .001$), less so when the rates were

positive (M_E = .13 vs. M_D = .31, *diff* = .18; $p < .005$), and inevident when these rates were negative (M_E = .77 vs. M_D = .82, *diff* = .05, $p > .05$). In other words, the preference for alignment was stronger when it was financially less costly to do so. Especially for monetary losses. These results were confirmed with a significant interaction between the sign of the outcomes, the period of recycling services and the level of interest rates (χ^2 (6, 320) = 14.9, p = .021).

B. Gain-loss asymmetry

Table 4.4 presents the mean proportion of participants choosing the later losses and earlier gains for each level of interest rates. The table also shows the pairwise comparisons tests across the seven levels.

Table 4.4 – Gain-loss asymmetry results – Study 1

Interest rates levels	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**
Losses	$.85_a$	$.79_b$	$.75_b$	$.60_c$	$.31_d$	$.19_e$	$.13_f$
Gains	$.47_a$	$.47_a$	$.49_a$	$.50_a$	$.53_a$	$.56_a$	$.51_a$
Note: Values not sharing the same subscript are significantly different at $p < .05$.							

For losses, the proportion of participants choosing the later outcomes declined steadily as the interest rates increased, thereby revealing a standard positive time preference (Fishburn & Rubinstein, 1982; Olsen & Bailey, 1981). In contrast, for gains, participants revealed very little variation across the seven levels of interest rates (as evidenced by the pairwise comparisons). These results seem peculiar for two reasons. One, half the participants in the gains condition preferred the later outcomes when the interest rates were negative and zero. Negative and zero discounting using binary choice tasks have been recently documented for monetary losses (e.g. Hardisty et al., 2013; Mitchell & Wilson, 2010), but has rarely been documented for monetary gains[25]. Two, contrary to the gain-loss asymmetry (and hypothesis H2), participants revealed

[25] Negative time preference has been documented for sequences of monetary gains (e.g. Chapman, 1996, Loewenstein & Sicherman, 1991) and for nonmonetary experiences (e.g. Loewenstein, 1987; Harris, 2012)

a stronger preference for the later losses than earlier gains when the interest rates were negative and zero.

To make sense of these findings a *k*-means clustering algorithm (Hartigan, 1975) was undertaken to group individuals in the gains condition according to the choices they made (refer to Appendix A for details). Four groups of participants emerged: a) the *positive discounters,* who switched from the earlier to the later outcomes as the interest rates increased; b) the *high negative discounters,* who were mainly choosing the later outcomes; c) the *high positive discounters,* who were predominantly choosing the earlier outcomes; and d) the *contrarians,* who switched from the ***later to the earlier outcomes*** as the interest rates increased. I refer to the latter group as the contrarians since they were systematically making choices that are contrary to the norm exemplified by the positive discounters. Figure 4.5 illustrates the choices made by the four groups across the seven levels of interest rates.[26]

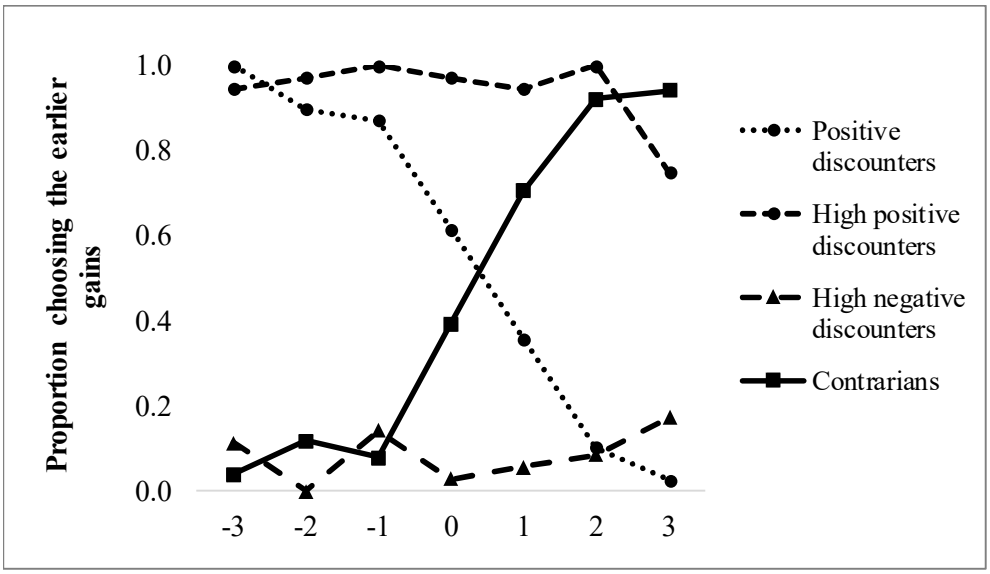


Figure 4.5 – Clustering analysis

Table 4.5 shows the number of participants assigned to each group. Interestingly, the contrarians were the most frequent.

[26] A similar analysis of participants assigned to the losses condition also revealed four groups: the *positive discounters,* who switched to the earlier outcomes when the interest rates were positive; the *negative discounters*, who switched to the earlier outcomes when the interest rate was zero; the high positive discounters, who were predominantly choosing the later outcomes irrespective of the level of interest rates; and the high negative discounters, who were predominantly choosing the earlier outcomes irrespective of the level of interest rates (refer to Appendix A for details).

Table 4.5 – Distribution of participants across groups – Study 1

Groups	Contrarians	Positive discounters	High positive discounters	High negative discounters
Frequency	51	39	36	35
Percentage	32%	24%	22%	22%

Discussion

Overall, the results of Study 1 were consistent with the predictions of the double-entry model, for both gains and losses. This was evidenced by a robust preference to align the timing of monetary outcomes with the period of recycling services. However, this preference diminished as the financial cost of alignment increased, especially for losses. In fact, most participants in the monetary losses condition opted for the later outcomes when the interest rates were negative irrespective of whether the services were early or delayed (i.e. the financially sensible but hedonically costly choice). These results suggest that people are less likely to opt for a hedonically favourable financial arrangement if the financial costs of achieving such an arrangement are high.

In addition to the alignment effect, preferences for the timing of losses (as expected) were also influenced by the interest rates, such that the likelihood of choosing the later losses declined steadily as these rates increased. In contrast, for gains, preferences did not vary at all. In fact, on average, half the participants preferred the smaller later outcomes to the larger sooner ones – a clear violation of intertemporal choice dominance. As a consequence of these choices, participants were less likely to choose the earlier gains than later losses when the interest rates were negative and zero (i.e. an inverse gain-loss asymmetry).

Clustering participants assigned to the gains condition according to the choices they made, revealed a group that was ***less*** likely to choose the later outcomes as the interest rates increased (the "contrarians"). Even though the contrarians violated the principles of intertemporal choice dominance, their choices can be *"rationalised"*. Recall that in the instructions of the experimental task I specifically asked participants to imagine themselves as hired advisors who were making choices on behalf of a county that was selling recycling services to a neighbouring county. It is therefore possible that these contrarians are in fact altruists who were acting to achieve what they perceived to be a fair outcome for both the county selling the services (their employer) and the one

buying these services. After all, if their employer was happy to receive the earlier or the later sums of money, then why not choose the outcome that proves to be the least onerous to the county buying these services. Alternatively, perhaps less plausibly, it could be that the contrarians presumed it was their county which was on the opposite side of the transaction (i.e. the county buying the recycling services), and therefore made a precautionary decision by choosing the least amount of money. It could also be that these participants did not process the information in the instructions carefully. These alternative possibilities are investigated in the following study.

4.5 Study 2

Study 2 uses the same general framework as Study 1. However, the framework was modified to test whether the contrarians were a) altruists who considered the wellbeing of both the residents of the county selling the services and the county buying these services, b) precautionary decision makers who were worried that their county could be the one buying these services, or c) misguided participants who did not process the instructions properly.

Therefore, in addition to manipulating the period of recycling services and the sign of the outcomes, the study also manipulated the level of association between the decision maker (i.e. the participant) and the county in question. As a result, participants were either asked to make decisions on behalf of their own county, a UK county (which is not theirs), or a Welsh county. There should be a strong association when participants are making decisions on behalf of their own county, a moderate association when making decisions on behalf of a UK county, and a weak association when making decisions on behalf of a Welsh county (the sample excluded participants from Wales)[27].

In general, it is expected that participants making decisions on behalf of their own county to be less altruistic than those making decisions on behalf of others. Therefore, if the contrarians are in fact altruists, then there should be less of them among participants making decisions on behalf of their own county compared to the other

[27] The sample consisted of participants from the following countries: 86% from England, 10% from Scotland and 4% from North Ireland.

counties. If they are precautionary decision makers, then there should be more of them in the UK county condition compared to the Welsh county condition since the counterparty to a UK county (i.e. the buyer county) could be theirs[28]. Finally, if they are misguided participants, then they should be equally distributed across the three conditions.

In addition to the above, the instructions were simplified, and the choice options were presented using text and figures to minimise any confusion.

As in Study 1, this study tests for both, the alignment effect – i.e. the preference to align the timing of monetary outcomes with the period of recycling services; and the gain-loss asymmetry – the tendency to discount gains more than equivalent losses.

Participants

A sample of 1,199 UK residents recruited through Bilendi completed the online survey. The data from 83 participants were excluded because of careless responding, determined by the following criteria: switching back and forth between options two standard deviations more than the average, or completing the study two standard deviations faster than the average natural log of completion time. Participants averaged 49 years of age with 39% holding a university degree, 58% in full-time or part-time employment and 59% being females. The median completion time of the survey was 12 minutes. Participants who successfully completed the survey were rewarded with loyalty points that could be exchanged for products of their liking.

Design and procedure

The introduction to the scenario was identical to the one used in Study 1 with one minor change to the years the contract between the two counties becomes effective (2016 – 2018 instead of 2015 – 2017). The duration of the contract remained the same.

[28] Even though the instructions to the UK county condition clearly stated that neither the buyer nor seller counties were the participant's, precautionary decision makers might still opt for the decision that would protect them in the long run. That is, they might presume that their county could also be buying these services under similar circumstances in the future.

Each participant was randomly assigned to one of the 2 (sign of the monetary outcomes: gains vs. losses) x 2 (period of recycling services: early vs. delayed) x 3 (affected community: own county vs. UK county vs. Welsh county) conditions. Once assigned to a condition, each participant was directed to a new page with additional information particular to that condition. Figure 4.6 provides an example of a county selling recycling services between 2016 and 2018. The participant in this case was making decisions on behalf of a Welsh county. A monetary losses scenario is reproduced in Appendix B.

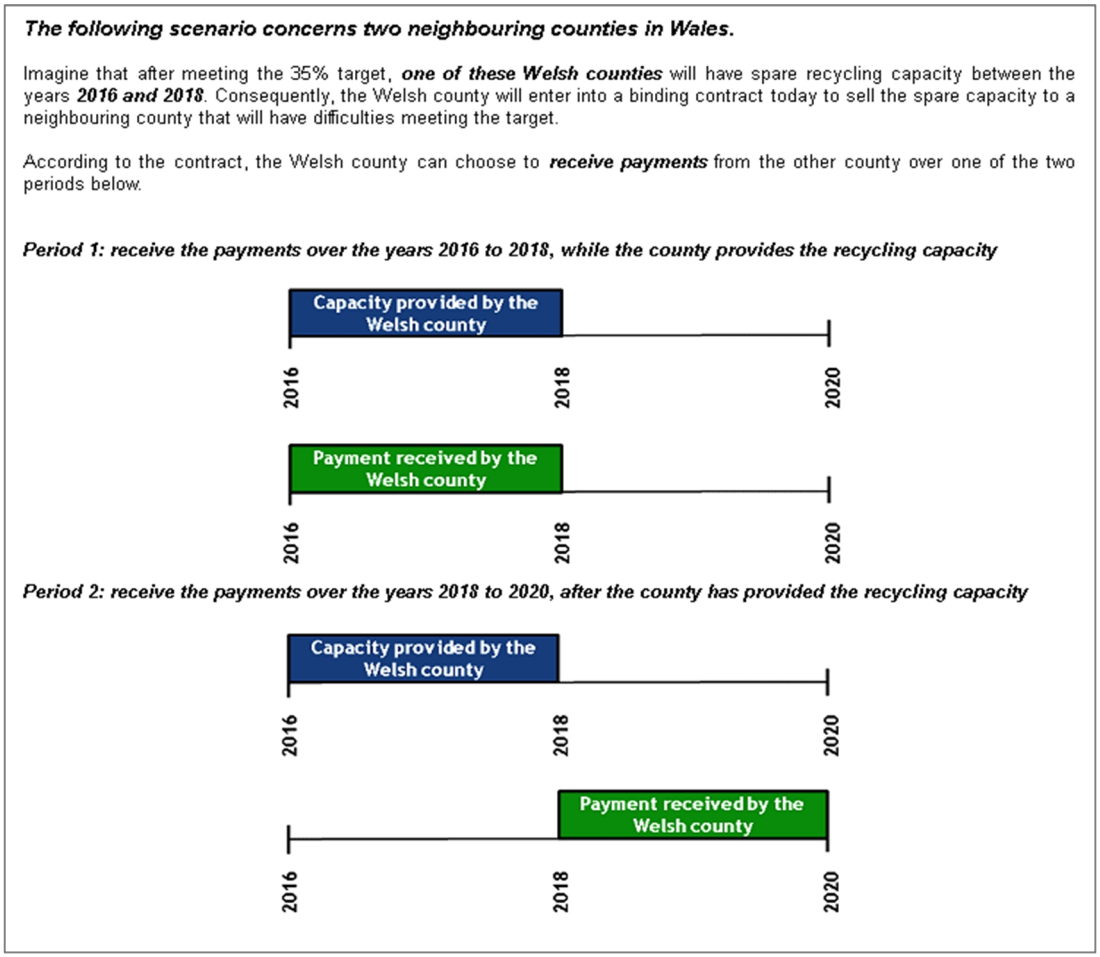


Figure 4.6 - Example a county selling recycling services in the early period

To ensure that the participants processed the information correctly, each condition was followed with a set of additional instructions on a separate page. For instance, participants assigned to the Welsh county in Figure 4.6 saw the following instruction:

"In the following questions, you will be asked to make a number of choices between possible pairs of payment plans. In each pair, one plan always involves the Welsh

county ***receiving payments over the years 2016 to 2018****, while the other always involves the Welsh county* ***receiving payments over the years 2018 to 2020****. These payment plans represent the average amount of money* ***the Welsh county would receive per household per year*** *in exchange for the recycling capacity provided."*

After which, they were directed to the page that contained the actual questions. An example is provided in Figure 4.7.

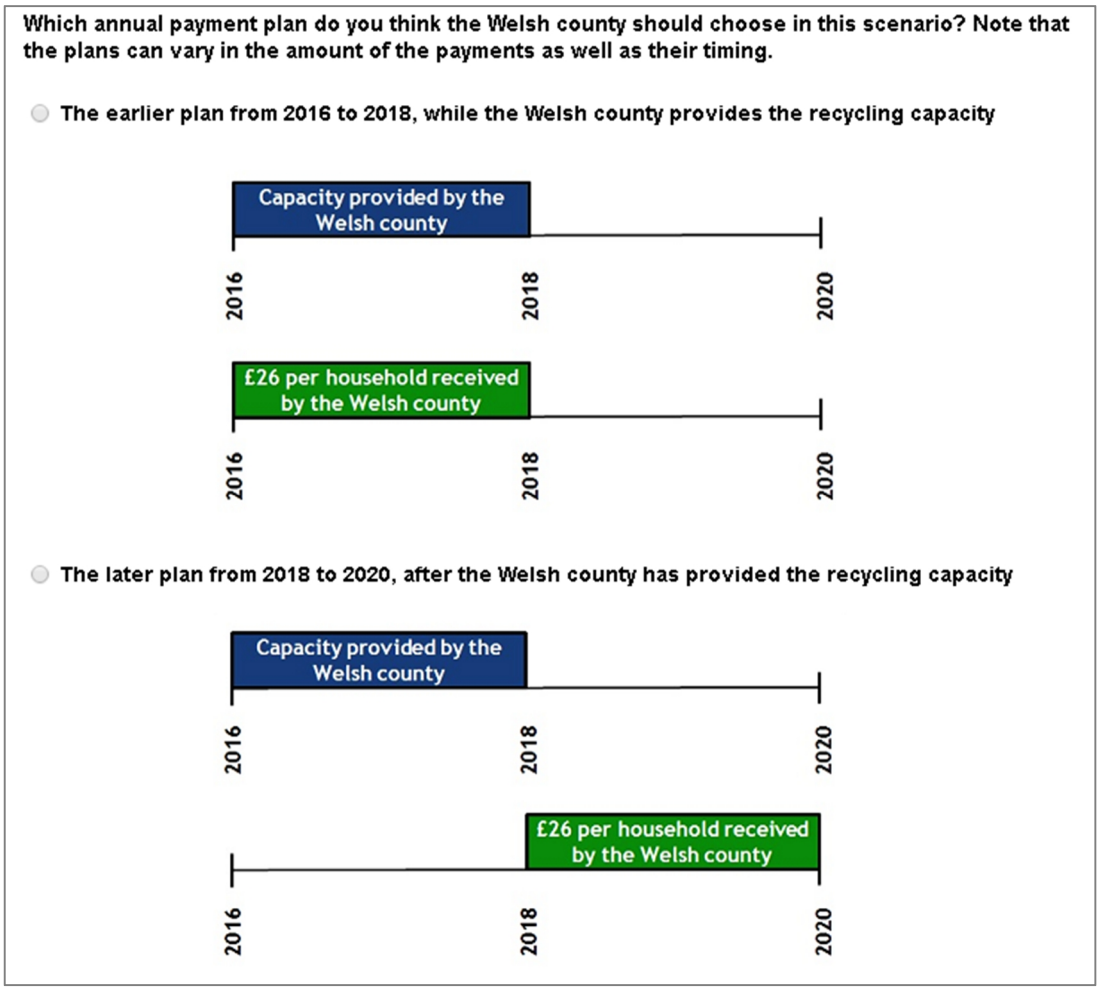


Figure 4.7 – Example of the choice tasks instructions

Each participant was presented with 10 pairs of possible payment plans using the general procedure already established in this thesis. The earlier amounts ranged between £20 and £30 per year. The later amounts were computed by compounding the earlier amounts over a period of two years using interest rates that ranged from *-7%* to *13%*. All pairs of payment plans were presented randomly and on separate screens to minimise carryover effects. In addition, I manipulated the presentation order of the choices (i.e. which option is on top or bottom of the screen). Table 4.6 displays the

amounts and interest rates used. In contrast to Study 1, three choice tasks were used to measure preferences when the earlier and later amounts are equal.

Table 4.6 – Price list for Study 2

Interest rate levels	x_t	Implied interest rates	x_{t+2}
-3	23	-7.0%	20
-2	29	-5.5%	26
-1	25	-2.0%	24
0	26	0.0%	26
0	22	0.0%	22
0	28	0.0%	28
1	21	4.5%	23
2	30	6.3%	34
3	24	9.5%	29
4	20	13.1%	26

Results

I first analyse the choices across the three affected communities factor (own county, UK county and Welsh county). Then, the impact of the period of recycling services on the timing of outcomes, and finally the gain-loss asymmetry.

All reported statistical results were carried out using a GEE model with a logit link function, with the *level of interest rates*, *sign of the outcome, period of recycling services* and *affected community* as predictors of the *timing of monetary outcomes* (earlier or later). The results were analysed by computing the proportion of participants choosing the earlier gains and later losses.

A. Affected community

Figure 4.8 presents the observed mean proportions for gains (left panel) and losses (right panel) across the three affected communities.

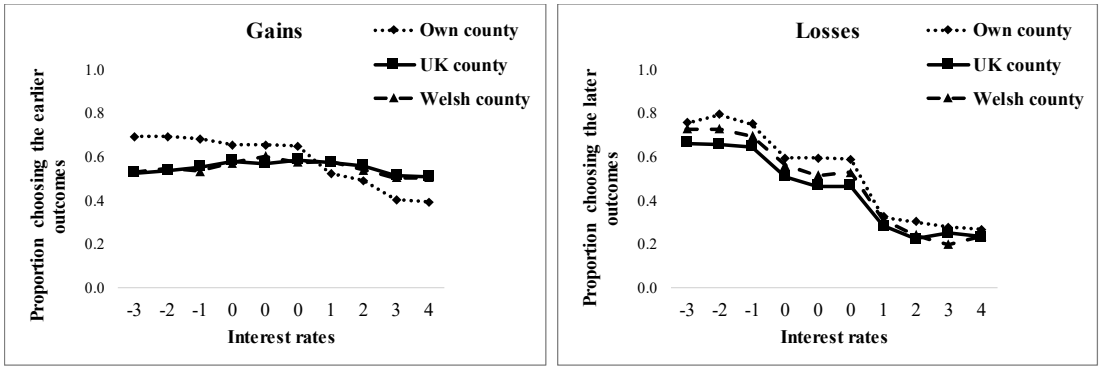


Figure 4.8 – Affected community x Interest rates interaction

On average, participants assigned to the losses condition were more likely to choose the later outcomes when making decisions on behalf of their own county (M = .52) as opposed to a UK county (M = .44) or a Welsh county (M = .47). However, these differences were not statistically significant (χ^2 (2, 550) = 5.21, p = .074). Apart from that, all three affected community groups revealed the same pattern of choices. That is, they were increasingly less likely to choose the later losses as the interest rates increased.

In contrast, for gains, Figure 4.8 reveals two different patterns of choices. Participants making decisions on behalf of their own county were less likely to choose the earlier gains as the interest rates increased (i.e. a positive time preference). Conversely, those making decision on behalf of a UK or Welsh county were slightly more likely to choose the *earlier gains* as the interest rates increased (i.e. a negative time preference). Interestingly, the pattern revealed by participants assigned to the UK or Welsh county was similar to the one observed in Study 1 (see Table 4.4 above). Therefore, suggesting that there is a strong presence of contrarians within the UK and Welsh county conditions.

To confirm, a *k*-means clustering analysis was conducted to group participants according to the choices they made (refer to Appendix B for details). Like Study 1, four groups in the gains condition emerged: the positive discounters, the high positive discounters, the high negative discounters and the contrarians. Table 4.7 presents the number of participants in each group. Interestingly, the proportion of contrarians observed in this study was lower than the one observed in Study 1, dropping from 32% to 15%. Therefore, implying that some confusion may have been eliminated by the simplified instructions. As in Study 1, the contrarians revealed a strong preference for

the outcomes with least amount of money (i.e. the later gains when the interest rates were negative, and the earlier ones when the rates were positive).

Table 4.7 – Distribution of participants across groups – Study 2

Groups	High positive discounters	High negative discounters	Positive discounters	Contrarians
Frequency	204	167	111	84
Percentage	36%	30%	20%	15%

As predicted, there was a significant difference in the distribution of contrarians across the three affected communities (χ^2 (2, 84) = 137.14, $p < .001$). Only 14% (N = 12) were making decisions on behalf of their own county, while the remaining 86% were equally divided between those who were making decisions on behalf of the UK county (N = 36) and the Welsh county (N = 36). In contrast, none of the other groups revealed significant differences in their distributions across the three communities (high positive discounters: χ^2 (2, 204) = 1.13, $p = .567$; high negative discounters: χ^2 (2, 167) = .048, $p = .976$; positive discounters: χ^2 (2, 111) = 1.41, $p = .494$).

These observations provide evidence supporting the proposition that the contrarians are most likely altruists who were making decisions they perceived to be fair for both the buying and selling counties. That is, there was no evidence supporting the "precautionary participants" explanation (since the number of contrarians was identical for the UK and Welsh counties), and no evidence supporting the "misguided participants" explanation (since the number of contrarians across the three affected communities was different).

In addition, an analysis of the survey completion times ruled out the possibility that participants making decisions on behalf of their own county were more attentive to the survey. In fact, participants making decisions on behalf of other counties took more time to complete the survey. The median completion time was ~12 minutes for participants assigned to the Welsh county, ~11 minutes and 30 seconds for those assigned to the UK county, and ~11 minutes for those assigned to their own county. Furthermore, an analysis of participants' responses to Frederick's (2005) 3-item cognitive reflection test ruled out potential differences in cognitive ability (F(2, 564) = .037, p = .964).

B. Period of recycling services

Figure 4.9 compares the proportions of participants choosing the earlier gains (left panel) and later losses (right panel) when the period of recycling services was either early or delayed.

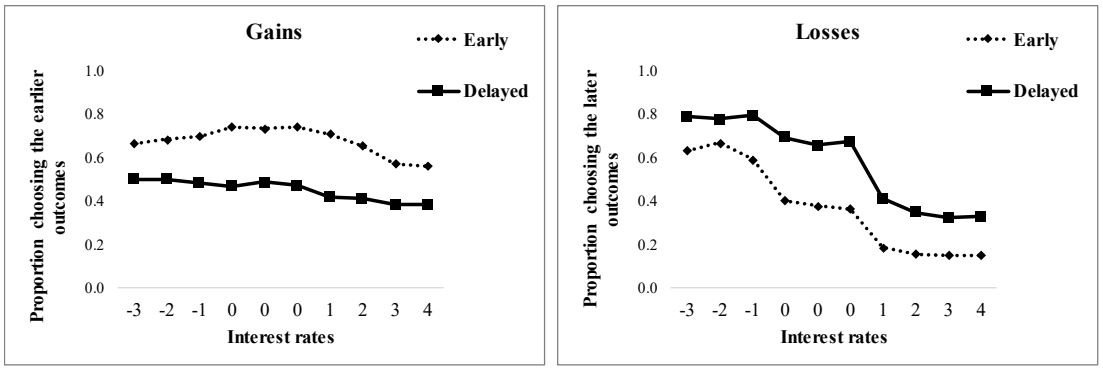


Figure 4.9 – Period x interest rates interaction for gains (left panel) and losses (right panel)

As in Study 1, there was a robust temporal alignment effect evidenced by a stronger preference for the earlier outcomes when the services were early, and the later ones when these services were delayed. This was true for both gains and losses (proportion choosing the earlier gains: $M_E = .67$ vs. $M_D = .45$; proportion choose the later losses: $M_E = .37$ vs. $M_D = .56$). However, the strength of this effect varied depending on the level of interest rates. According to Figure 4.9, this effect was strongly evident when the interest rates were zero (for gains: $M_E = .74$ vs. $M_D = .47$, $d = .29$; for losses: $M_E = .38$ vs. $M_D = .67$, $d = .26$), but less so when the interest rates were negative (for gains: $M_E = .68$ vs. $M_D = .49$, $d = .19$; for losses: $M_E = .63$ vs. $M_D = .78$, $d = .16$) or positive (for gains: $M_E = .62$ vs. $M_D = .40$, $d = .22$; for losses: $M_E = .16$ vs. $M_D = .35$, $d = .19$). In other words, participants were less likely to align the monetary outcomes to the period of recycling services as the cost of alignment increased. These results were confirmed with a significant interaction between the levels of interest rates, sign of the outcomes and period of recycling services (χ^2 (9, 1116) = 30.0, $p < .001$).

C. *Period of recycling services by affected community*

Figure 4.10 displays the proportion of participants choosing the earlier gains (left panel) and later losses (right panel) for the three affected communities when the recycling services were either early or delayed.

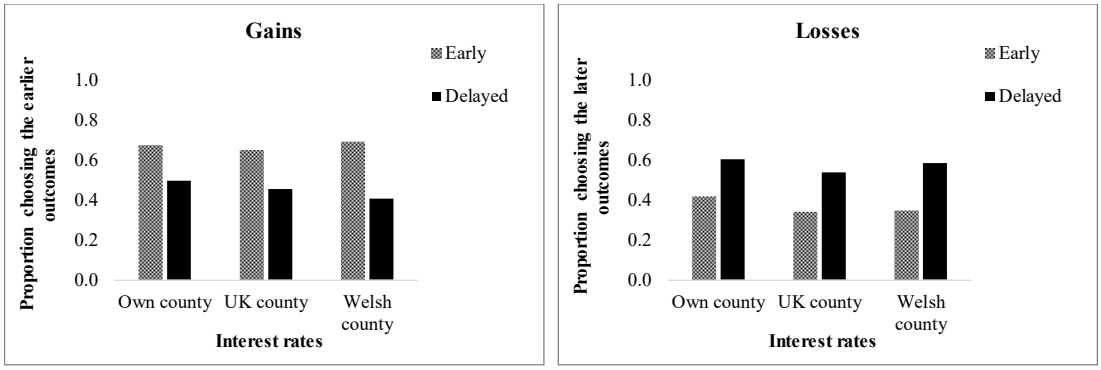


Figure 4.10 – Period x affected community interaction

In general, participants were more likely to align the timing of outcomes to the period of recycling services when making decisions on behalf of the Welsh county (diff between the early and delayed conditions for gains: d = .29, for losses: d = .24), followed by the UK county (for gains: d = .20; for losses: d = .20), and finally by those who were making decisions on behalf of their own county (for gains: d = .18; for losses: d = .18). However, these differences were not statistically significant. That is, there was no evidence of a significant interaction between the sign of the outcomes, affected community and period of recycling services (χ^2 (2, 1116) = 2.89, p = .235). There was also no evidence of an interaction between the sign, affected community, period of recycling services and interest rates (χ^2 (18, 1116) = 21.0, p = .278).

D. Gain-loss asymmetry

Table 4.8 presents the proportion of participants choosing the later losses and earlier gains across the 10 levels of interest rates.

Table 4.8 – Gain-loss asymmetry results – Study 2

Interest rates levels	**-3**	**-2**	**-1**	**0**	**0**	**0**	**1**	**2**	**3**	**4**
Losses	$.71_a$	$.72_a$	$.70_a$	$.55_b$	$.52_b$	$.53_b$	$.30_c$	$.26_c$	$.24_c$	$.24_c$
Gains	$.58_a$	$.59_a$	$.59_a$	$.60_a$	$.61_a$	$.60_a$	$.56_a$	$.53_b$	$.47_c$	$.47_c$
Note: Values not sharing the same subscript are significantly different at $p < .05$.										

Overall, participants preferred the earlier gains more than the later losses when the interest rates were positive or zero, thereby revealing a typical gain-loss asymmetry. However, because of the choices made by the contrarians, this preference was reversed when these rates were negative.

In fact, a comparison of the choices made by participants who were making decisions on behalf of their own county (the group that had the fewest contrarians) shows that they were equally inclined to choose the later losses and earlier gains when the interest rates were negative (avg. across the 3 choices: $M_{Losses} = .76$ vs. $M_{Gains} = 68$, $p = .452$) and zero (avg. across the 3 choices: $M_{Losses} = .59$ vs. $M_{Gains} = .65$, $p = .723$), but more likely to choose the earlier gains than later losses when these rates were positive (avg. across the 4 choices: $M_{Losses} = .29$ vs $M_{Gains} = 45$, $p < .001$). In other words, these participants revealed a stronger preference to prepay for consumption than to collect earnings in arrears.

Discussion

As in Study 1, deferring the consumption period of services elicited a stronger preference for the later losses, while expediting the provision period of these services elicited a stronger preference for the earlier gains. Therefore, revealing a robust preference to align the timing of monetary outcomes (gains and losses) to the period of recycling services. This was true regardless of the level of interest rates (but more so when the interest rates were zero). Interestingly, the evidence for losses concerning the negative rates is inconsistent with Study 1, but consistent with the results of Study 3 in Chapter 3.

There was no evidence that participants assigned to the losses condition were making different choices on behalf of their own county compared to the other counties. One, they revealed the same pattern of choices across all the levels of interest rates. That is, they were less likely to choose the later outcomes as the interest rates increased (positive time preference). Two, they revealed a similar tendency to align the timing of outcomes to the period of recycling services. In contrast, those assigned to the gains condition revealed two different patterns of choices across the levels of interest rates. Participants making decisions on behalf of their own county were less likely to choose the earlier gains as the interest rates increased (i.e. revealing a positive time preference). Conversely, those making decisions on behalf of the UK or Welsh county were equally inclined to choose the earlier gains regardless of the level of interest rates (i.e. a neutral time preference). In fact, the pattern of choices revealed by participants making decision on behalf of a UK or Welsh county was similar to the one observed for the gains condition in Study 1.

A *k*-means clustering analysis confirmed that there were more contrarians making decisions on behalf of other counties as opposed to their own county, thereby supporting the proposition that the contrarians observed in Study 1 were predominantly altruists who were making choices they perceived to be fair to both the buying and selling counties. This evidence suggests that individuals care about equity and the wellbeing of the society when making social decisions on behalf of others. These results are consistent with De Dreu et al. (1994) that individuals in social contexts care about the fair and equitable distribution of resources between negotiating parties, and with De Vries (1991) who showed that gain-framed individuals are more likely to help minimise other's losses than maximise other's gains. These results are also consistent with the evidence from experiments using a modified version of the dictator game (Kahneman, Knetsch & Thaler, 1986) whereby third-parties frequently punished dictators and/or compensated recipients in the event of an inequitable distribution of money (e.g. Almenberg et al., 2011; Fehr & Fischbacher, 2004; Lotz et al., 2010).

4.6 General discussion

This chapter examined the temporal preferences of UK citizens for monetary gains and losses in exchange for a communal service that was either exchanged in the near or distant future.

Overall, the results revealed a robust *temporal alignment effect* for both gains and losses – i.e. a preference to align the timing of costs with the benefits. This effect was observed when the participants assumed the role of an external advisor (Study 1), and when they were making decisions on behalf of their own county or another county (Study 2). Therefore, suggesting that people use similar mental accounting rules when making financial decisions for themselves and others. Although, one particular group, the contrarians, proved to be an exception to this observation. Instead, these contrarians were making choices that minimise the costs to the county buying the communal services, but maintain an acceptable payoff to the county selling these services. Therefore promoting what they perceived to be an equitable distribution of resources.

These findings are consistent with the predictions of the double-entry model, that people dislike postpaying for consumption, and collecting earnings in advance. In fact, Study 2 shows that many preferred to *pay more sooner than less later* when the communal services were early, and to *receive less later than more sooner* when these services were delayed. In their paper, Prelec and Loewenstein (1998) argue that the imputed cost to consuming now and paying later is a "real cost" in the sense that it actually reduces the pleasure of consumption. These results support this claim. These results also support the proposition that temporally aligning the costs and benefits of communal services strengthens the mental association between the two. Thereby, offsetting the disutility from these costs.

On a policy level, these findings suggest that government can improve tax collection (and even justify an increase in taxes) by clearly highlighting the benefits these taxes are financing to the taxpayers. One way to do so is by means of temporal hypothecation that was discussed in Chapter 3. These findings also suggest that government can intervene to moderate the public's impatience for monetary and nonmonetary communal benefits by drawing attention to the costs of these benefits. For instance, in relation to the proposed shale wealth fund[29] that was mentioned in Chapter 1, the UK government may want to highlight the costs of developing and extracting the shale gas in way that persuades the public to support an appropriate distribution of benefits over time.

Prelude to Chapter 5

The two-period framework used in this chapter (i.e. early versus delayed services) raises two concerns. One, some might argue that the observed pattern of choices may have been caused by an inertia to stick with the default option of alignment as opposed to nonalignment – i.e. a status quo bias (e.g. Kahneman et al., 1991; Korobkin, 1998; Samuelson & Zeckhauser, 1988). That is, people expect the monetary outcomes to be aligned with period of services, and as a consequence any deviation from alignment

[29]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/544241/shale_wealth_fund_final_pdf-a.pdf

needs to be justified. Two, the costs and benefits of spending / revenue sharing communal programmes rarely have such perfect temporal alignment.

Consequently, the following chapter, extends the investigation using a framework that consists of five-periods, such that the exchange of goods or services: precedes the earlier and later monetary outcomes, b) is aligned with the earlier outcome, c) is in-between the earlier and later outcomes, d) is aligned with the later outcome, and e) follows the earlier and later outcomes.

4.7 Appendix A – Study 1

Scenarios

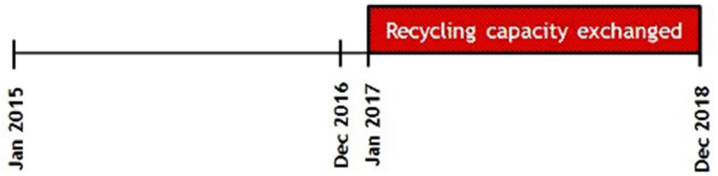
Imagine that from January 2017 to December 2019, one county (the Seller county) will sell additional recycling capacity to another (the Buyer county). However, by January 2019 the Buyer county will be able to meet its own recycling needs.

In exchange, every household in the Seller county will receive monthly payments from the Buyer county for a period of two years.

The Seller county can receive the payments over one of two periods, as shown in the figure below.

Period 1: From Jan 2015 to Dec 2016, **before providing the recycling capacity**

Period 2: From Jan 2017 to Dec 2018, **while providing the recycling capacity**



In the following questions you will see several possible pairs of payment plans. These plans are the monthly payments the Seller county will receive from the Buyer county. In each choice, one payment plan is over Period 1, the other over Period 2.

Imagine you are an advisor to the Seller county. For each choice, indicate which payment plan you would recommend the Seller county agree to, if that choice was the one they actually faced.

- **£3.75 monthly per household from Jan 2015 to Dec 2016, before providing the recycling capacity**
- **£3.75 monthly per household from Jan 2017 to Dec 2018, while providing the recycling capacity**

Figure 4.11 – Example of a county selling delayed recycling services

Clustering analysis

We use a *k*-means clustering algorithm (Hartigan, 1975; Hartigan & Wong, 1978) to group participants according to the choices they made. The *k*-means algorithm works by partitioning the input data into *k* clusters by moving it around to minimize the variability within clusters and to maximize it between them. Accordingly, the algorithm will group participants with similar choice patterns into the same cluster.

To determine the optimal number of clusters *k,* we calculated the sum of squared distance between each observation of a cluster and its centroid (also referred to as sum of square error - SSE) for $k = 2$ to $k = 15$. After which, we plotted the within cluster SSE against the number of clusters *k* (see Figure 4.12). The optimal number of clusters is determined by the point where the within cluster SSE becomes stable, which in this

case is k = 5 for both gains and losses (also known as the *elbow criterion method*, Ketchen & Shook, 1996).

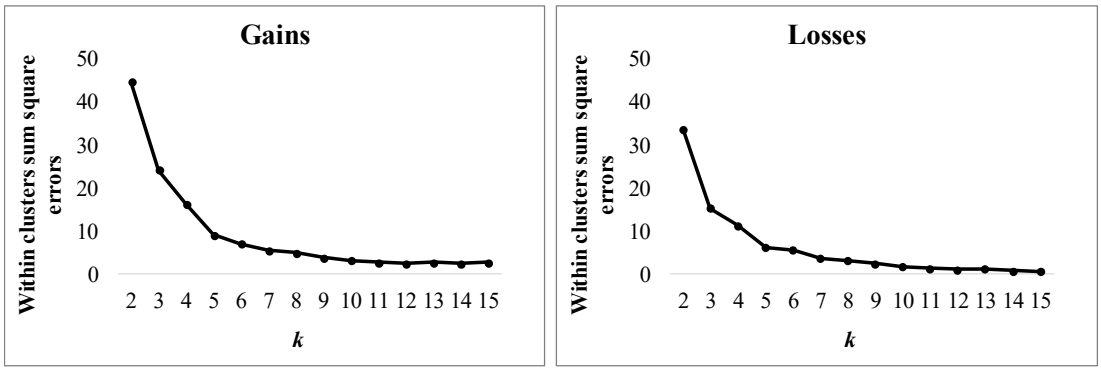


Figure 4.12 – Optimal number of clusters using elbow criterion method

A. Monetary gains

Table 4.9 displays the proportion of participants choosing the earlier gains at each level of interest rates for the five clusters, along with the number of participants in each cluster.

Table 4.9 – Clustering analysis – Study 1 (Gains)

Interest rates	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
	High negative discounters	**High positive discounters**	**Positive discounters**	**Contrarians**	**Contrarians**
-3	0.1	0.9	1.0	0.1	0.0
-2	0.0	1.0	0.9	0.0	0.1
-1	0.1	1.0	0.9	0.0	0.1
0	0.0	1.0	0.6	0.5	0.1
1	0.1	0.9	0.4	1.0	0.0
2	0.1	1.0	0.1	0.9	0.9
3	0.2	0.8	0.0	0.9	1.0
Number of participants	**35**	**36**	**39**	**36**	**15**
Percentage	**22%**	**22%**	**24%**	**22%**	**10%**
Mean implied discount rate	**11.9%**	**-12.4%**	**1.52%**	**n/a**	**n/a**

Participants in Cluster 1 were predominantly choosing the later outcomes, irrespective of the level of interest rates. The group has an average implied discount rate equivalent to -12.4%. Therefore, we refer to them as the *high negative discounters*. Conversely, participants in Cluster 2 were predominantly choosing the earlier outcomes, irrespective of the level of interest rates. The group has an average implied discount

rate equivalent to 11.9%. Accordingly, we refer to them as the *high positive discounters*. Participants in Cluster 3 are standard discounters who switched to the later outcomes as the interest rates increased. The cluster is a mix between those who switched to the later outcomes when the interest rate was zero (~ 30%) or positive (~ 60%). The group has an average implied discount rate equivalent to 1.52%. We refer to them as the *positive discounters*. Finally, clusters 4 and 5 consisted of participants who switched from the ***later to the earlier outcomes*** as the interest rates increased. That is, they were making choices that is contrary to the expected norm. As a result, we refer to them as the *contrarians*.

B. Monetary losses

Table 4.10 shows the proportion of participants choosing the later losses at each level of interest rates for the five clusters, along with the number of participants in each cluster.

Table 4.10 – Clustering analysis - Study 1 (Losses)

Interest rates	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
	High negative discounters	**High positive discounters**	**Negative discounters**	**Positive discounters**	**Others**
-3	0.1	1.0	1.0	1.0	0.0
-2	0.1	1.0	1.0	0.9	0.0
-1	0.0	1.0	0.7	1.0	0.2
0	0.0	1.0	0.0	1.0	1.0
1	0.0	1.0	0.0	0.3	0.3
2	0.1	1.0	0.0	0.0	0.2
3	0.1	0.7	0.0	0.0	0.3
Number of participants	**23**	**28**	**43**	**63**	**6**
Percentage	**14%**	**17%**	**26%**	**39%**	**4%**
Mean implied discount rate	**-12.2%**	**11.7%**	**-2.71%**	**2.60%**	**n/a**

Participants in Cluster 1 were predominantly choosing the earlier outcomes, irrespective of the level of interest rates. The group has an average implied discount rate equivalent to -12.2%. As a result, we refer to them as the *high negative discounters*. Conversely, participants in Cluster 2 were predominantly choosing the later outcomes, irrespective of the level of interest rates. The group has an average implied discount rate equivalent to 11.7%. Therefore, we refer to them as the *high*

positive discounters. Participants in Cluster 3 predominantly switched to the earlier outcomes when the interest rate was zero. The group has an average implied discount rate equivalent to -2.71%. Therefore, we refer to them as the *negative discounters.* In contrast, participants in Cluster 4 switched to the earlier outcomes when the interest rates were positive. They have an average implied discount rate equivalent to 2.60%. Accordingly, we refer to them as the *positive discounters*. Finally, Cluster 5 consists of 6 participants who were predominantly choosing the earlier outcomes but switched to later outcomes when the interest rate was zero.

C. Distribution of groups

Figure 4.13 compares the frequency of participants within each group when the services were either early or delayed.

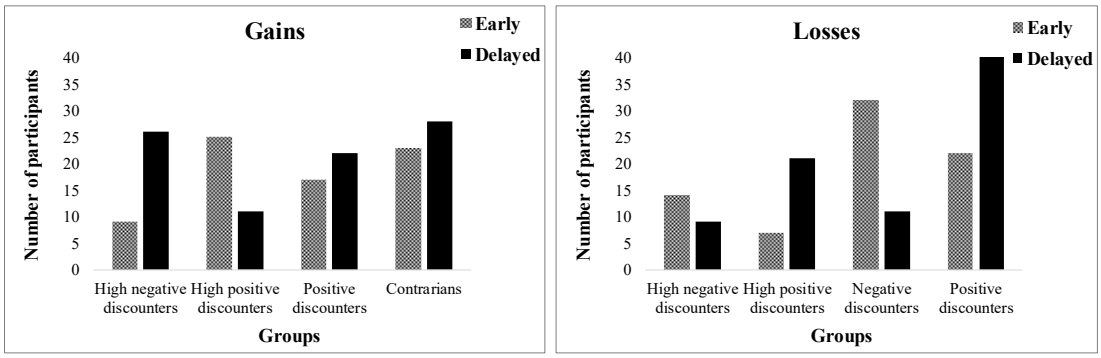


Figure 4.13 – Distribution of groups across conditions – Study 1

For gains (refer to the left panel), there were more *high negative discounters* in the delayed services condition compared to the early one ($N_E = 9$ vs $N_D = 26$; χ^2 (1, 35) = 8.25, p = .004). Conversely, there were more *high positive discounters* in the early services condition compared to the delayed one ($N_E = 25$ vs $N_D = 11$; χ^2 (1, 36) = 5.44, p = .020). Interestingly, there were more positive discounters in the delayed condition than the early one ($N_E = 17$ vs $N_D = 22$; χ^2 (1, 39) = .641, p = .423). However, this difference was not significant. There were also more *contrarians* in the delayed condition than the early one ($N_E = 23$ vs $N_D = 28$; χ^2 (1, 51) = .490, p = .484). However, this difference was also not significant.

For losses (refer to the right panel), there were more *high negative discounters* and *negative discounters* in the early services condition compared to the delayed one (for the high negative discounters: $N_E = 14$ vs $N_D = 9$, χ^2 (1, 23) = 1.08, p = .297; for the negative discounters: $N_E = 32$ vs $N_D = 11$, χ^2 (1, 43) = 10.25, p = .001). However, the

difference for the former was not significant. In contrast, there were more *high positive discounter* and *positive discounters* in the delayed services condition compared to the early one (for the high positive discounters: $N_E = 7$ vs $N_D = 21$; $\chi^2 (1, 28) = 7.00$, $p = .008$); for the positive discounters: $N_E = 22$ vs $N_D = 41$; $\chi^2 (1, 63) = 5.73$, $p = .017$).

4.8 Appendix B – Study 2

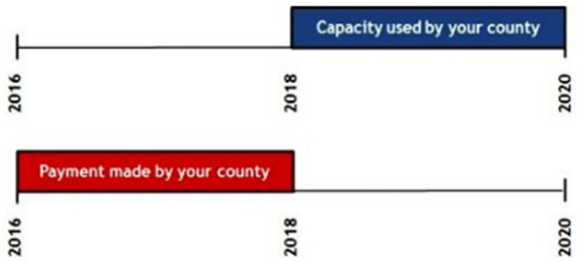
Scenarios

The following scenario concerns two neighbouring counties in the UK, of which one is yours.

Imagine that ***your county*** will not be able to meet the 35% target between the years ***2018 and 2020***. Consequently, your county will enter into a binding contract today to buy additional recycling capacity from a neighbouring county that will have spare capacity to sell.

According to the contract, your county can choose to ***make payments*** to the other county over one of the two periods below.

Period 1: make the payments over the years 2016 to 2018, before your county uses the recycling capacity



Period 2: make the payments over the years 2018 to 2020, while your county uses the recycling capacity

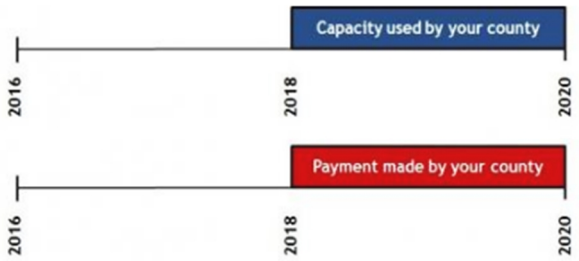


Figure 4.14 – Example a county buying recycling services in the delayed period

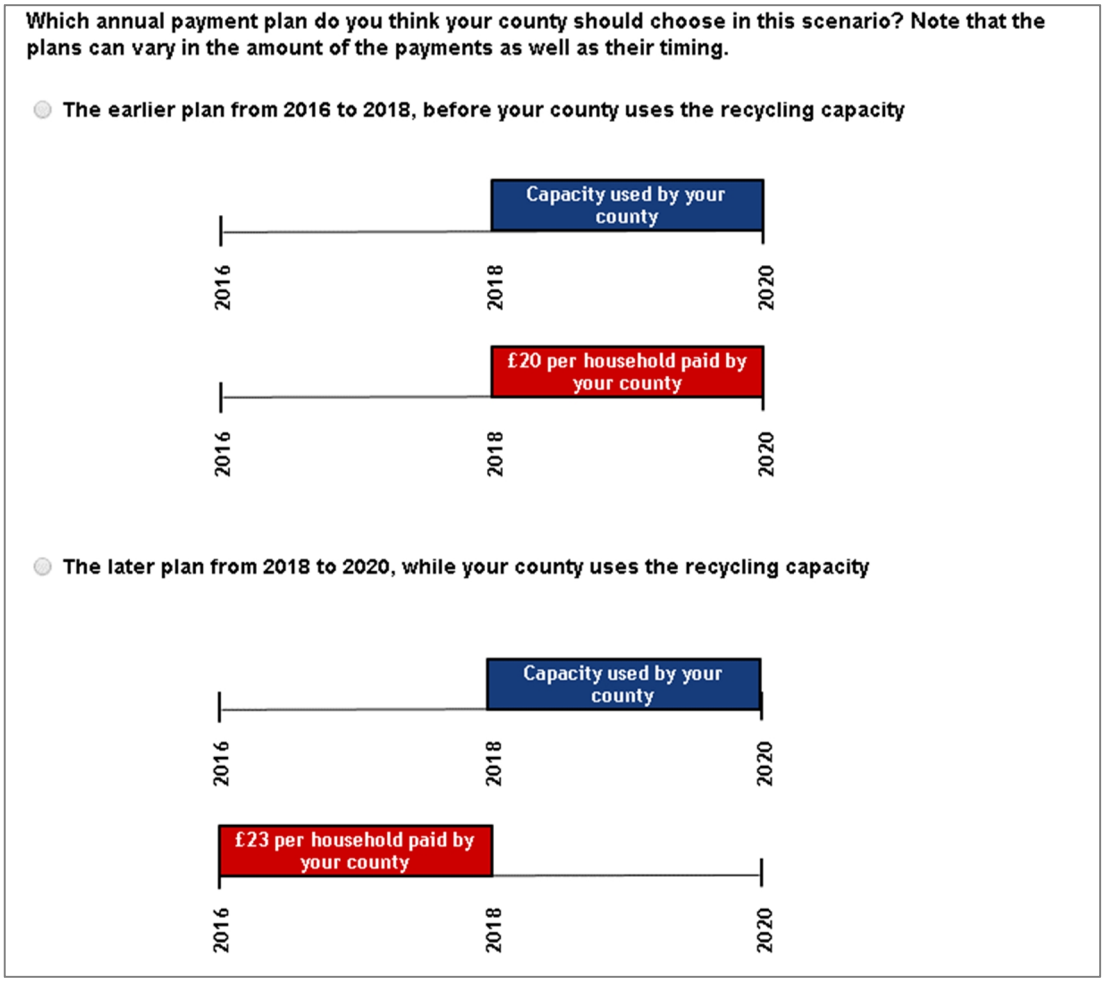


Figure 4.15 – Example of the choice tasks instructions

Clustering analysis

Using the elbow criteria, the optimal $k = 4$ for both gains and losses.

A. Monetary gains

Table 4.11 shows the proportion of participants choosing the earlier gains at each level of interest rates for the five clusters, along with the number of participants in each cluster.

Table 4.11 – Clustering analysis – Study 2 (Gains)

	Cluster 1	**Cluster 2**	**Cluster 3**	**Cluster 4**
	High negative discounters	**High positive discounter**	**Positive discounters**	**Contrarians**
-3	0.2	0.9	1.0	0.0
-2	0.2	0.9	0.9	0.0
-1	0.2	0.9	0.9	0.1
0	0.0	1.0	1.0	0.3
0	0.0	1.0	0.9	0.4
0	0.0	1.0	0.9	0.4
1	0.1	1.0	0.3	0.9
2	0.1	1.0	0.0	0.9
3	0.1	0.9	0.0	0.9
4	0.1	0.8	0.1	0.9
Number of participants	**167**	**204**	**111**	**84**
Percentage	**20%**	**15%**	**36%**	**30%**
Mean implied discount rate	**-5.60%**	**11.17%**	**2.85%**	**n/a**

Participants in Cluster 1 were predominantly choosing the later outcomes irrespective of the level of interest rates. The group has an average implied discount rate equivalent to -5.60%. Therefore, we refer to them as the *high negative discounters*. Conversely, participants in Cluster 2 were predominantly choosing the earlier outcomes irrespective of the level of interest rates. The group has an average implied discount rate equivalent to 11.17%. Accordingly, we refer to them as the *high positive discounters*. Participants in Cluster 3 are standard discounters who switched to the later outcomes as the interest rates increased. The group has an average implied discount rate equivalent to 2.85%. We refer to them as the *positive discounters*. Finally, Clusters 4 consisted of the *contrarians* who switched from the later to the earlier outcomes as the interest rates increased.

B. Monetary losses

Table 4.12 shows the proportion of participants choosing the later losses at each level of interest rates for the five clusters, along with the number of participants in each cluster.

Table 4.12 – Clustering analysis – Study 2 (Losses)

	Cluster 1	**Cluster 2**	**Cluster 3**	**Cluster 4**
	High negative discounters	**High positive discounter**	**Negative discounters**	**Positive discounters**
-3	0.1	0.9	1.0	1.0
-2	0.1	0.8	1.0	1.0
-1	0.1	0.9	0.8	1.0
0	0.1	0.9	0.1	1.0
0	0.0	0.9	0.0	0.9
0	0.0	0.9	0.1	1.0
1	0.1	0.9	0.1	0.3
2	0.1	0.9	0.0	0.1
3	0.1	0.9	0.1	0.0
4	0.1	0.9	0.1	0.1
Number of participants	**146**	**121**	**107**	**176**
Percentage	**27%**	**22%**	**19%**	**32%**
Mean implied discount rate	**-6.26%**	**11.20%**	**-1.37%**	**2.92%**

Participants in Cluster 1 were predominantly choosing the earlier outcomes, irrespective of the level of interest rates. The group has an average implied discount rate equivalent to -6.26%. As a result, we refer to them as the *high negative discounters*. Conversely, participants in Cluster 2 were predominantly choosing the later outcomes, irrespective of the level of interest rates. The group has an average implied discount rate equivalent to 11.2%. Therefore, we refer to them as the *high positive discounters*. Participants in Cluster 3 predominantly switched to the earlier outcomes when the interest rate was zero. The group has an average implied discount rate equivalent to -1.37%. Therefore, we refer to them as the *negative discounters.* In contrast, participants in Cluster 4 switched to the earlier outcomes when the interest rates were positive. They have an average implied discount rate equivalent to 2.92%. Accordingly, we refer to them as the *positive discounters*.

C. Distribution of groups

Figure 4.16 compares the frequency of participants within each group when the services were either early or delayed.

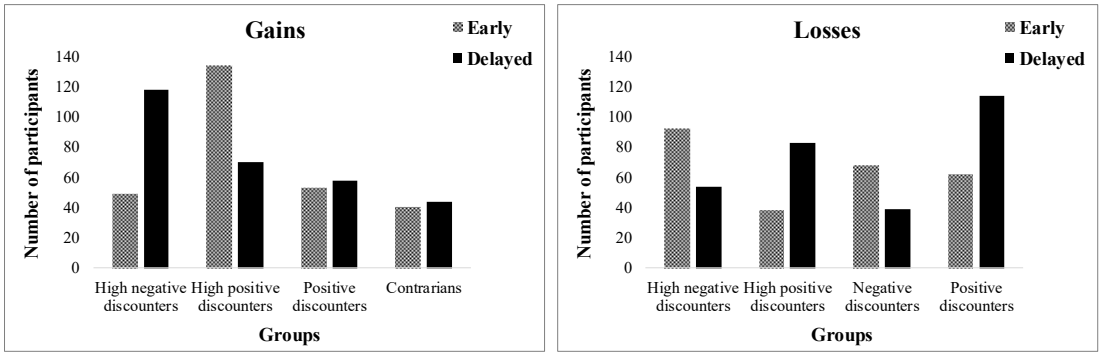


Figure 4.16 – Distribution of groups across conditions – Study 2

For losses (refer to the left panel), there were more *high negative discounters* and *negative discounters* in the early services condition compared to the delayed one (for the high negative discounters: $N_E = 92$ vs $N_D = 54$, χ^2 (1, 146) = 9.89, $p = .002$; for the negative discounters: $N_E = 68$ vs $N_D = 39$, χ^2 (1, 107) = 7.86, $p = .005$). In contrast, there were more *high positive discounter* and *positive discounters* in the delayed services condition compared to the early one (for the high positive discounters: $N_E = 38$ vs $N_D = 83$; χ^2 (1, 121) = 16.7, $p < .001$); for the positive discounters: $N_E = 62$ vs $N_D = 114$; χ^2 (1, 176) = 15.3, $p < .001$).

For gains (refer to the right panel), there were more *high negative discounters* in the delayed services condition compared to the early one ($N_E = 49$ vs $N_D = 118$; χ^2 (1, 167) = 28.5, $p < .001$). There were also more *high positive discounters* and *contrarians* in the delayed services condition compared to the early one (for the high positive discounters: $N_E = 53$ vs $N_D = 58$; χ^2 (1, 167) = .225, $p = .635$; for the contrarians: $N_E = 40$ vs $N_D = 44$; χ^2 (1, 84) = .190, $p = .663$). However, neither difference was significant. Conversely, there were more *positive discounters* in the early services condition compared to the delayed one ($N_E = 134$ vs $N_D = 70$; χ^2 (1, 204) = 20.0, $p < .001$).

5 CHAPTER FIVE

5.1 Introduction

Chapter 4 explored preferences for the timing of monetary outcomes (gains and losses) in exchange for communal services that were either exchanged in the near or distant future (a two-period framework). The results revealed a preference for the earlier outcomes when the exchange took place in the near future, and the later outcomes when the exchange was further delayed. These preferences were triggered by a desire to temporally align the monetary outcomes with the period of communal services. The idea being that temporal alignment facilitates the mental association[30] of monetary losses with the consumption of services, thereby offsetting the disutility from these losses; and the monetary gains with the provision of services, thereby offsetting the disutility from having to provide these services. However, establishing a mental association between the costs and benefits of consumption / provision of a service is not preconditioned by temporal alignment. For instance, both Thaler and Johnson (1990) and Linville and Fischer (1991) argue that events occurring within a short period are likely to be mentally integrated (a form of mental association), while those which are temporally distanced are likely to be segregated (a form of mental disassociation). This is consistent with Gourville and Soman's (1998) theory of payment / benefit depreciation – that temporally separating costs from benefits (e.g. prepaying for consumption), and benefits from costs (e.g. getting paid in advance for work) is likely to lead to the depreciation of these costs / benefits over time; and as a consequence to their disassociation.

Accordingly, this chapter explores preferences for the timing of monetary outcomes by extending the two-period framework used in Chapter 4 into five periods, such that the timing of goods or services (hereafter, *products*) either : a) preceded the earlier and later monetary outcomes, b) was aligned with the earlier outcome, c) was in-between the earlier and later outcomes, d) was aligned with the later outcome, or e) followed the earlier and later outcomes (see section 5.2 for further details).

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[30] Prelec and Loewenstein (1998) used the term coupling

This is a novel setup which enables the examination of timing preferences for all possible combinations of cost-benefit sequences. To my knowledge no studies have utilised such a setup before. Additionally, the chapter investigates whether individuals with different attitudes towards debt – elicited using a new diagnostic tool developed by Scholten et al. (2016) – would have divergent preferences for the timing of monetary outcomes. Specifically, whether their attitude towards debt (i.e. being debt-tolerant or debt-averse) is predictive of their preferences for the timing of monetary payments (losses).

These preferences were examined in three studies each pertaining to a different context. Study 1 manipulated the timing of sale or purchase of a personal product. To minimise product-specific effects (e.g. durability, hedonicity, whether the product is perceived favourably by the decision maker) it was referred to as item *X*.

Study 2 explored these preferences in a trading context whereby *individuals* buy or sell Green Energy (GE) credits to offset carbon emissions[31]. To some extent, this study mimics the futures market for trading commodities and financial instruments in which traders enter into binding contracts today to buy or sell an asset for an agreed price, with delivery and payment occurring at some point in the future.

Study 3 replicated Study 2 in a *communal* setting whereby UK counties buy or sell GE credits to offset their carbon emissions from non-green energy consumption.

5.2 Experimental framework

Intertemporal choice tasks

All three studies included a *standard intertemporal choice task* and a *scenario-based task* that consisted of a series of binary choices involving earlier and later sums of money (either monetary gains or losses), with a fixed time delay at t = 3 and 9 months.

[31] There already exists a market for trading certificates that offset carbon emissions often referred to as "carbon credits". However, because of some negative press in the UK about trading carbon credits, I refer to these certificates as green energy credits http://www.bbc.co.uk/news/business-24828797

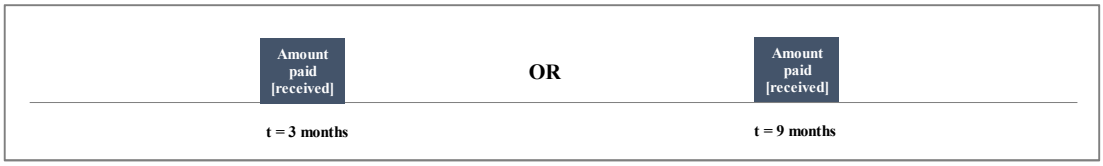

Figure 5.1 – Standard intertemporal choice task

The standard task (refer to Figure 5.1) served as neutral baseline condition (a reference point) to compare between the scenario conditions.

The scenario-based task tested the effect of temporally distancing the timing of a given product from the earlier or later monetary outcomes. Accordingly, the task consisted of five periods spread evenly over the length of one year, such that the product was traded at t = 0, 3, 6, 9 and 12 months (see Figure 5.2). Therefore, at t = 0, the trade took place at the beginning of the year, before paying or receiving any money. At t = 3 months, it was aligned with the earlier monetary outcome. At t = 6 months, it was in-between the two monetary outcomes. At t = 9 months, it was aligned with the later outcome. Finally, at t = 12 months, the trade took place at the end of the year, following the payment or receipt of money.

Figure 5.2 – Scenario-based task

The debt battery

In addition to the two tasks, all three studies administered Scholten et al.'s (2016) *debt battery,* a diagnostic tool developed to identify different attitudes towards acquiring and/or prolonging *debt* – such that debt is construed as an obligation to pay a sum of money in the near or distant future.

The debt battery consists of seven pairs of payments. Each pair is a choice between a payment of £100 sooner or £100 later[32]. The first four pairs involve an immediate payment (t = today) and a delayed payment at t = 1, 2, 3 or 4 years. These choices measure the tendency to acquire debt. The remaining three pairs consist of an earlier

[32] The amount was set at £100 because it was neither too small to be considered trivial nor too large to introduce concerns about liquidity constraints.

payment at t = 1, 2 or 3 years and a later one at t = 4 years. These measure the tendency to prolong debt (refer to Table 5.1 for further details).

Table 5.1 – Debt battery – as depicted in Scholten et al.

		t (years)				
Decision	**Choice task**	**0 (today)**	**1**	**2**	**3**	**4**
Acquire debt	{0, 1}	–$100	–$100			
	{0, 2}	–$100		–$100		
	{0, 3}	–$100			–$100	
	{0, 4}	–$100				–$100
Prolong debt	{1, 4}		–$100			–$100
	{2, 4}			–$100		–$100
	{3, 4}				–$100	–$100

Accordingly, the debt battery distinguishes between four types of individuals. The *debt-tolerant*, both acquire and prolong debt, and so always prefer to make the later payment. The *debt-averse*, neither acquire nor prolong debt, and so always prefer the earlier payment. The *debt-takers*, acquire but do not prolong debt. Therefore, prefer to pay later when faced with a choice between an immediate and a delayed outcome, and sooner when both outcomes are delayed. Finally, the *debt-holders*, dislike acquiring debt but once in debt they tend to prolong it. As a result, prefer to pay sooner rather than later when faced with a choice between an immediate and a delayed outcome, and later when both outcomes are delayed.

The debt battery has two major advantages in comparison with other scales developed to measure attitudes towards debt (e.g. Callender & Jackson, 2005; Caetano et al., 2011; Davies & Lea, 1995; Lea et al., 1993; Livingston & Lunt, 1992; Walters et al., 2016). One, it is a two-dimensional measure that evaluates the attitude to acquire and prolong debt. A feature that is particularly useful for intertemporal choice studies which typically consist of choices between an immediate and a delayed outcome, or two delayed outcomes. Two, it makes no reference to the origin of the payment obligation (e.g. consumption, fine, taxes, loan), and avoids labelling the future payment as “debt” – thereby minimising any frame-related biases.

It is likely that people with different attitudes towards debt have different preferences for the timing of payments in exchange for consumption. For instance, the debt-averse might have a strong preference to prepay for consumption because they want to enjoy this consumption debt-free. In contrast, the debt-tolerant are probably not too concerned about the timing of consumption in relation to the payments, and may in fact prefer situations in which they consume now and pay later. These considerations are addressed in this chapter, with formal hypotheses derived in the following section.

5.3 Predictions

Temporal contiguity (proximity) of costs and benefits

The experienced disutility from the costs of a trade (i.e. the sale or purchase of a product) is reduced when these costs are mentally associated with the benefits. This mental association is strengthened when the costs and benefits are temporally contiguous (Hirst et al., 1994; Soman & Gourville, 2001; Linville & Fischer, 1991; Kamleitner & Hoelzl, 2009; Thaler & Johnson, 1990)[33].

Therefore, preferences for the timing of monetary outcomes should be highly influenced by their proximity to the trading period, such that deferring the trade from t = 0 to t = 12 months (as shown in Figure 5.2) will elicit a stronger preference for the later outcomes. This proposition is elaborated in the following subsections.

A. Monetary losses

Irrespective of the trading period, from a financially rational perspective, it would be more sensible to pay at t = 9 months as opposed to t = 3 months, unless the cost of deferring the payment exceeds the marginal cost of money (Fisher, 1931). However, paying at t = 9 months when the trade precedes the earlier and later outcomes (Condition 1 in Figure 5.2) weakens the mental association between the costs and

[33] Temporal contiguity is not explicitly addressed by the double-entry model since it approximates the impact of past and future outcomes using a step function [0, 1]. Therefore, from a modelling perspective, the later monetary loss in Condition 1 of Figure 5.2 should not attenuate the benefits of consumption more than the sooner loss. Likewise, the earlier monetary gain in Condition 5 should not buffer the cost of consumption less than the later gain. However, the theory implicitly assumes that the costs and benefits of consumption will gradually depreciate as hypothesised by Gourville and Soman (1998), and as depicted in Figure 2.1 for monetary losses, and Figure 4.1 for monetary gains.

benefits, and prolongs the anxiety of having to pay for a product that have already been received. Especially since the benefits from the product will depreciate over time (e.g. Gourville & Soman, 1998). Therefore, all else being equal, hedonically it would be more painful to pay at t = 9 months than t = 3 months. Likewise, it would be more painful to pay at t = 9 months when the trade and the earlier outcome are temporally aligned (Condition 2).

In contrast, paying at t = 9 months when the trade is either aligned with the later outcome (Condition 4), or follows the earlier and later outcomes (i.e. Condition 5) entails little hedonic costs since the mental association between the monetary losses and the benefits is high. Therefore, under these circumstances people will generally be in favour of the later outcomes.

H1a: receiving the product at t = 9 or 12 months will elicit a stronger preference for the later losses compared to t = 0 or 3 months.

B. Monetary gains

For gains, financially rationality prescribes that it would be more sensible to get paid at t = 3 months as opposed to t = 9 months. However, getting paid at t = 3 months when the trade follows the earlier and later outcomes (Condition 5 in Figure 5.2), weakens the mental association between the benefits and costs, and prolongs the anxiety from the obligation to provide a product in exchange for earnings that have already been received. Especially that the experienced utility from the earnings are likely to depreciate over time (e.g. Gourville & Soman, 1998). Therefore, all else being equal, hedonically it would be more appealing to collect the earnings at t = 9 months as opposed to t = 3 months. Likewise, it would be more appealing to collect the earnings at t = 9 months when the trade and the later outcome are temporally aligned (Condition 4).

In contrast, getting paid at t = 3 months when the trade is aligned with the earlier outcome (Condition 2), or precedes the earlier and later outcomes (Condition 1) entails little hedonic costs since the mental association between the monetary gains and the trade is high. As a result, most would be in favour of collecting the earlier gains.

H1b: providing the product at t = 0 or 3 months will elicit a stronger preference for the earlier gains compared to t = 9 or 12 months.

Throughout this chapter, the term *temporal contiguity effect* will be used to denote the preference to experience the costs and benefits of a trade in close proximity. In principle, this effect is less restrictive than *temporal alignment*, which requires the costs and benefits to be perfectly aligned.

Cost-benefit sequence

In addition to the effect of temporal contiguity, preferences for the timing of outcomes are also influenced by the desire for costs to precede benefits (Loewenstein & Prelec, 1991; 1993). This preference has been observed using mixed sequences of *monetary outcomes* (e.g. Ross & Simonson, 1991), mixed sequences of *nonmonetary outcomes* (Loewenstein & Prelec, 1993), and mixed sequences of *monetary and nonmonetary outcomes* (Prelec & Loewenstein, 1998). For instance, most participants in Ross and Simonson (1991) preferred monetary sequences that ended with a gain (e.g. lose $15 then win $85 as opposed to win $85 then lose $15). Likewise, most participants in Loewenstein and Prelec (1993) preferred spending a weekend with an abrasive aunt first and friends later as opposed to friends first and aunt later. Most importantly, participants in Prelec and Loewenstein (1998) preferred to prepay for nondurable consumption, and to collect earnings following the completion of a brief task.

The experimental framework described in section 5.2 disentangles the effects of temporal contiguity and preference for improvement, particularly when comparing the choices at t = 6 month (Condition 3 in Figure 5.2) with the baseline condition. The following explains why.

Recall that Condition 3 is a choice between an earlier outcome at t = 3 months and a later one at t = 9 months, whereby the product is traded at t = 6 months. Therefore, the trade is temporally equidistant from the earlier and later outcomes. In other words, the costs and benefits are equally contiguous irrespective of the timing of monetary outcomes.

In addition, Condition 3 can be viewed as a decision between two sequences: a) an *improving sequence*, in which the product is either paid for prior to being delivered, or sold before getting paid; and b) a *declining sequence*, in which the product is paid for after being delivered, or sold post getting paid. In contrast, the baseline condition is a choice between two simple outcomes (i.e. pure monetary gains or losses). Therefore, in comparison, there should be a stronger preference for the earlier losses and later gains at t = 6 months.

H2: Exchanging the product at t = 6 months will elicit a stronger preference for the earlier losses and later gains relative to the baseline condition.

Debt attitude

Evidence from several studies administered by Scholten et al. (2016) suggest that the debt-tolerant and the debt-averse make up the two largest groups (~ 80% to 85%) with varying proportion between the two depending on the given sample. Therefore, I will focus on these groups when deriving hypotheses and analysing the data[34].

The debt-tolerant are positive discounters who discount future losses, and more so the longer these losses are delayed. As a result, they tend to acquire and prolong debt. In contrast, the debt-averse are negative discounters who amplify the disutility from future losses, and more so for longer delays. As a result, they neither acquire nor hold on to debt. In one study from Scholten et al., participants diagnosed as debt-tolerant were more likely than the debt-averse to choose sequences with a deferred payment £y (pay £0 today and pay £y in 1 year) than sequences with an immediate payment £x (pay £x today and pay £0 in 1 year), in which $y > x$. In other words, the debt-tolerant discounted the future payments more than the debt-averse. In another study, Scholten et al. observed positive discounting among the debt-tolerant but negative discounting among the debt-averse - using price lists with single dated losses and discount rates that ranged between -45% and 40%. This was true irrespective of magnitude (£20, £100 or £500) and time delay (t = 1 or 2 years).

[34] The samples used in the three studies are relatively small, and were split between gains and losses. Therefore, it is unlikely to have enough debt-takers or debt-holders to derive meaningful results.

In contrast, the evidence from Scholten et al. for monetary gains is mixed. For instance, the debt-tolerant and debt-averse were equally likely to prefer sequences with an immediate outcome £x (receive £x today and receive £0 in 1 year) to sequences with a deferred outcome £y (receive £0 today and receive £y in 1 year), even when $y > x$. Accordingly, they were equally likely to reveal impatience for gains. However, the debt-averse revealed slightly higher discount rates for the single dated monetary gains (using the same setup as above). That is, they were slightly more impatient than the debt-tolerant for single dated gains.

In light of these findings, it is expected that the debt-averse would reveal a stronger preference for the earlier losses than the debt-tolerant. However, this preference will be moderated as the trade period of the underlying product is deferred. This is because the disutility associated with the deferred payments should be buffered by the consumption benefits. In other words, the temporal contiguity effect will be more robust for the debt-averse than debt-tolerant, in the context of losses.

In contrast, given the evidence from Scholten et al., it is unlikely to observe extreme differences between the two groups in the context of gains.

H3: The debt-averse are likely to exhibit a stronger temporal contiguity effect than the debt-tolerant, for losses but not for gains.

5.4 Study 1

Study 1 explored preferences for the timing of monetary outcomes (gains and losses) when the sales [purchase] period of an item X varied according to the framework developed in section 5.2.

For exploratory purposes, the study included an additional "gift/charity" condition. Consequently, one group of participants were told that they will be receiving item X as a gift instead of having to buy it (monetary losses condition), while another group were told that they will be donating item X to charity instead of selling it (monetary gains condition). These manipulations were implemented at t = 6 months because it presents the most explicit test for the double-entry model.

Recall that from the perspective of the double-entry model the preference to prepay for consumption is triggered by the desire to buffer the disutility from monetary losses, and enjoy consumption as if it were free. Likewise, for gains, the preference to collect earnings in arrears is triggered by the desire to buffer the disutility from the obligation to provide some product in the future, and to enjoy the earnings debt-free.

Since the gift is a free product, and the donation is voluntary, then there should be no reason for these events to have an impact on the timing of monetary outcomes. In other words, there should be no difference between the gift / charity conditions and their respective baseline conditions. Therefore, by extension, there should be a stronger preference for the later gains and earlier losses when item *X* is sold / purchased at t = 6 months as opposed to being received as gift / donated it to charity.

Participants

A sample of 199 UK residents recruited through Prolific Academic[35] completed the online survey. Participants averaged 33 years of age, with 57% holding a university degree, 65% in full-time or part-time employment and 54% being females. The median completion time was a little over 3 minutes. Participants who successfully completed the survey were paid £0.5 upon completion.

Design and procedure

The survey comprised of three parts. Part one consisted of seven intertemporal choices, each pertaining to a different condition. Half the participants were randomly assigned to the monetary gains conditions, while the other half were assigned to the monetary losses.

First, participants were presented with the standard intertemporal choice task. Accordingly, they indicated whether they prefer to pay [receive] £100 in 3 or 9 months. The choices were presented graphically as shown in Figure 5.3.

[35] A UK-based company that helps researchers to recruit online participants - https://prolific.ac/

Figure 5.3 – Visual illustration of the standard task

Then, they were presented with the gift/charity condition. Participants were told that they will be receiving item *X* as a gift [donating item *X* to charity] in 6 months. After which they indicated whether they prefer to pay [receive] £100 in 3 or 9 months. The choices were also presented graphically as shown in Figure 5.4.

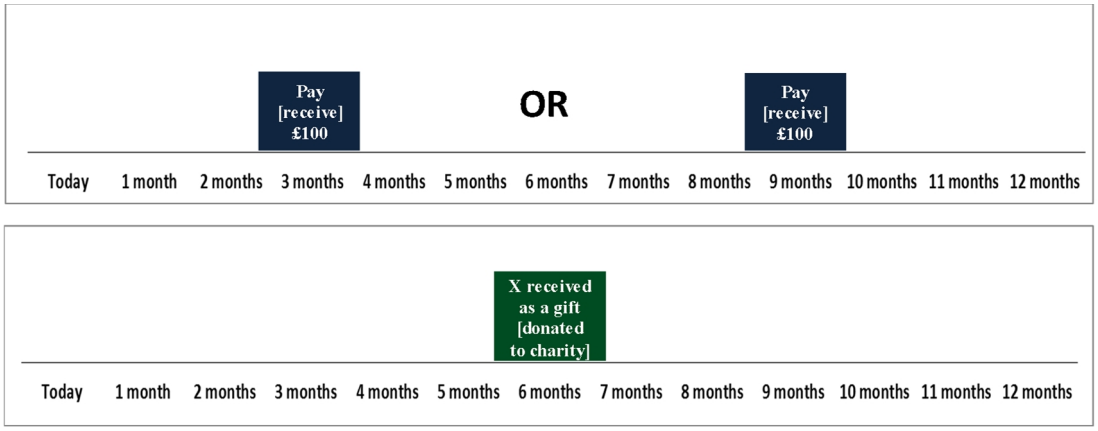

Figure 5.4 – Visual illustration of the gift / donation scenario

Finally, they were presented with the five purchase/sale conditions from Figure 5.2. Participants were told that they will be buying [selling] an item *X* in t = 0, 3, 6, 9 or 12 months from today. After which they indicated whether they prefer to pay [receive] £100 in exchange for *X* in 3 or 9 months. In line with other conditions, the choices were also presented graphically. Figure 5.5 provides an example in which the purchase [sale] of item *X* always preceded the monetary outcomes. Conditions 3 to 7 were randomly presented to minimise carry over effects.

Figure 5.5 – Visual illustration of a purchase [sale] condition

In part two, participants completed Scholten et al.'s 7-item debt battery. Following their instructions, the choices were presented in order of increasing or decreasing delay. Therefore, half the participants were randomly assigned to the increasing order (i.e. choices presented sequentially from {0, 1} to {3, 4} – refer to Table 5.1), while the other half were assigned to the decreasing one (i.e. from {3, 4} to {0, 1}).

Finally, in part three, participants self-reported their attitude towards debt using a 4-item questionnaire developed by Walters et al. (2016), then provided some personal information including their gender, age, education, employment and household income.

The questionnaire consisted of the following: a) "I prefer to pay my debts as soon as possible", b) "I prefer to delay paying my debts if possible", c) "having debt makes me feel uncomfortable", and d) "having debt doesn't bother me". Responses were given on a five-point scale ranging from 'strongly disagree' to 'strongly agree', and were reverse-coded for items b and d, such that a higher score on the scale refers to a more positive, or less negative, attitude toward debt.

Scholten et al. used the questionnaire to examine the relation between the exhibited debt attitude (using the debt battery), and the expressed one. Their findings revealed a strong convergence between exhibited and expressed attitudes, with the debt-tolerant and debt-averse expressing the least and most negative attitudes towards debt, respectively. While those diagnosed as debt-takers fell somewhere in-between. It is used in this study for the same purpose.

Results

An analysis of the effect of manipulating the trade period of item *X* on the timing of outcomes is presented first. Then, the classification results of the debt battery. The section concludes with a comparative analysis of the preferences revealed by the debt-tolerant and the debt-averse. To help the reader navigate through this study (and the chapter in general) a summary of the key results is provided at the end of each subsection.

A. Trade period of item X

The analysis in this section was carried out using a GEE model with a logit link function, with the *sign of monetary outcomes (gains or losses)* and *seven conditions* as predictors of the *timing of monetary outcomes* (earlier or later). The results were analysed by calculating the proportion of participants choosing the *earlier* gains, and *later* losses.

Table 5.2 presents the observed proportions along with the results of the pairwise comparisons between the seven conditions.

Table 5.2 – Mean proportion choosing the earlier gains and later losses

	Baseline	**Gift / charity**	**Today**	**3-months**	**6-months**	**9-months**	**12-months**
Gains	$.97_{a}$	$.89_{b}$	$.94_{a,b}$	$.90_{b}$	$.79_{c}$	$.48_{d}$	$.55_{d}$
Losses	$.36_{a,b}$	$.38_{a,b}$	$.35_{a}$	$.44_{b,c}$	$.47_{c}$	$.59_{d}$	$.57_{d}$
Note: Values not sharing the same subscript are significantly different at $p < .05$.							

For gains, almost all the participants preferred the earlier outcomes in the baseline condition, thereby revealing a robust positive time preference. However, this preference diminished as the sales period of item *X* was deferred.

In comparison with the baseline condition, participants were 3%, 7%, 18%, 49% and 42% less likely to choose the earlier outcomes when item *X* was *sold* at t = 0, 3, 6, 9, and 12 months, respectively. Therefore, most preferred the earlier outcomes when the sale took place immediately or in the near future, but nearly half switched to the later outcomes when the sale took place later.

Likewise, for losses, most preferred to pay earlier in the baseline condition, thereby revealing a negative time preference. However, this preference diminished as the purchase of item *X* was deferred.

Compared to the baseline condition, participants were 8%, 11%, 23% and 21% more likely to choose the later losses when item *X* was purchased at t = 3, 6, 9 and 12 months respectively, but 1% less likely to do so when *X* was purchased at t = 0. In other words, like gains, participants revealed a strong preference for the earlier outcomes, but this preference reversed when the purchase of item *X* was later.

A.1. Temporal contiguity effect

Figure 5.6 displays the mean proportion of participants choosing the earlier gains (left panel) and later losses (right panel) for t = 0 vs. t = 12 months and t = 3 months vs. t = 9 months. The results show that participants were more likely to choose the earlier outcomes (gains and losses) for t = 0 and 3 months compared to t = 9 and 12 months (all *p*'s < .05, see Table 5.2 above for details), thereby revealing a robust temporal contiguity effect. Interestingly, this effect was stronger for gains than losses.

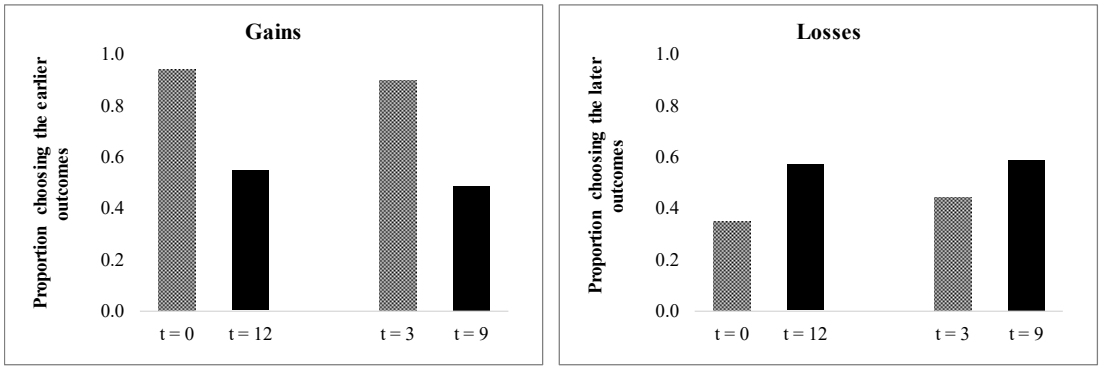

Figure 5.6 – Temporal contiguity effect

A.2. Cost-benefit sequence

For gains, participants were less likely to choose the earlier outcomes at t = 6 months compared to the baseline condition ($M_{t=6}$ = .79 vs. $M_{Baseline}$ = .97). Therefore, there was a significant *preference for improvement* in addition to the temporal contiguity effect – i.e. some participants opted for item *X* to be delivered before collecting their earnings. Conversely, for losses, participants were more likely to choose the later outcomes at t = 6 months in comparison with the baseline condition ($M_{t=6}$ = .47 vs. $M_{Baseline}$ = .36). Therefore, contrary to hypothesis H2 (and the predictions of the

double-entry model), preferences for the timing of losses were not influenced by the sequence of costs and benefits, but by the proximity of the purchase period to these losses.

A.3. Gift / charity conditions

A comparison of the charity condition with the baseline condition revealed a small but significantly stronger preference for the later gains when *X* was voluntarily given away ($M_{Charity}$ = .89 vs. $M_{Baseline}$ = .97). Despite that, participants were less likely to choose the later gains when *X* was donated as opposed to sold at t = 6 months (($M_{Charity}$ = .89 vs. $M_{t=6}$ = .79). That is, there was a preference for improvement when item *X* was given away to charity, but this preference was not as robust as the one observed when *X* was sold. Therefore, supporting the predictions of the double-entry model.

For losses, participants showed no difference between the gift condition and the baseline condition (M_{Gift} = .38 vs. $M_{Baseline}$ = .36). However, they were more likely to choose the later losses when *X* was purchased at t = 6 months as opposed to being offered as a gift (M_{Gift} = .38 vs. $M_{Baseline}$ = .47). While the former result supports the double-entry model, the direction of the latter contradicts it.

Results 1: In summary, there was a robust temporal contiguity effect that was stronger for gains than losses. There was also a preference for improvement for gains, but not for losses.

B. Debt battery

Following Scholten et al. (2016), a *k*-means clustering algorithm was used to group participants according to their choices on the debt battery[36]. Four groups emerged. These groups correspond to the debt-tolerant, debt-averse, debt-takers and debt-holders that were identified by the original study.

Figure 5.7 displays the choices made by these groups for each of the seven debt battery items. The vertical axis displays the proportion of participants choosing the later

[36] Recall that the algorithm uses an iterative process to group the input data into *k* clusters so as to minimise the within-cluster variability and maximise the between-cluster one. To identify the optimal *k,* we used Ketchen and Shook's (1996) elbow method – see Appendix [A] in Chapter 4 for details.

payments, while the horizontal one displays the seven items in increasing order of delay. For example, the item (0, 1) refers to the choice between paying £100 today or £100 in one year, while the item (2, 4) refers to the choice between paying £100 in two or £100 in four years. Recall that the first four questions were designed to measure the tendency to acquire debt, while the latter three to prolong it.

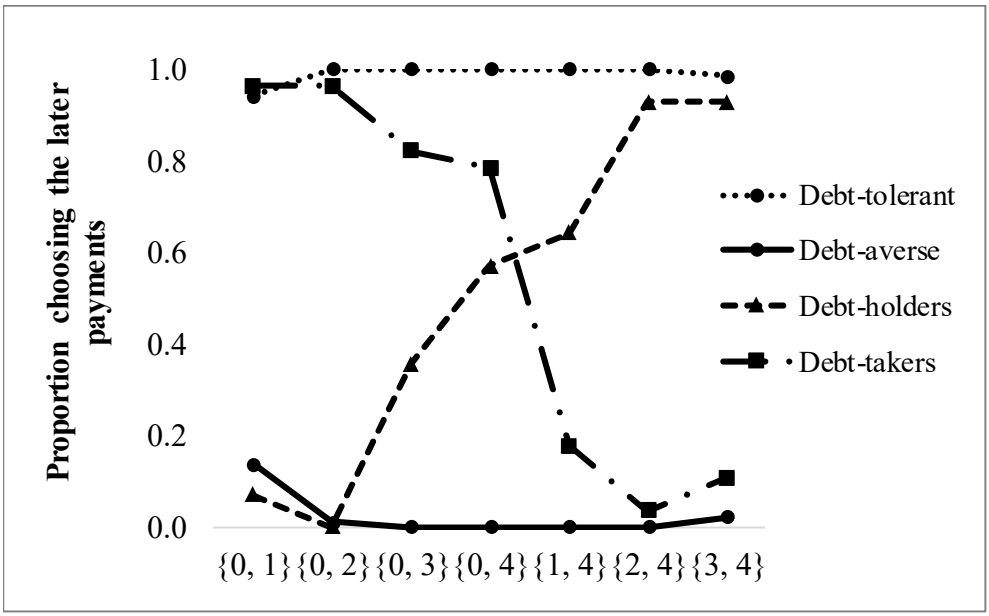

Figure 5.7 – Debt battery groups

Accordingly, the debt-averse were predominantly choosing the earlier payments. Therefore, they neither wanted to acquire nor prolong the debt. In contrast, the debt-tolerant were predominantly choosing the later payments, revealing a strong tendency to acquire and hold on to debt. The debt-takers were highly inclined to pay later when choosing between the immediate and the deferred payments (for t = 1, 2, 3 and 4 years), and to pay sooner when choosing between the two deferred payments. Therefore, revealing a tendency to acquire but not to prolong debt. Conversely, the debt-holders were more inclined to pay sooner when choosing between the immediate and the deferred payments (particularly for t = 1, 2 and 3 years), and to pay later when choosing between the two deferred payments. Thereby, revealing an aversion to the acquisition of debt. However, once in debt, they would hold on to it.

In line with Scholten et al., the debt-averse scored the least on the self-reported attitude towards debt (M = 1.56, SD = .52), followed by the debt-takers (M = 1.82, SD = .67), the debt-holders (M = 2.21, SD = .80) and finally the debt-tolerant (M = 2.75, SD =

.83). A Tukey HSD pairwise comparisons test confirmed that all the observed differences were significant at the 5% level.

Table 5.3 presents the number of participants across the four debt battery group, split by the condition they were assigned to in part one. Combined, the debt-tolerant and debt-averse made up around 80% of the sample (N = 157 out of 199).

Table 5.3 – Distribution of the debt battery group split by gain-loss conditions

	Debt-tolerant	Debt-averse	Debt-takers	Debt-holders
Gains	36	37	11	15
Losses	34	50	3	13
Total	*70*	*87*	*14*	*28*
Percentage	*35%*	*44%*	*7%*	*14%*

C. Debt attitude by trade period interaction

Figure 5.8 displays the mean proportion of the debt-tolerant and debt-averse choosing the earlier gains (left panel) and later losses (right panel) for the seven conditions.

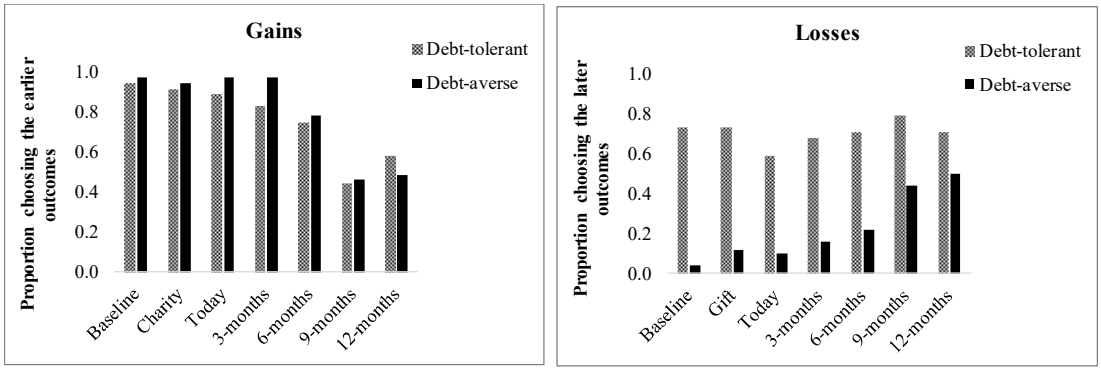

Figure 5.8 – Debt attitude x Trade period interaction

As expected, for gains, the debt-averse and debt-tolerant were equally likely to choose the earlier outcomes. This was true for each of the seven conditions (none of the observed differences, if any, reached levels of significance). Accordingly, both groups revealed a robust temporal contiguity effect, as well as a strong preference for improvement.

This, however, was not the case for losses. First, as expected, the debt-averse were in general less likely to choose the later outcomes than the debt-tolerant. In fact, most of the debt-averse preferred the earlier outcomes, while most of the debt-tolerant

preferred the later ones (M_{DA} = .23 vs. M_{DT} = .71). Second, the debt-averse were significantly more likely to be influenced by the timing of item *X*. In fact, in comparison with the baseline condition, they were 6%, 12%, 18%, 40% and 46% more likely to choose the later losses at t = 0, 3, 6, 9 and 12 months, respectively. That is, they revealed a strong temporal contiguity effect. In contrast, apart from t = 0, none of the observed differences for the debt-tolerant group reached levels of significance (see Table 5.4 for the pairwise comparisons).

Table 5.4 – Proportion of the debt-tolerant and debt-averse choosing the later losses

	Baseline	Gift / charity	Today	3-months	6-months	9-months	12-months
Debt-tolerant	$.74_{a}$	$.74_{a,}$	$.59_{b}$	$.68_{a,b}$	$.71_{a}$	$.79_{a}$	$.71_{a}$
Debt-averse	$.04_{a}$	$.12_{a,b}$	$.10_{a,b}$	$.16_{b}$	$.22_{b}$	$.44_{d}$	$.50_{d}$
Note: Values not sharing the same subscript are significantly different at $p < .05$.							

In general, the debt-averse disliked the idea of paying later (as evidenced by the baseline condition), but they disliked it less when the losses were in close proximity with item *X* (nearly half the participants preferred the later payments when *X* was purchased at t = 9 or 12 months). This indicates that the disutility experienced from the deferred monetary losses was buffered by the proximity of the consumption benefits to these losses.

Results 2: For gains, the debt-averse and debt-tolerant had similar preferences for the timing of monetary outcomes. That is, both revealed a robust temporal contiguity effect and a preference for improvement. For losses, the debt-tolerant showed little variation across the seven condition, predominantly choosing the later outcomes. In contrast, the debt-averse revealed a strong temporal contiguity effect.

Discussion

In general, preferences for the timing of monetary outcomes (gains and losses) were strongly influenced by the timing of item *X*. This was evidenced by a gradually increasing tendency to choose the later outcomes as the sale / purchase period of item *X* was deferred. In other words, deferring the sale / purchase of item *X* diminished the preference for the earlier gains, and strengthened the preference for the later losses.

Essentially making participants more patient for gains, and less so for losses. These results strongly support the temporal contiguity hypothesis, that people prefer to experience the costs of a trade in close proximity to the benefits.

In addition, framing the choice as a decision between an improving and a declining mixed sequence (as opposed to a choice between two simple outcomes) elicited a stronger preference for the later gains and later losses. That is, there was a stronger preference for the *improving sequence* for gains, and the *declining sequence* for losses. The latter challenges the predictions of the double-entry model, and the literature regarding preferences for sequences of outcomes (Loewenstein & Prelec, 1991, 1993). However, given the small number of participants assigned to the losses condition (N = 100) and the size of this effect ~ 9%, it would be difficult to draw any meaningful conclusions from this observation (this pattern, for instance, was not observed in Studies 2 and 3).

Finally, as expected, there was no evidence that having different attitudes towards debt (the obligation to make future payments) was predictive of preferences for the timing of monetary gains. However, it was highly predictive of preferences for the timing of losses. Participants who were diagnosed as debt-tolerant (i.e. those who generally discount the disutility of delayed payments) were highly inclined to pay later regardless of the timing of item *X*. Accordingly, their debt-tolerance was neither moderated nor strengthened by expediting or deferring the purchase period of item *X*. In contrast, those who were classified as debt-averse (i.e. those who generally amplify the disutility of delayed payments) were less likely to choose the earlier losses as the purchase period of *X* was deferred. Thereby providing strong evidence that the disutility from the deferred losses was buffered by the benefits from consumption.

5.5 Study 2

This study differs from Study 1 in three ways. One, it explored preferences for the timing of monetary outcomes when buying or selling a specific product, Green Energy ("GE") credits. Two, it introduced some variability between the monetary outcomes to test the robustness of the contiguity effect. Therefore, some choices had smaller later outcomes, some were equal, and some larger later (i.e. three levels of interest rates: negative, zero and positive). Finally, the order of the standard task and scenario-

based task were manipulated to counterbalance any presentation order effects. Accordingly, for some participants the standard task preceded the scenario-based task, and vice versa for others.

Participants

A sample of 199 UK residents recruited through Bilendi completed the online survey. The data from 6 participants were excluded because of missing responses. Participants averaged 47 years of age with 36% holding a university degree, 55% in full-time or part-time employment and 42% being females. The median completion time was 10 minutes. Participants who successfully completed the survey were rewarded with loyalty points that could be exchanged for products of their liking.

Design and procedure

Following a brief introduction, participants were randomly assigned to a monetary gains or losses condition. Thereafter, half the participants completed the standard intertemporal choice task, while the other half completed the scenario-based task. Those who completed the standard task first, proceeded to complete the scenario task, and vice versa. Table 5.5 summarises the four between-participants design.

Table 5.5 – Between-participants design for Study 2

		Order of tasks presentation	
		Standard task	**Scenario task**
Sign of the monetary outcomes	**Gains**	Monetary gains with the standard task presented first	Monetary gains with the scenario task presented first
	Losses	Monetary losses with the standard task presented first	Monetary losses with the scenario task presented first

A. The standard task

Participants read the following instructions: *"In the following questions you will be asked to choose between **paying [receiving]** an earlier or a later sum of money. For each question please select the payment you prefer to **make [receive]**. The payments will change from one question to the next".*

Following the instructions, participants responded to three randomised questions corresponding to the subsequent levels of interest rates: -10%, 0% and 10% (see subsection C below for details concerning the monetary amounts and interest rates). Figure 5.9 provides an example. Note that the timeline was modified from Study 1 to fit the context of the scenario.

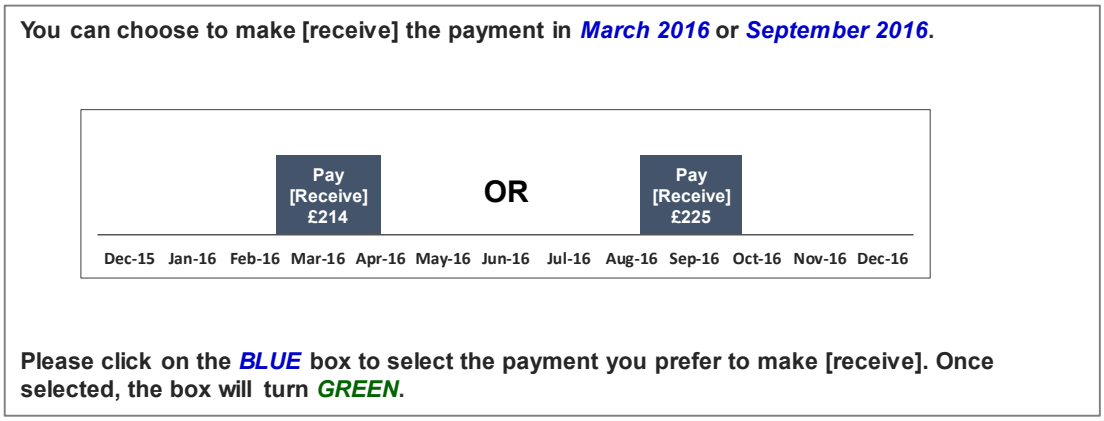

Figure 5.9 – Graphical illustration of the standard task

B. The scenario task

Participants read the following scenario: *"Imagine that individuals in the UK can now buy or sell green energy credits in a regulated market to offset carbon emitted from non-green energy consumption. In the following questions, you will be asked to imagine that you have entered into a binding contract today to* ***buy [sell]*** *a number of green energy credits in 2016. Each question is a choice between an earlier or a later payment. Please select the payment you prefer to* ***make [receive]****. The payments, and the timing of the green credits exchange will vary from one question to the next".*

Each participant was then randomly presented with five blocks of questions matching the five periods from Figure 5.2 (refer to Table 5.6 for details). For instance, one block consisted of the green energy credits being received [delivered] in March 2016 (i.e. Condition 2 in Figure 5.2). In line with the standard task, each block consisted of three randomised questions corresponding to the following levels of interest rates: -10%, 0% and 10%. Once participants responded to the three questions, they moved on to the next block.

Table 5.6 – Within-participants design for Study 2

	GE credits exchange date	Description of condition
t = 0	December 2015	Credits delivered prior to the monetary outcomes
t = 3 months	March 2016	Credits aligned with the earlier monetary outcomes
t = 6 months	June 2016	Credits delivered in-between the monetary outcomes
t = 9 months	September 2016	Credits aligned with the later monetary outcomes
t = 12 months	December 2016	Credits delivered following the monetary outcomes

Figure 5.10 provides an example of the GE credits being received [delivered] in March 2016.

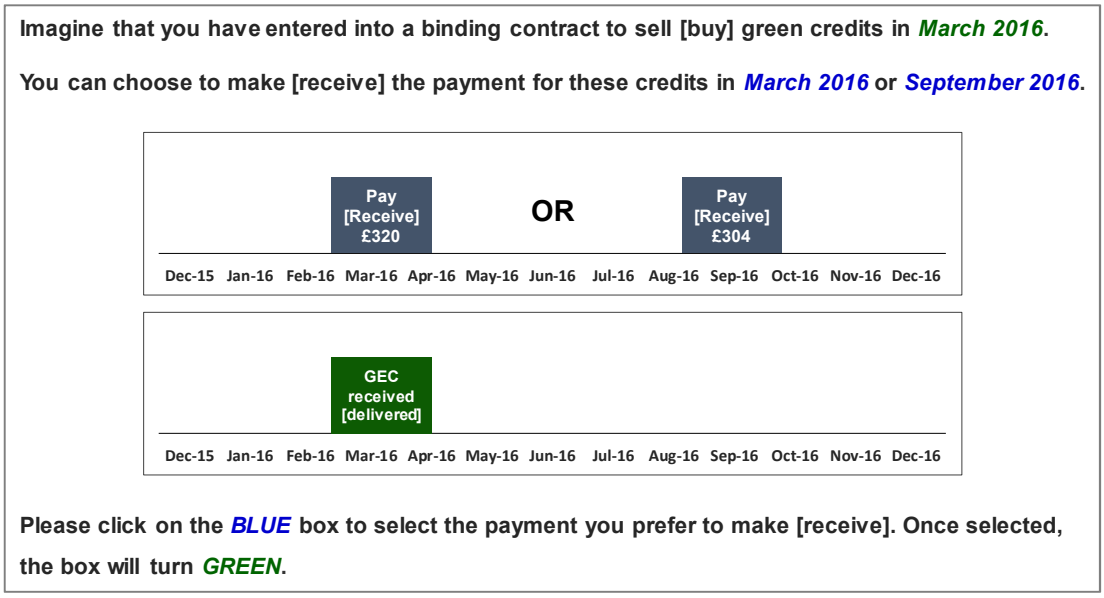

Figure 5.10 – Visual illustration of the scenario-based task

C. Monetary amounts

In total, each participant saw 18 pairs of choices, split across the six conditions and three levels of interest rates (negative, zero and positive). To avoid repeating the same monetary amounts across trials, 18 amounts ranging between £200 and £400 were randomly generated (the "early amounts"). The three levels of interest rates (-10%, 0% and 10%) were then applied to the 18 early amounts to compute the delayed ones. Nine amounts ranged between £200 and £300, while the other nine ranged between £300 and £400. For each trial, one of the 18 pairs was randomly selected. Table 5.7 displays the earlier and later amounts for each level of interest rates.

Table 5.7 – Price list for Study 2

Early amounts		Delayed amounts		
		-10%	**0%**	**10%**
1	£214	£204	£214	£225
2	£221	£210	£221	£232
3	£237	£225	£237	£249
4	£241	£229	£241	£253
5	£249	£237	£249	£262
6	£252	£240	£252	£265
7	£258	£245	£258	£271
8	£269	£256	£269	£283
9	£273	£260	£273	£287
10	£316	£301	£316	£332
11	£320	£304	£320	£336
12	£327	£311	£327	£344
13	£338	£322	£338	£355
14	£343	£326	£343	£361
15	£347	£330	£347	£365
16	£353	£336	£353	£371
17	£360	£342	£360	£378
18	£371	£353	£371	£390

D. Other survey questions

Following the experimental tasks, participants self-reported their attitude towards carbon offsetting and the environment. Specifically, towards: a) carbon offsetting as a tool to reduce emissions and tackle climate change, b) buying carbon offsets, and c) the environment in general. The purpose was to examine whether having a positive or negative attitude towards the environment in general, and carbon offsetting in particular had an impact on the timing of outcomes.

The items were adapted from a scale developed by Whitmarsh and O'Neill (2010) to measure people's pro-environmental self-identity and pro-environmental behaviour. These consisted of the following: a) "carbon off-setting can help reduce unavoidable emissions", b) "carbon offsetting can help tackle climate change", c) "I am the type of person who would buy carbon offsets", d) "carbon offsetting is just another form of taxation", and e) "I think of myself as an environmentally-friendly consumer".

Responses were given on a five-point scale ranging from 'strongly disagree' to 'strongly agree,' and were reverse-coded for item *(d)*, such that a higher score on the

scale refers to a more positive, or less negative, attitude toward carbon offsetting. The 5-items achieved an internal consistency Cronbach's α of 0.8 with corrected item-total correlations of .67, .69, .60, .36 and .36 for items *(a)* to *(e)*, respectively. Accordingly, I group items *(a)* to *(c)* together in a *pro-carbon offsets* index. The readjusted index achieved an internal consistency Cronbach's α of 0.85 with corrected item-total correlations of .78, .78 and .61 for items *(a)* to *(c)*, respectively.

Participants also completed Scholten et al.'s 7-item *debt battery* and Frederick's (2002) 3-item cognitive reflection test, before providing some personal information including gender, age, education, employment status and household income.

Results

An analysis of the effect of manipulating the timing of GE credits exchange on preferences for the timing of outcomes is presented first. This is followed by an examination of these effects across the three levels of interest rates, and for the groups identified by the debt battery. Particularly, the debt-tolerant and debt-averse.

In addition, analysis of the effect of task order, and whether having different attitudes towards the environment and carbon offsetting had any influence on the timing of outcomes are reproduced in Appendix A.

The statistical analysis in subsections A and B was carried out using a GEE model with a logit link function, with the *sign of the outcomes*, *presentation order*, *interest rates* and *six conditions* as predictors of the *timing of monetary outcomes* (earlier or later). The results were analysed by calculating the proportion of participants choosing the *earlier* gains, and *later* losses.

A. Trade period of GE credits

Table 5.8 presents the observed proportion of participants choosing the earlier gains and later losses, for each of the six conditions. The table also reports the results of the pairwise comparisons between these conditions.

Table 5.8 – Mean proportion choosing the earlier gains and later losses

	Baseline	Dec-15	Mar-16	Jun-16	Sep-16	Dec-16
		t =0	*t =3 months*	*t =6 months*	*t =9 months*	*t =12 months*
Gains	0.68_{a}	0.66_{a}	0.67_{a}	$0.64_{a,b}$	$0.60_{b,c}$	0.56_{c}
Losses	0.54_{a}	0.54_{a}	$0.57_{a,b}$	$0.57_{a,b}$	0.61_{b}	0.61_{b}
Note: Values not sharing the same subscript are significantly different at $p < .05$.						

In comparison with the baseline condition, participants were 2%, 1%, 4%, 8% and 11% *less* likely to choose the earlier gains for t = 0, 3, 6, 9 and 12, respectively. Therefore, indicating that preferences for the earlier gains declined (albeit moderately) as the trade period of GE credits was deferred.

For losses, participants were 0%, 3%, 3%, 7% and 7% *more* likely to choose the later outcomes for t = 0, 3, 6, 9 and 12 months relative to the baseline condition. Therefore, as for gains, they revealed a moderate but significantly stronger preference for the later outcomes when the GE credits were traded later.

A.1. Temporal contiguity effect

Figure 5.11 compares the choices for t = 0 and 3 months versus t = 9 and 12 months. Unlike Study 1, these results reveal a weak preference for temporal contiguity between the monetary outcomes and the timing of green credits delivery, for both gains and losses. Despite that, for gains, the observed differences between the earlier periods (t = 0 or 3 months) and the later periods (t = 9 or 12 months) were all statistically significant (see Table 5.8 above for the pairwise comparisons). This, however, was not the case for losses. Specifically, the differences between t = 3 months and t = 9 or 12 months did not reach levels of statistical significance.

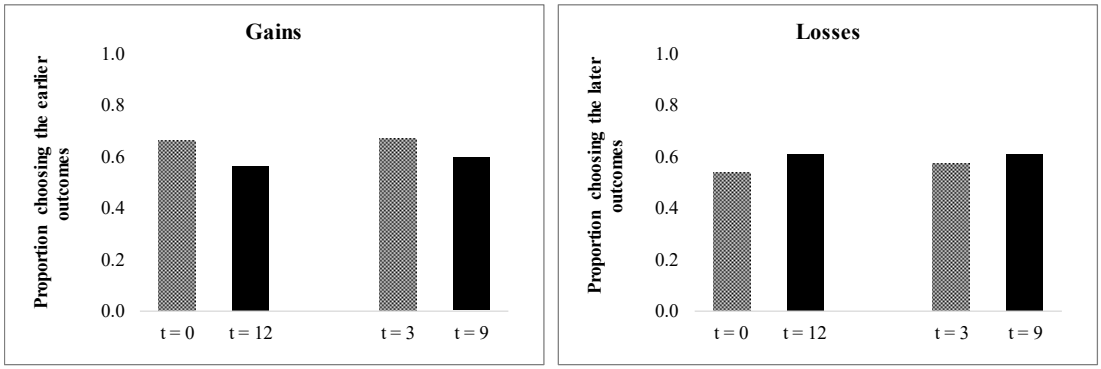

Figure 5.11 – Temporal contiguity effect

A.2. Cost-benefit sequence

There was no evidence of a preference for improvement for either gains or losses. Participants were in general as likely to choose the earlier gains or later losses at t = 6 months and the baseline condition (refer to Table 5.8 above for details).

Results 3: Overall, there was a weak temporal contiguity effect for both gains and losses, and no evidence of a preference for improvement.

B. Trade period by Interest rates interaction

Figure 5.12 displays the mean proportion of participants choosing the earlier gains (left panel) and later losses (right panel) for the six conditions across the three levels of interest rates (-10%, 0% and 10%).

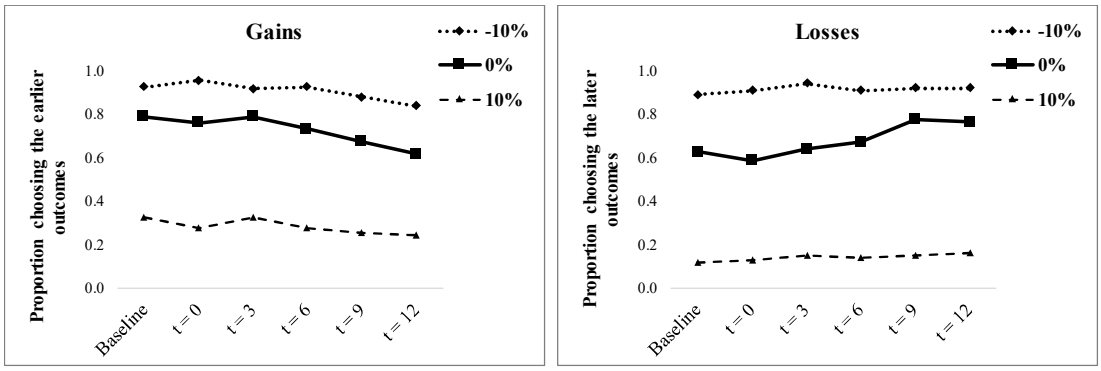

Figure 5.12 – Trade period x Interest rates interaction

Overall, there was a diminishing preference for the earlier gains and later losses as the interest rates increased from negative (M_G = .90, M_L = .91) to zero (M_G = .72, M_L = .67) to positive (M_G = .28, M_L = .14). There was also very little variation observed across the six conditions when the interest rates were either negative or positive, indicating that participants were unaffected by the timing of GE exchange. Instead, they were making choices that in general maximised their gains and minimised their losses.

However, there was a robust temporal contiguity effect for both gains and losses when the interest rates were zero. This was evidenced with a stronger preference for the earlier outcomes at t = 0 and 3 months compared to t = 9 and 12 months (prop. choosing the earlier gains: $M_{t=0}$ = .76 vs. $M_{t=12}$ = .61, p = .002, d = .15; $M_{t=3}$ = .79 vs. $M_{t=9}$ = .67, p = .008, d = .12; prop. choosing the later losses: $M_{t=0}$ = .58 vs. $M_{t=}$

$_{12}$ = .76, p < .001, d = .18; $M_{t=3}$ = .64 vs. $M_{t=9}$ = .77, p = .008, d = .13). In addition, there was no evidence of any significant differences between t = 0 and t = 3 months or between t = 9 and 12 months.

Result 4: There was robust temporal contiguity effect ***only*** *when the interest rates were zero.*

C. Debt attitude

As in Study 1, a *k*-means clustering algorithm was used to group participants according to their choices on the debt battery. Three groups emerged: the debt-tolerant, debt-averse and debt-takers. Unlike Study 1, the debt-tolerant were by far the most dominant group (68%), followed by the debt-averse (20%) and then the debt-takers (9%) – see Table 5.9 below[37]. The pattern of choices revealed by each group was similar to the ones observed in Figure 5.7 (refer to Study 1). That is, the debt-tolerant preferred the later payments; the debt-averse preferred the earlier payments; the debt-takers preferred the earlier payments when both payments were delayed, but the later ones when the earlier payments were immediate.

Table 5.9 – Distribution of the debt battery group split by gain-loss conditions

	Debt-tolerant	**Debt-averse**	**Debt-takers**
Gains	71	19	7
Losses	64	20	10
Total	135	39	17
Percentage	*68%*	*20%*	*9%*

Like Study 1, the following analysis was restricted to the debt-tolerant and debt-averse. Statistical analysis was carried out using a GEE model with a logit link function, with the *sign of the outcomes*, *interest rates*, *six conditions* and *two debt groups* as predictors of the *timing of monetary outcomes*.

[37] Nine participants exhibited multiple switching, therefore could not be assigned to any of the three group.

C.1. Debt attitude x Sign Interaction

In general, the debt-tolerant were more likely to choose the earlier gains and later losses than the debt-averse (prop. choosing the earlier gains: $M_{DT} = .67$ vs. $M_{DA} = .57$; prop. choosing the later losses: $M_{DT} = .63$ vs. MDA = .37). However, these results were qualified with a sign by debt group interaction (χ^2 (2, 172) = 4.50, $p = .034$). According to a pairwise comparisons test, the observed difference between the debt-tolerant and debt-averse was not significant for gains ($p = .10$), but highly significant for losses ($p < .001$). Therefore, as expected the debt-tolerant preferred the later losses, while the debt-averse preferred the earlier ones.

C.2. Debt attitude x Interest rates interaction

These results were further qualified with an interaction between the sign, interest rates and debt groups (χ^2 (2, 172) = 11.46, $p = .003$). Figure 5.13 plots this interaction. The left panel displays the choices for gains, while the right panel displays these choices for losses.

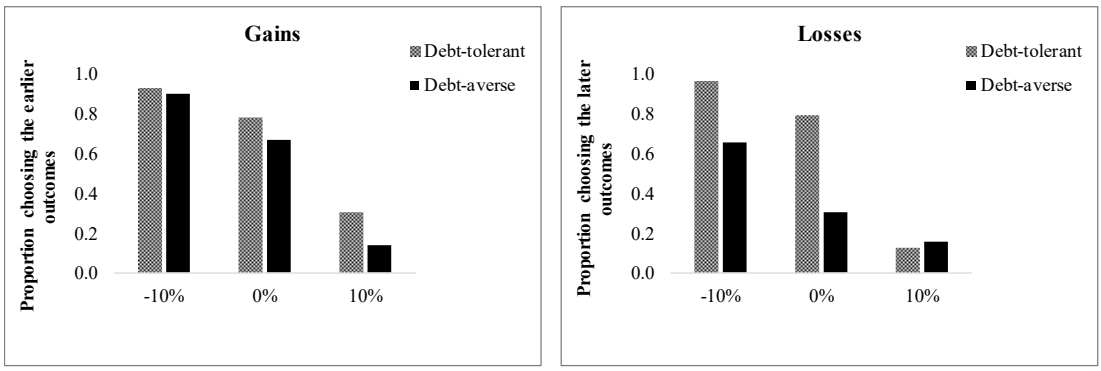

Figure 5.13 – Debt attitude x Interest rates interaction

For gains, both the debt-tolerant and debt-averse revealed a stronger preference for the earlier outcomes as the interest rates increased. However, the debt-tolerant were more likely to choose the earlier outcomes when the interest rates were positive ($p = .011$) – i.e. they were slightly more impatient.

For losses, the debt-tolerant preferred the later outcomes when the interest rates were negative or zero, and the earlier ones when the rates were positive. Therefore, revealed a strong desire to minimise costs (i.e. were sensitive to the increase in interest rates). The debt-averse, on the other hand, were sensitive to the increase in interest rates (as

evidenced by their declining preference for the later losses), and to the timing of these losses as evidenced by their lower likelihood to choose the later outcomes when the interest rates were negative ($p < .001$) or zero ($p < .001$). That is, they amplified the disutility of the deferred losses to an extent that some of them were willing to pay more money sooner than less money later.

C.3. Debt attitude by trade period interaction

As expected, there was a significant interaction between the sign of the outcomes, the two debt groups and the six conditions (χ^2 (5, 172) = 15.0, p = .010). Figure 5.14 plots this interaction. The left panel displays the proportion of the debt-tolerant and debt-averse choosing the earlier gains, while the right panel displays these proportions for losses.

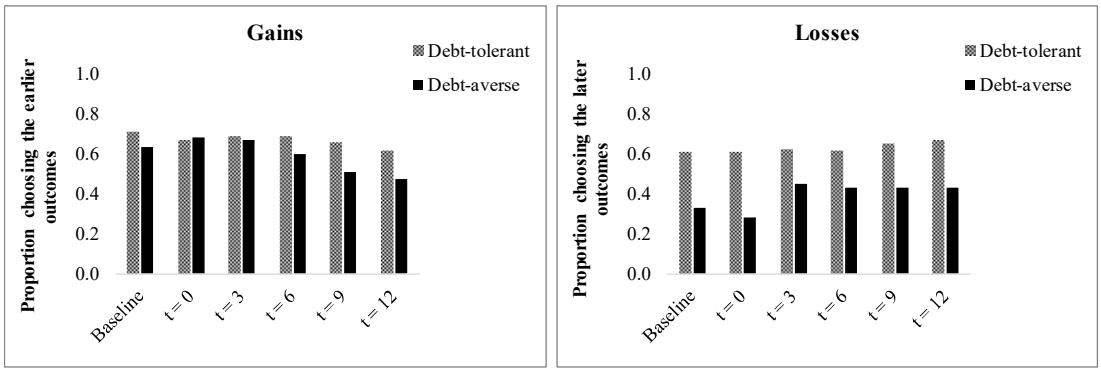

Figure 5.14 – Debt attitude x Trade period interaction

Monetary gains

Contrary to hypothesis H3, the debt-tolerant and debt-averse revealed different preferences for the timing of monetary gains as the trade period of GE credits was deferred. According to Figure 5.14 (refer to the left panel), the debt-tolerant were equally inclined to choose the earlier outcomes for all six conditions (all p's > .05). Therefore, were generally unaffected by the timing of GE credits (this was true irrespective of the level of interest rates).

Conversely, the debt-averse were 5% and 4% *more* likely to choose the earlier outcomes at t = 0 and 3 months, but 4%, 12% and 16% *less* likely to do so at t = 6, 9 and 12 months relative to the baseline condition. In other words, they revealed a stronger preference for the earlier gains when the period of GE credits exchange was

early, and the later ones when the exchange was delayed (i.e. at t = 9 and 12 months). These effects were even more robust when the interest rates were zero. In comparison with the baseline condition, the debt-averse were 10% and 5% *more* likely to choose the earlier outcomes at t = 0 and 3 months, but 15%, 40% and 40% *less* likely to do so at t = 6, 9 and 12 months. Therefore, the debt-averse revealed both a strong temporal contiguity effect, and a strong preference for improvement.

Monetary losses

For losses, the debt-tolerant were equally inclined to choose the later outcomes for all six conditions (all p's > .05). Therefore, were also unaffected by the timing of GE credits exchange. Like gains, this was true irrespective of the level of interest rates. In contrast, the debt-avers were 5% *less* likely to choose the later outcomes at t = 0, and 10% *more* likely to do so at t = 3, 6, 9 and 12 months relative to the baseline condition. As with gains, these effects were more robust when the interest rates were zero. That is, the debt-averse were 5% *less* likely to choose the later outcomes at t = 0, 16% *more* likely to do so at t = 3 and 6 months, and 26% more likely to do so at t = 9 and 12 months.

In line with Study 1, these results suggest that the debt-averse disliked the deferred losses in general. However, they disliked them less when these losses were strongly associated with consumption. Interestingly, buying the GE credits before paying for them (t = 0) further amplified the disutility of the deferred payments in comparison with the baseline condition.

Result 5: The debt-averse revealed a strong temporal contiguity effect for both gains and losses, especially when the interest rates were zero. In contrast, the debt-tolerant were unaffected by the timing of GE credits, predominantly choosing to maximise their gains and minimise their losses.

Discussion

Study 2 explored preferences for the timing of monetary outcomes (gains and losses) in a trading context, whereby *individuals* buy and sell a commodity (GE credits) that can be used to offset carbon emissions. Specifically, when the exchange period

(periods t = 0 to t = 12 months) and future price (levels of interest rates) of this commodity varied.

Overall, there was a robust temporal contiguity effect for both gains and losses, but only when the price of GE credits was the same in the earlier and later periods – thereby replicating the results of Study 1. However, when prices varied, participants generally opted for the larger gains and smaller losses. That is, they were more likely to choose the earlier gains and later losses when the interest rates were negative rates, and vice versa when the rates were positive rates. These results suggest that people care more about their financial welfare as opposed to their hedonic welfare when contiguity is financially costly.

This was particularly true for participants diagnosed as debt-tolerant as they were in general unaffected by the timing of GE credits, but strongly inclined to choose the later gains and earlier losses as the interest rates increased. In contrast, the debt-averse revealed a stronger preference for the later gains and losses when the exchange period was deferred. This effect, however, was more robust when the earlier and later outcomes were the same.

Studies 1 and 2 were designed to test the temporal contiguity effect when making financial decisions on an *individual* level. However, Chapters 3 and 4 provided evidence that people use similar mental accounting rules to make financial decisions on a communal level. Accordingly, the aim of the following study is to test the temporal contiguity effect using the same setup from Study 2, but with a modified scenario to reflect the communal nature of the GE credits exchange. Specifically, participants were told that the UK government is launching a green energy scheme in which counties consuming more non-green energy than the national per person average will have to buy GE credits to offset their excess carbon emissions, while counties consuming less than the national average can sell these GE credits.

5.6 Study 3

Participants

A sample of 410 UK residents were recruited through Bilendi. They averaged 53 years of age, with 40% holding a university degree, 57% in full-time or part-time employment, 60% earning a household income between £20k and £60k, and 37% being females. The median completion time of the survey was 11 minutes. Participants who successfully completed the survey were rewarded with loyalty points that could be exchanged for products of their liking.

Design and procedure

Following a brief introduction, participants were randomly assigned to a monetary gains or losses condition. As in Study 2, half the participants completed the standard task first and the scenario task afterwards, while the other half completed the scenario task first and the standard task afterwards.

A. The standard task

The instruction to the task read as follows: *"Imagine a UK county that has a choice between **paying [receiving]** an earlier or a later sum of money to [from] the government. For each of the following questions, please select the amount you think the county should **pay [receive]**. The amounts will change from one question to the next."*

Participants then responded to three randomised questions corresponding to the following levels of interest rates: -10%, 0% and 10%. Figure 5.15 provides an example.

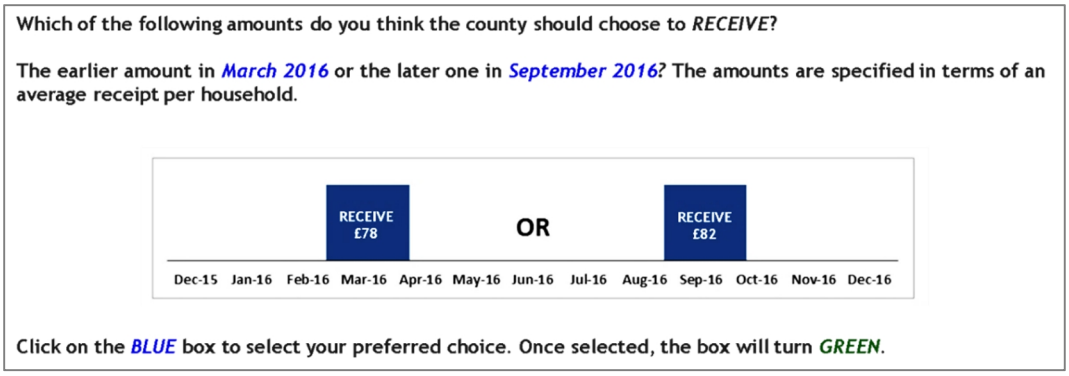

Figure 5.15 – Visual illustration of the standard task

B. The scenario task

The instructions to the scenario task read as follows: *"Imagine that the UK government is launching a green energy scheme to combat the looming threat of climate change. As a result, counties consuming more non-green energy than the national per person average will have to buy green energy credits to offset the excess greenhouse gases emitted. Meanwhile, counties consuming less than the national average can sell these green energy credits."*

In addition to the written instructions, they were provided with the following diagram to explain how the green energy credits scheme would work.

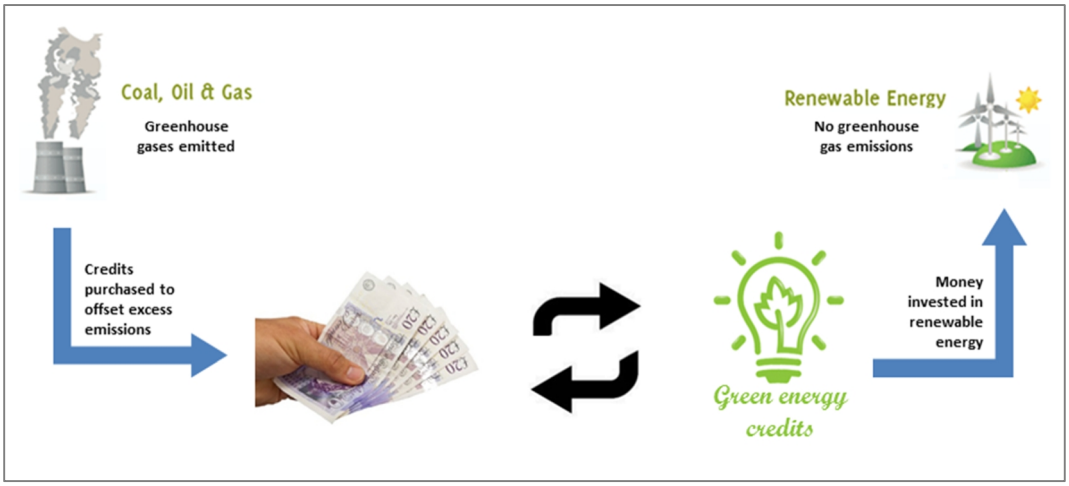

Figure 5.16 – Visual illustration of the green energy credits scheme

Participants assigned to the losses conditions were then told that the county in question was consuming more non-green energy than the national per person average. As a result, the county will be entering into a **binding contract today to buy a number of green energy credits**. Conversely, those assigned to the gains conditions were told

that the county was consuming less non-green energy than the national per person average. As a result, the county will be entering into a **binding contract today to sell a number of green energy credits**. In both cases, participants were told that the sale and purchase of these energy credits will take place through a centralised market regulated by the government.

Following these instructions, each participant was randomly presented with five blocks identical to the ones used in Study 2. Each block consisted of three randomised questions corresponding to the following levels of interest rates: -10%, 0% and 10%. Figure 5.17 provides an example a county purchasing green energy credits in June 2016.

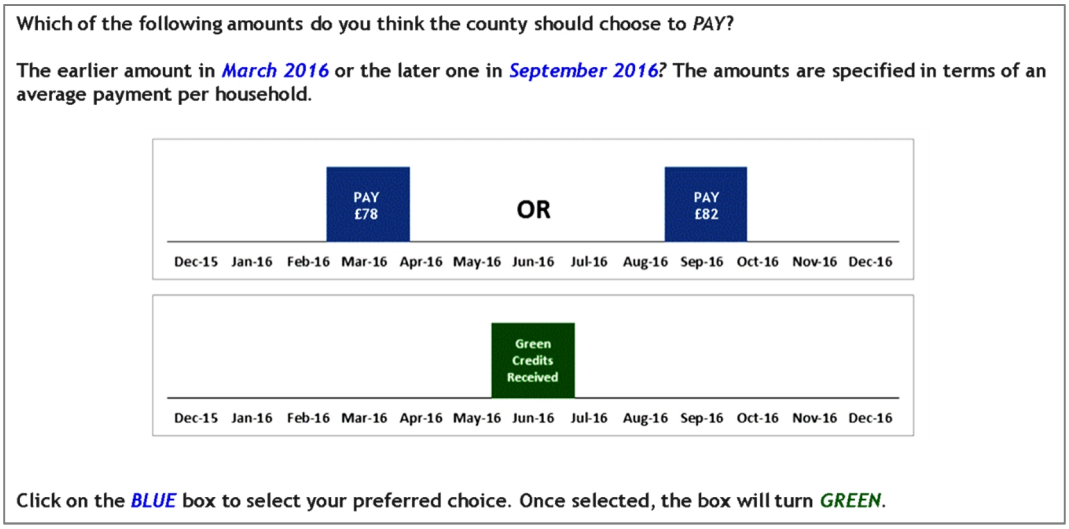

Figure 5.17 – Visual illustration of the scenario-based task

C. Monetary amounts

As in Study 2, 18 amounts ranging between £50 and £90 were randomly generated (the "early amounts"), then compounded using the three levels of interest rates (-10%, 0% and 10%) to compute the delayed amounts. Only one of the 18 pairs was randomly selected for each trial (choice). Table 5.10 displays the amounts used.

Table 5.10 – Price list for Study 3

Early amounts		Delayed amounts		
		-10%	0%	10%
1	£53	£50	£53	£56
2	£57	£54	£57	£60
3	£59	£56	£59	£62
4	£60	£57	£60	£63
5	£61	£58	£61	£64
6	£63	£60	£63	£66
7	£65	£62	£65	£68
8	£66	£63	£66	£69
9	£71	£68	£71	£75
10	£73	£69	£73	£77
11	£75	£71	£75	£79
12	£76	£72	£76	£80
13	£77	£73	£77	£81
14	£78	£74	£78	£82
15	£81	£77	£81	£85
16	£84	£80	£84	£88
17	£89	£85	£89	£94
18	£94	£89	£94	£99

Participants also completed Scholten et al.'s 7-item *debt battery*, Walters et al.'s (2016) 4-item self-reported attitude towards debt, and Frederick's (2002) 3-item cognitive reflection test, before providing some personal information including their gender, age, education, employment status and household income.

Results

The overall effect of manipulating the timing of GE credits exchange on preferences for the timing of outcomes is analysed first. This is followed by an examination of these effects across the three levels of interest rates, and for the groups identified by the debt battery. Particularly, the debt-tolerant and debt-averse. As in Study 2, the analysis of the task order is reproduced in Appendix B.

All reported statistical results in subsection A were carried out using a GEE model with a logit link function, with the *sign of the outcomes*, *presentation order*, *interest rates* and *six conditions* as predictors of the *timing of monetary outcomes* (earlier or later). The results were analysed by calculating the proportion of participants choosing the earlier gains and later losses.

A. Trade period of GE credits

Table 5.11 presents the proportion of participants choosing the earlier gains and later losses, along with the results of the pairwise comparisons tests between the six conditions.

Table 5.11 – Mean proportion choosing the earlier gains and later losses

	Baseline	**Dec-15** *t = 0*	**Mar-16** *t = 3 months*	**Jun-16** *t = 6 months*	**Sep-16** *t = 9 months*	**Dec-16** *t = 12 months*
Gains	0.63_a	0.70_b	0.68_b	0.50_c	0.40_d	0.44_d
Losses	0.57_a	$0.53_{a,b}$	0.51_b	0.56_a	0.66_c	0.64_c
Note: Values not sharing the same subscript are significantly different at $p < .05$.						

Preferences for the timing of monetary outcomes were strongly influenced by the timing of GE credits trade, for both gains and losses. In comparison with the baseline condition, participants were 7% and 5% *more* likely to choose the earlier gains when the credits were traded at t = 0 and 3 months, but 13%, 23% and 19% *less* likely to do so when the trade was scheduled for t = 6, 9 and 12 months, respectively.

For losses, participants were 4%, 7% and 1% *less* likely to choose the later outcomes when the trade was scheduled for t = 0, 3 and 6 months, but 9% and 7% more likely to do so for t = 9 and 12 months, respectively. Therefore, like Studies 1 and 2 there was a diminishing preference for the earlier gains and an increasing preference for the later losses, as the period of benefits (GE credits) was deferred.

A.1. Temporal contiguity effect

Figure 5.18 compares the choices at t = 0 and 3 months with t = 9 and 12 months. It reveals a robust preference for temporal contiguity between the monetary outcomes and the period of GE credits exchange. That is, participants were more likely to choose the earlier outcomes for t = 0 and 3 months, and the later ones for t = 9 and 12 months (refer to Table 5.11 for the pairwise comparisons). As in Study 1, this effect was stronger for gains than losses.

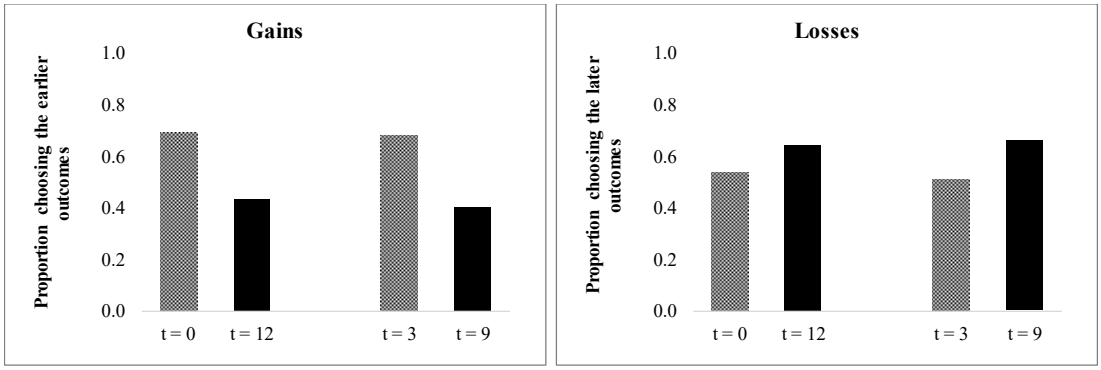

Figure 5.18 – Temporal contiguity effect

A.2. Cost-benefit sequence

For gains, participants were more likely to choose the later outcomes when the exchange was scheduled for t = 6 months relative to the baseline condition. Therefore, as in Study 1, they revealed a preference for having costs (the sale of GE credits) precede benefits (monetary earnings) – i.e. a preference for improvement.

In contrast, for losses, participants were equally likely to choose the later outcomes at t = 6 months and the baseline condition. Therefore, as in Studies 1 and 2, there was no evidence of a preference for improvement, indicating that preferences for the timing of losses were mostly driven by the desire for temporal contiguity.

Result 6: There was a robust temporal contiguity effect that was stronger for gains than losses. In addition, for gains there was also evidence of a preference for improvement.

A.3. Trade period of GE credits x Interest rates interaction

Figure 5.19 displays the mean proportion of participants choosing the earlier gains (left panel) and later losses (right panel) for the six conditions across the three levels of interest rates (-10%, 0% and 10%).

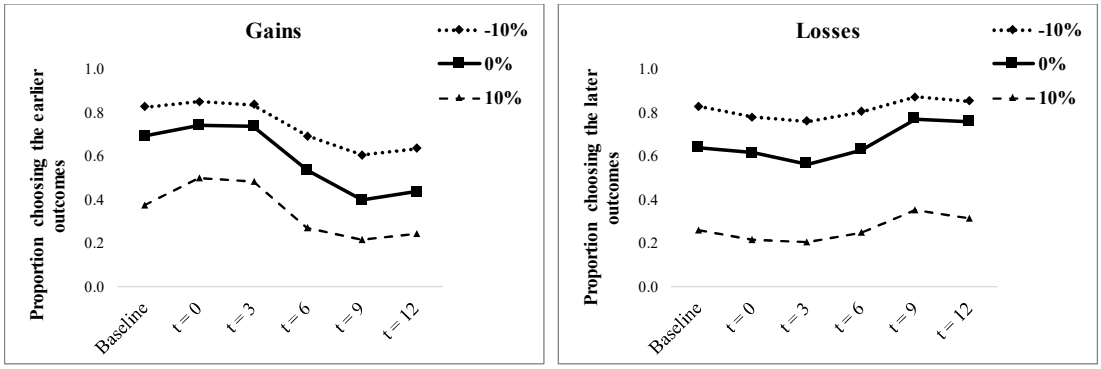

Figure 5.19 – Trade period x Interest rates interaction

Overall, there was a declining preference for the early gains and later losses as the interest rates increased from negative (M_G = .74, M_L = .81) to zero (M_G = .59, M_L = .66) to positive (M_G = .34, M_L = .26).

However, unlike Study 2 deferring the period of GE credits exchange elicited a stronger preference for the later outcomes, regardless of sign or level of interest rates. In fact, there was no evidence of an interaction between the sign, interest rates and six conditions (χ^2 (10, 410) = 11.25, p = .338).

Accordingly, there was a significant temporal contiguity effect for both gains and loss across all levels of interest rates, as well as a strong preference for improvement in the case of monetary gains. These effects were highly robust when the interest rates were zero, and were stronger for gains than losses at every level of interest rates.

Result 7: there was a significant temporal contiguity effect irrespective of the sign or level of interest rates.

B. Debt battery

As in Studies 1 and 2, we use a *k*-means clustering algorithm to group participants according to their debt battery choices. Four groups emerged: the debt-tolerant (68%), debt-averse (19%), debt-takers (8%) and debt-holders (5%). Coincidentally, the observed proportions for the first three groups were identical to the ones from Study 2.

Table 5.12 – Distribution of the debt battery group split by gain-loss conditions

	Debt-tolerant	Debt-averse	Debt-takers	Debt-holders
Gains	128	40	22	13
Losses	152	36	11	8
Total	280	76	33	21
Percentage	68%	19%	8%	5%

The pattern of choices revealed by each group was similar to the ones observed in Figure 5.7 (refer to subsection B in Study 1). That is, the debt-tolerant preferred the later payments; the debt-averse preferred the earlier payments; the debt-takers preferred the earlier payments when both payments were delayed, but the later ones when the earlier payments were immediate; and finally the debt-holders preferred the later payments when both payments were delayed, but the earlier ones when the earlier payments were immediate.

As expected, the debt-averse scored the least on the self-reported attitude towards debt (M = 1.65, SD = .60), followed by the debt-takers (M = 1.92, SD = .65), the debt-tolerant (M = 2.01, SD = .86) and finally the debt-holders (M = 2.18, SD = .90). However, according to a Tukey HSD pairwise comparisons test only the difference between the debt-averse and debt-tolerant, and between the debt-averse and debt-holders reached levels of significance.

Like Studies 1 and 2, the following analysis was restricted to the debt-tolerant and debt-averse.

B.1. Debt attitude by Sign interaction

On average, the debt-tolerant were more likely to choose the earlier gains and later losses than the debt-averse. However, this difference was much more evident for losses than gains (prop. choosing the later losses: $M_{DT} = .63$ vs. $M_{DA} = .39$, $p < .001$; prop. choosing the earlier gains: $M_{DT} = .58$ vs. $M_{DA} = .47$, $p = .003$).

B.2. Debt attitude by Interest rates interaction

Figure 5.20 plots the sign, debt groups and interest rates interaction. Interestingly, the observed patterns are similar to the ones from Study 2, for both gains and losses. However, for gains, the main difference between the debt-tolerant and debt-averse was

observed when the interest rates were zero (p = .002) as opposed to when the rates were positive (as in Study 2). This was mainly because the debt-averse were more likely to be influenced by the timing of GE credits exchange when the earlier and later outcomes were equal.

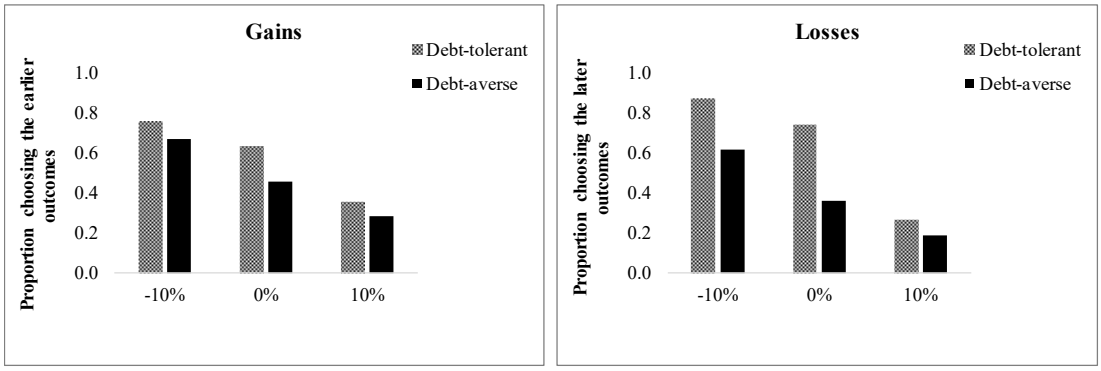

Figure 5.20 – Debt attitude x Interest rates interaction

B.3. Debt attitude by Trade period interaction

Contrary to Studies 1 and 2, there was no evidence of an interaction between the sign, debt groups and six conditions (χ^2 (5, 356) = 8.12, p = .149) – see Figure 5.21 below.

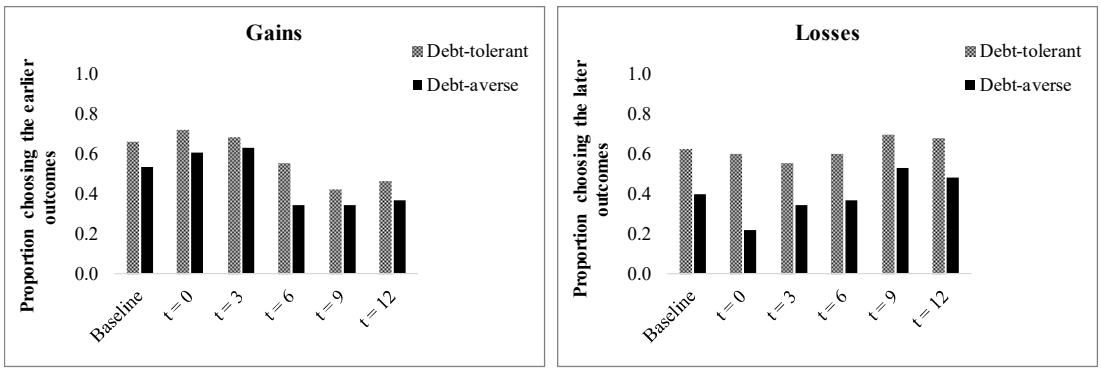

Figure 5.21 – Debt attitude x Trade period interaction

In general, both the debt-tolerant and debt-averse in the gains and losses conditions were significantly influenced by the timing of GE credits exchange. Relative to the baseline condition, the debt-tolerant were 6% and 2% *more* likely to choose the earlier gains for t = 0 and 3 months, but 10%, 24% and 20% *less* likely to do so for t = 6, 9 and 12 months, respectively. Likewise, the debt-averse were 8% and 10% *more* likely to choose the earlier gains for t = 0 and 3 months, and 19%, 19% and 17% *less* likely to do so for t = 6, 9 and 12 months, respectively. Therefore, both groups revealed a diminishing preference for the earlier gains as the period of GE credits exchange was deferred. Specifically, both groups revealed a strong contiguity effect (as evidenced

by their choice at t = 0 and 3 months compared to t = 9 and 12 months), and both groups revealed a preference for having costs precede the benefits (as evidenced by their choices at t = 6 months relative to the baseline condition). Although, the latter effect was stronger for the debt-averse.

Result 8: For gains, there was no evidence that the timing of GE credits exchange influenced the choices of the debt-tolerant and debt-averse differently, which is consistent with Study 1 but not Study 2.

For losses, the debt-tolerant were 2%, 7% and 3% *less* likely to choose the later outcomes for t = 0, 3 and 6 months, but 7% and 5% *more* likely to do so for t = 9 and 12 months, respectively. While the debt-averse were 18%, 6% and 3% *less* likely to choose the later outcomes for t = 0, 3 and 6 months, but 13% and 8% more likely to do so for t = 9 and 12 months, respectively. Particularly interesting is the large drop observed at t = 0 for the debt-averse. It indicates (as in Study 2) that buying the GE credits before paying for them further amplified the disutility of the deferred payments. Apart from that, the timing of GE credits exchange had a similar effect on the choices of the two debt groups. That is, both groups revealed a stronger preference for the later losses as the period of GE credits exchange was deferred. Specifically, both groups revealed a significant contiguity effect. Albeit, this effect was stronger for the debt-averse.

Result 9: The debt-tolerant preferred the later losses, and this preference strengthened when the GE credits were exchanged later (t = 9 or 12 months). In contrast, the debt-averse preferred the earlier losses, and more so when the GE credits were exchanged sooner (t = 0 or 3 months). However, this preference was moderated by the benefits when the exchange period was deferred (t = 9 or 12 months).

Discussion

In general, the results of Study 3 replicated the temporal contiguity effect observed in Studies 1 and 2. However, unlike Study 2, this effect persisted for the negative and positive interest rates. That is, participants in Study 3 were more susceptible to the timing of GE credits manipulation, and overall less likely to maximise gains and minimise losses relative to Study 2 (i.e. less patient for gains and losses). Two

explanations are offered. One, the range of monetary outcomes was significantly smaller in study 3 (£50 to £90) than Study 2 (£200 to £400), thereby triggering a *magnitude effect* – such that small outcomes are discounted more than large ones (e.g. Benzoin et al., 1989; Shelly, 1993). Two, participants in Study 3 were making choices on behalf of a UK county (i.e. communal decision) as opposed to themselves (personal decision). As a result, they may have been more inclined to make decisions from a hedonic perspective as opposed to a financial one.

As in Study 1, there was a stronger contiguity effect for gains than losses, and a stronger preference for costs to precede the benefits (i.e. a preference for improvement) for gains but not for losses. It is not entirely clear why participants made choices in such a manner. It could be that non-monetary benefits depreciate at a lower rate than monetary ones. Therefore, there is more residual utility from nonmonetary benefits to offset the outstanding payment. It could also be that there is a stronger incentive to enjoy money rather than consumption debt-free because people are more accustomed to the idea of consumption on credit, and to receive earnings following the completion of a job or a task. Finally, it could be that the absence of information about the duration of consumption induced some participants to perceive the nonmonetary benefit as a durable good.

Finally, in line with Studies 1 and 2, the debt-averse and debt-tolerant differed in their preferences for the timing of losses. The debt-averse preferred the earlier losses in general. This preference was *accentuated* when GE credits were received before being paid for, and *moderated* when the period of GE credits was deferred. The debt-tolerant, on the other hand, preferred the later losses, and more so when the GE credits were exchanged later.

5.7 General discussion

The research in this chapter was motivated by three objectives. One, to test the consistency of the preferences observed in Chapter 2 using a multi-period framework. Two, to test the consistency of these preferences across domains: personal (Studies 1 and 2) and communal (Study 3). Three, to gain an understanding of how people with different attitudes towards debt evaluate cost-benefit trade-offs.

Temporal contiguity – In general, all three studies revealed a robust *temporal contiguity effect* for both gains and losses – i.e. a preference to experience the costs and benefits of a trade in close proximity. This evidence has two implications. One, the preference to temporally align the costs and benefits is not a matter of a default option bias, but the product of a mental accounting process whereby temporal separation results in the disassociation of costs from benefits. An event that can be hedonically costly if benefits precede costs (Prelec & Loewenstein, 1998). Two, people reveal the same biases when making financial decisions on a personal and communal level – this, in fact, may be more robust for communal decisions, as evidence by Study 3. These findings suggest that people in general dislike borrowing from the future to consume more today, both on a personal (e.g. borrowing from a pension plan) and a communal level (e.g. borrowing against future shale gas revenues). This is consistent with the findings of Meissner (2014) who observed significant under-consumption when borrowing is necessary in order to consume optimally.

Sequence of outcomes – Both Studies 1 and 3 revealed a preference for improvement in the case of monetary gains, but not losses. The latter appears to be inconsistent with the predictions of the double-entry model, that people prefer to prepay for consumption. One possible explanation for this inconsistency (and asymmetry between gains and losses) is the (intended) absence of any explicit information about the *duration* of consumption. Prior research that reported a preference for prepayment provided explicit information about the consumption interval (e.g. Hirst et al., 1994; Patrick and Park, 2006, Prelec & Loewenstein, 1998). Accordingly, it would be worthwhile in the future to test whether providing explicit information about the duration of consumption would trigger a stronger preference for prepayment.

Attitude towards debt – There were systematic differences between the debt-tolerant and debt-averse for losses, but not for gains. The debt-tolerant were in general making sensible financial decisions that are consistent with the predictions of the standard economic model. Especially when they were making personal decisions. Consequently, their choices were not strongly influenced by the trade period of consumption. In contrast, the debt-averse disliked the idea of paying later, and more so when the consumption benefits preceded the costs. However, this aversion was moderated when the consumption benefits were deferred. In other words, they disliked

the later losses less when these were strongly associated (coupled) with the benefits. This evidence suggests that the debt-averse are highly prone to experience the pain of paying, but this pain could be diminished by situational factors that strongly couple the costs to the benefits.

5.8 Appendix A - Study 2

Presentation order

On average, participants were more likely to choose the earlier gains and later losses when the standard intertemporal choice task preceded the scenario-based task (prop. choosing earlier gains: $M_{standard\_task}$ = .67 vs. $M_{scenario\_task}$ = .61; prop. choosing later losses: $M_{standard\_task}$ = .56 vs. $M_{scenario\_task}$ = .58). Despite that, there was no evidence of a significant presentation order effect (χ^2 (1, 199) = 2.48, p = .115) and no evidence of a sign by presentation order interaction (χ^2 (1, 199) = .389, p = .533). These results, however, were qualified with a significant interaction between the presentation order, the sign of the outcomes and the six condition (χ^2 (5, 199) = 25.5, p < .001).

Figure 5.22 compares the choices at t = 0 versus t = 12 months and t = 3 months versus t = 9 months, for gains (top panels) and losses (bottom panels), when the standard task either preceded or followed the scenario-based task. Note that the labels on the horizontal axis refer to the presentation order. Therefore, the label "standard task" means that it was presented before the scenario-based task, and vice versa.

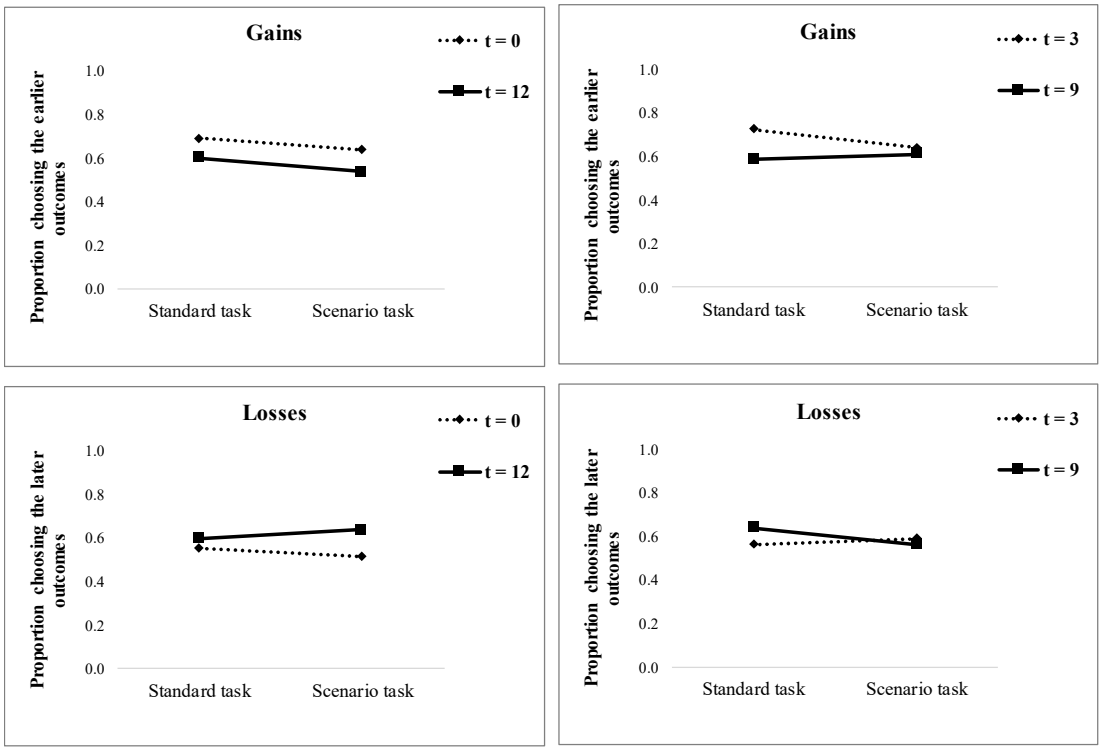

Figure 5.22 – Presentation order – Study 2

I analyse the data of the gains conditions first. According to the top left panel, there was a stronger preference for the earlier gains at t = 0 than t = 12 months, regardless of the presentation order (standard task: $M_{t=0} = .69$ vs. $M_{t=12} = .60$, $p = .002$; scenario-based task: $M_{t=0} = .64$ vs. $M_{t=12} = .54$, $p = .002$). In contrast, the top right panel revealed a stronger preference for the earlier gains at t = 3 months than t = 9 months when the standard task preceded the scenario-based task ($M_{t=3} = .72$ vs. $M_{t=9} = .59$, $p = .003$), but not when the scenario-based task was presented first.

For losses, both panels revealed an interaction between the timing of GE credits exchange and the presentation order. According to the bottom left panel, there was no difference between t = 0 and t = 12 months when the standard task was presented first. However, there was a stronger preference for the later losses at t = 12 months when the scenario-based task was presented first ($M_{t=0} = .51$ vs. $M_{t=12} = .64$, $p = .027$). Conversely, the bottom right panel revealed a *marginally* stronger preference for the later losses at t = 9 months compared to t = 3 months, when the standard task preceded the scenario-based task ($M_{t=3} = .56$ vs. $M_{t=9} = .64$, $p = .074$), but no difference between the two timings when the scenario-based task was presented first.

Despite these interactions, the lack of consistency in the observed patterns suggests that these effects were not systematic. Moreover, there was no evidence of a significant interaction between the sign, timing of GE credits trade, and presentation order in Study 3.

Self-reported attitude towards the environment and carbon offsetting

Participants self-reported their attitude towards carbon offsetting and the environment on a five-point scale ranging from 'strongly disagree' to 'strongly agree'. **Error! Reference source not found.** presents the proportion of participants who self-reported a *negative* (rating < 3), *neutral* (rating = 3) and *positive* (rating > 3) attitude.

In general, participants viewed themselves as environmentally friendly consumers (item *e*, avg. rating > 3). They also believed that carbon offsetting can help reduce harmful emissions and tackle problems of climate changes (items *a* and *b*, avg. rating > 3). However, they were not strongly inclined to buy carbon offsets (item *c*, avg.

rating < 3), and some even perceived carbon offsetting as another form of taxation (item *d*, avg. rating < 3).

Table 5.13 – Self-reported attitude towards carbon offsetting and the environment

	Negative (rating < 3)	Neutral (rating = 3)	Positive (rating > 3)	Average rating
Pro-carbon index*	.32	.26	.42	3.00
Item (a)	.22	.37	.41	3.17
Item (b)	.21	.36	.43	3.20
Item (c)	.38	.43	.19	2.65
Item (d)**	.13	.49	.38	2.62
Item (e)	.08	.32	.60	3.61

* The index consisted of items (a), (b) and (c)
** Item (d) was reverse coded such that a higher score on the scale refers to a more positive, or less negative, attitude toward carbon offsetting

For losses, participants who revealed a positive attitude towards carbon offsetting (i.e. scored more than the average on the pro-carbon index) were more likely to choose the later outcomes than those who were neutral or negative (M_{Pos} = .60 vs. $M_{Neutral}$ = .54 vs. M_{Neg} = .57). In contrast, for gains, these participants were less likely to choose the earlier outcomes compared to those who were neutral or negative (M_{Pos} = .68 vs. $M_{Neutral}$ = .64 vs. M_{Neg} = .60). Therefore, having a positive attitude towards carbon offsetting elicited a stronger preference for the later losses and earlier gains. However, these differences were not statistically significant.

In addition, for losses, participants who viewed themselves as environmentally friendly were *less* likely to choose the later outcomes than those who were neutral or negative (M_{Pos} = .60 vs. $M_{Neutral}$ = .54 vs. M_{Neg} = .44). On the other hand, for gains, participants were equally inclined to choose the earlier outcomes, irrespective of their perceived friendliness towards the environmental (M_{Pos} = .63 vs. $M_{Neutral}$ = .65 vs. M_{Neg} = .64). Therefore, being environmentally friendly elicited a stronger preference for the earlier losses. However, there was no evidence of sign by item (e) interaction (χ^2 (2, 199) = 3.76, p = .152), possibly because of the small proportion of participants who self-reported a negative attitude (~ 8%).

Finally, for losses, participants who viewed carbon offsets as another form of taxation (i.e. viewed them negatively), were more likely to choose the later outcomes compared to those who did not. In particular, when the interest rates were zero (M_{Pos} = .69 vs.

$M_{Neutral}$ = .62 vs. M_{Neg} = .95) – refer to the right panel of **Error! Reference source not found.** below. In contrast, there was no evidence of any significant differences between the three groups for gains. These results were confirmed with a significant interaction between the sign of the outcomes, level of interest rates and item (d) (χ^2 (2, 199) = 16.44, p = .036).

Overall, these results suggest that having a negative attitude towards the environment in general, and towards carbon offsetting in particular, might have elicited a stronger preference for the later losses.

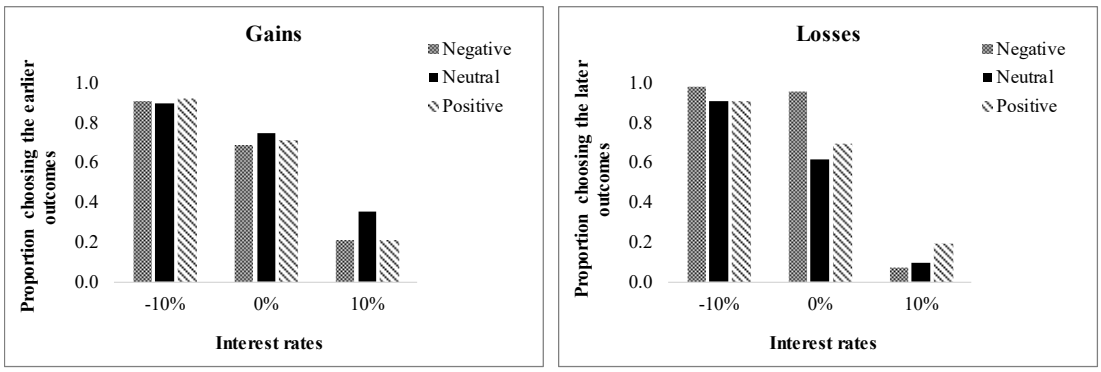

Figure 5.23 – Sign x Interest rates x Item (d) interaction

5.9 Appendix B - Study 3

Presentation order

As in Study 2, participants were, on average, more likely to choose the earlier gains and the later losses when the standard intertemporal choice task was presented before the scenario-based task (prop. choosing the earlier gains: $M_{standard\_task}$ = .58 vs $M_{scenario\_task}$ = .52; prop. choosing the later losses: $M_{standard\_task}$ = .62 vs $M_{scenario\_task}$ = .55). This was evidenced with a significant presentation order effect (χ^2 (1, 410) = 10.0, p = .001).

Unlike Study 2, there was no evidence of a significant interaction between the sign, timing of GE credits trade, and presentation order (χ^2 (5, 410) = 10.4, p = .063). Figure 5.24 compares the choices at t = 0 versus t = 12 months and t = 3 months versus t = 9 months, for gains (top panels) and losses (bottom panels), when the standard task either preceded or followed the scenario-based task.

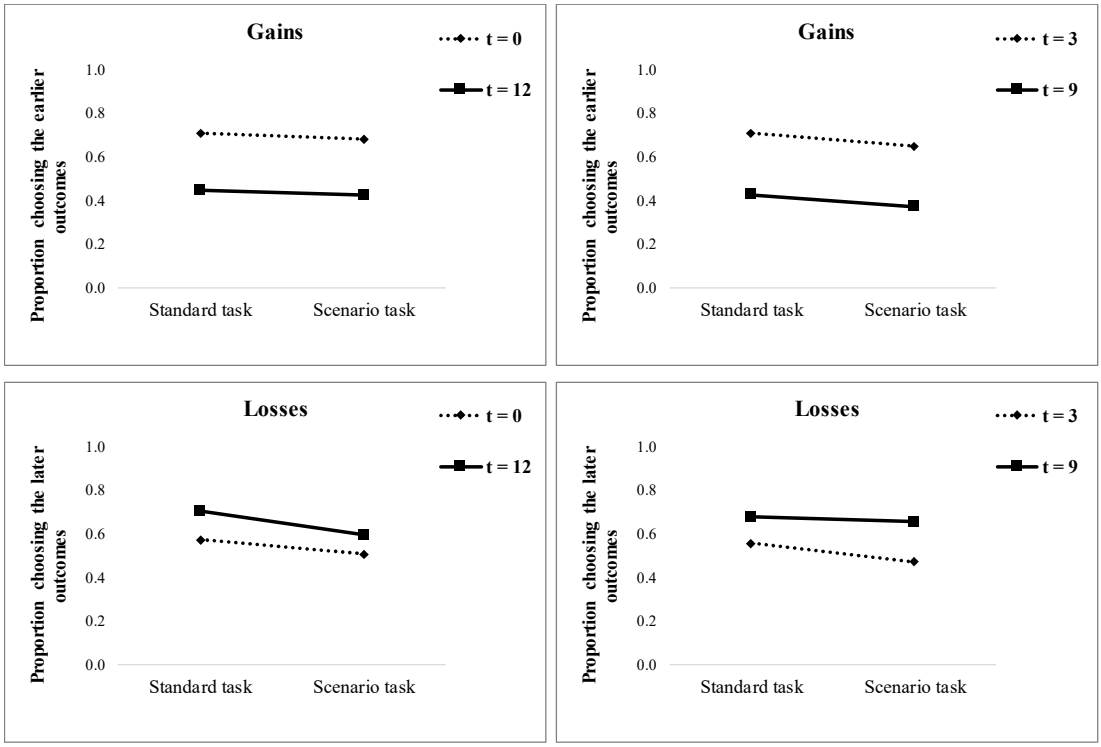

Figure 5.24 – Presentation order – Study 3

As shown by Figure 5.24, the presentation order had *no impact* on the choices made by participants assigned to the gains conditions, and a *marginal impact* on the choices made by those assigned to the losses conditions. For gains, preferences for the timing

of outcomes were determined solely by the timing of GE credits exchange. On the other hand, for losses, the observed difference between t = 0 and t = 12 months diminished slightly when the scenario-based was presented first. Despite that, this difference was still significant ($M_{t=0} = .51$ vs. $M_{t=12} = .59$, $p = .003$). Conversely, the observed difference between t = 3 and t = 9 months diminished slightly when the standard task was presented first. However, this difference was still highly significant ($M_{t=3} = .55$ vs. $M_{t=12} = .67$, $p < .001$). Therefore, manipulating the presentation order did not influence the preferences for the timing of outcomes in a substantial way.

6 CHAPTER SIX

Ordinary citizens in different parts of the world have been taking active roles in deciding how and (possibly when) their taxes are spent, and government benefits distributed. Despite that, there is a significant lack of understating in the literature (and possibly among policy makers) how such decisions are made. To that end, this thesis presented a series of studies examining how ordinary citizens make (or want to make) communal financial decisions. The aim was to learn whether their communal preferences are similar to the ones they would have when making decisions for themselves as individuals. Moreover, the thesis asked if the double-entry model, a well-supported theory of individual preferences, can also explain communal preferences.

More specifically, this thesis examined people's preferences for the timing of monetary outcomes (gain and losses) in social and personal contexts, across several domains, and under different conditions. For instance, Chapter 3 investigated whether the type and duration of communal projects, and whether the consumption period of benefits from these projects has an impact on the preferred timing of monetary losses. While several studies have already addressed the first question in the domain of private consumption (e.g. Hirst et al., 1994; Patrick & Park, 2006; Prelec & Loewenstein, 1998), none have done so in the domain of communal consumption. Furthermore, none have yet explicitly examined the impact of manipulating the period of consumption on the timing of payments. In general, the evidence suggested that people dislike post-consumption payments even when it is economically preferable to do so. Instead, they prefer to prepay for short-lived projects (*a duration effect*), and to align the timing of payments to the period of consumption of long-lived ones (*an alignment effect*). Therefore, supporting the evidence from the private goods literature, and the predictions of the double-entry model in the domain of losses.

Chapter 4, extended the investigation of the alignment effect to the domain of monetary gains. That is, the chapter explored preferences for the timing of monetary gains and losses in exchange for communal services that were either exchanged in the near or distant future. It also evaluated the divergence in preferences when individuals make decisions on behalf of their own community and other people's communities. The studies in this chapter are unique in two ways. One, preferences for the timing of

monetary gains and losses were examined using the same context and framework. Two, these preferences were assessed for decisions that people make for themselves and for others. Overall, the results revealed a robust temporal alignment effect for both gains and losses; and for people making decisions on behalf of their own counties and the counties of others. Interestingly, there were no qualitative differences among participants making choices for themselves and others in the losses condition. This, however, was not the case for gains. One group, *the contrarians*, were more likely to be present among participants making decisions on behalf of other counties. This group of participants preferred to receive the smaller monetary gains irrespective of the timing of these outcomes. At first, the choices of the contrarians appeared to be the result of misconception among participants. However, further analysis revealed that these participants were in fact "altruists" making choices that they perceived to be socially equitable – i.e. choosing to minimise the costs to the county buying the communal services, but maintaining an acceptable payoff to the county selling these services. These findings are consistent with those from De Dreu et al. (1994) and De Vries (1991).

Finally, Chapter 5 studied the timing preferences for monetary outcomes in a multiperiod setup that considered all possible combinations of cost-benefit sequences. The main purpose was to test whether the mental association of costs with benefits is facilitated by the temporal proximity (contiguity) of these costs and benefits. In addition, the chapter examined whether attitude towards debt (debt tolerance vs. debt aversion) – elicited using a novel diagnostic tool developed by Scholten et al. (2016) – is predictive of preferences for the timing of losses. Two major results emerged. One, there was a robust contiguity effect evidenced by a preference to experience the costs and benefits of a trade in close proximity. Two, this effect was much more robust for the debt-averse than the debt-tolerant.

Taken together, the studies from the three chapters suggest that people prefer communal costs to either precede or occur at the same time as the benefits; and when either is not possible, to minimise the temporal distance between the two. These preferences were observed for both gains and losses; for decisions that have a direct impact on the decision maker, or no impact at all; and for choices made between and within participants. These findings suggest that communal financial decisions are, in

general, motivated by the same mental accounting rules that people use to make personal ones. In particular, the rules prescribed by the double-entry model (e.g. prospective accounting / coupling).

Directions for future research

The evidence from Study 1 in Chapter 3 concerning the type of benefits effect (hedonic vs utilitarian) on the timing of payments was inconclusive due to the lack of control for the ratings of hedonic / utilitarian attributes of the projects. Future research should investigate this issue further, and possibly use stimuli that are clearly hedonic (e.g. a fireworks display or a funfair) and utilitarian (e.g. first aid training course). Appropriate stimuli can be identified using a pre-test in which an independent group of participants are asked to rate how pleasurable/useful certain products/projects are. In addition, any prospective study should investigate the effects of duration and type of benefits for personal and communal consumption using a single framework / experiment. As well as, administer Scholten et al. (2016) debt-battery to identify differences in preferences (if any) between the debt-tolerant and debt-averse.

Chapter 4 suggested that the contrarians were predominantly altruists, however it did not completely rule out the possibility that some of the contrarians were participants who did not interpret the experiment instructions properly. Therefore, prospective studies should eliminate any potential misinterpretation by simplifying the instructions, and employing appropriate manipulation checks. For instance, participants could be informed prior to the main experimental task about the condition they will be assigned to, then asked to identify whether it was a monetary gains or losses condition pre and post task. Those who misidentify the condition they were assigned to would be excluded from the study.

Finally, Chapter 5 implied that people use similar mental accounting rules to make personal and communal financial decisions. However, the two domains were tested separately. Future research should examine the two effects using the same framework and under identical conditions. Two possible studies are proposed. One, to extend Study 1 from Chapter 5 such that one group of participants would indicate their preferences for the timing of payments in exchange for a personal product *X*, while the other group would indicate the same in exchange for a communal project *X*.

Participants could also be asked to identify what in their opinion *X* would be. The latter information can be used to run a mediation analysis to test whether the type or durability of benefits could explain the observed patterns. Two, run a variant of Study 3 from Chapter 5 in which participants trade green energy credits for personal and communal consumption.

Chapter 5 also revealed a stronger contiguity effect for gains than losses, suggesting that non-monetary benefits might mentally depreciate at a lower rate than monetary ones. Past research revealed that monetary benefits can start to mentally depreciate as early as three days following its receipt, with the rate increasing as a function of delay (Siemens, 2007). However, no such research has been undertaken to determine the depreciation rate of nonmonetary benefits. Consequently, future research should determine if the two depreciate at the same rate.

Future research should also determine whether the length of the interval between the monetary outcomes and the trade period matters, especially when the trade takes place in-between the outcomes. For instance, will people be more likely to prepay for consumption if it was temporally closer to the earlier payments than the later ones, and vice versa? The answer according to the evidence in this chapter is yes. However, further tests are required to confirm this. Furthermore, would it make a difference if the intervals were in days or years instead of months?

Lastly, Prelec and Loewenstein (1998) suggested that "tightwads" are more likely to experience the pain of paying than "spendthrifts", which prompted Rick et al. (2008) to develop a 4-item "spendthrift-tightwad" scale to measure individual differences in the pain of paying. Their findings suggest that spending differences are more likely in situations that amplify the pain of paying, such that tightwads are more likely, for instance, to prepay than postpay for short-lived consumption. They also find that tightwads are in general more likely to pay off their credit card balance on time, and are less likely to carry debt in general. Future research could explore the overlap (if any) between the "spendthrift-tightwad" scale and the debt-battery. Specifically, for similarities in behaviour between the debt-averse and tightwads; and the debt-tolerant and spendthrifts. In addition, future research could also examine the cost-benefit trade-off preferences of the debt-takers and debt-holders.

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