Time Preference for Investment in the Environment:

The Impact of Intrinsic Motivation

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Abstract

Insights from behavioural economics suggest that individuals rely on different discount rates to assess the present values of gains and losses (the *sign effect*). They also suggest that individuals rely on different discount rates to assess investment in financial, environmental and health domains. A first objective is to further consider these valence versus domain effects. The second, novel, objective is to question whether individuals are likely to employ a higher discount rate for the benefits of investment if they also derive intrinsic value from action. The analysis focuses on perceptions of intrinsic value derived from action to conserve the environment. Will intrinsic motivation increase the *sign effect* and the difference between the discount rate in different domains? In a questionnaire survey, we collected data from 450 undergraduate students. Participants made choices between hypothetical financial, environmental and health gains and losses that took effect either immediately, or with a delay of 10 years. Results suggest the presence of valence and domain effects and further suggests that intrinsic motivation over action is likely to increase *present bias* by increasing the *sign effect*. This dimension of time preference is likely to have an impact on differences between discount rates in different domains.

Keywords: environmental morale; intangible goods; intertemporal preferences; intrinsic motivation.

JEL Classification: D90, H3, H39.

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1. Introduction

Textbooks that focus on public-sector investment insist that it is 'rational' to rely on a single discount rate to compare the present values of gains and losses (e.g., Mishan and Quah 2007). They argue that it is 'rational' to discount future gains and losses continuously and exponentially. With this advice, governments have usually relied on a single discount rate to assess the present values of gains and losses (a discount rate determined by the rate of return earned on conservative financial investments)[2].

By comparison, behavioural economics indicates that individuals rely on more than one rate of discount. Extensive evidence suggests they discount gains more than losses (e.g., Thaler 1981; Frederick *et al* 2002); the valence of outcomes is important. Less extensive, and more mixed evidence, suggests they also rely on different discount rates to assess investments in different sectors of the economy; domain is important. For example, studies that compare time preferences for financial outcomes and for health outcomes report that domain is relevant (e.g., Chapman 1996a, 1996b, 2003; Böhm and Pfister 2005; Gattig and Hendrickx 2007). A first objective in this paper is to add to these empirical findings.

The representative individual in neoclassical economics (*homo economicus*) takes action to achieve a preferred outcome but, in practice, individuals might also take action to derive intrinsic value from action. An individual is '...intrinsically motivated to perform an activity when one receives no apparent reward except the activity itself…' (Deci 1971 p 105). Intrinsic motivation is relevant when individuals believe they will derive intrinsic value from action. Perceptions of the intrinsic value of action depend on the belief that action is morally 'right', and the expectation that others will acknowledge the value of action (Frey 1997). One example of intrinsic value from action is the 'warm glow' that individuals derive when they give to charity (Andreoni 1990). The second, more novel, objective in this paper is to question

whether individuals are likely to employ a higher discount rate for the benefits of investment if they also derive intrinsic value from action.

The focus of attention falls on the relevance of perceptions of the intrinsic value derived from action to conserve the environment. If individuals derive intrinsic value from 'green' action, how will it affect valence and how will it affect comparisons across domains? How will intrinsic motivation influence differences between discount rates employed in an environmental domain and discount rates employed in other domains?

Comparisons reported in section *3.2 (ii)* below are between the discount rates of individuals who derive intrinsic value from action and individuals who are more akin to *homo economicus* (only deriving value from the impact from outcomes). In just the same way as tax morale is used to assess the relevance of intrinsic value derived by complying honestly with taxation (e.g. Torgler 2005), environmental morale is used to assess the relevance of the intrinsic value derived when action is taken to conserve the environment. Are individuals with higher environmental morale likely to rely on higher discount rates for benefits (across valence and across domains)[3]?

To begin, the next section of the paper will focus on the behavioural literature that indicates that individuals have different discount rates across valence and across domains (financial, environmental and health)[4]. With evidence drawn from a questionnaire survey, later sections of the paper focus on the proposition that perceptions of the intrinsic value of action are relevant when comparing time preferences for action.

2. Valence and domain: are there different time preferences?

Is there evidence that individuals rely on different discount rates (across valence and across domain)?

2.1. Evidence of Different Time Preferences

An increasing number of studies indicate that individuals rely on different discount rates for gains and for losses. Losses are generally discounted at a lower rate than gains. Valence is important (Thaler 1981; Loewenstein 1987; Hardisty and Weber 2009).

Domain is also relevant. Some environmental studies report that almost 30-50 per cent of individuals do not discount environmental outcomes (Gattig and Hendrickx 2007), but this literature does not compare different domains[5]. Studies that compare time preferences for financial outcomes and for health outcomes insist that domain is relevant (e.g., Chapman and Elstein 1995; Chapman 1996a, 1996b, 2003; Böhm and Pfister 2005; Gattig and Hendrickx 2007). With reference to different elicitation methods (i.e., matching and choice tasks), they report that there is a very low correlation between discount rates in different domains. However, Hardisty and Weber (2009) argue that differences across domains (financial and environmental) are not as significant as differences across costs and benefits.

While there is evidence to suggest that discount rates differ over valence and over domain, there is a debate as to which of these differences is the most relevant. Hardisty and Weber (2009) compared individuals' choices between hypothetical financial, environmental and health gains and losses occurring immediately, or with a delay from a few days to a maximum of 10 years. They concluded that 'valence is a more salient contextual feature than domain' (Hardisty and Weber 2009 p 339). Correlations within valence (across domains) were stronger than those within domains (across valence). They argued that to predict health losses, it would be more helpful to know how individuals discount monetary losses or environmental losses than to know how individuals discount health gains. They concluded that discount rates for costs and benefits in one domain are relevant when predicting discount rates in other domains.

2.2 Why is there Evidence of Different Time Preferences?

Behavioural economics has identified many predictable forms of 'anomalous behaviour'. One important anomaly (described in prospect theory) is likely to be relevant when focusing on the *sign effect* (i.e. the difference between the discount rate for gains and the discount rate for losses). This anomaly is that individuals are very susceptible to *loss aversion*. Individuals are so susceptible to loss aversion that, in prospect theory (Kahneman and Tversky 1979), the value function is approximately twice as steep in 'losses' as it is in 'gains'.

With this anomaly, there is also evidence of *temporal loss aversion*. Individuals display *temporal loss aversion* when their perception of the interval preceding a loss is shorter than the interval preceding a gain, and when this difference arises as a consequence of individual's susceptibility to the 'end point' (Bilgin and Le Bouef 2010). In experiments, the interval that precedes a loss appears shorter than the interval that precedes a gain. For example, Wilkinson and Klaes (2012 p 274) suggest that, if there was an interval before an individual moved to a city to take up a new job, the interval for a person not looking forward to the new job would '…appear shorter than it would for the person looking forward to the move.' With *loss aversion*, the subjective size of the effect of the move is greater (losses attract more attention than gains) and the individual's perception of the interval is shorter. As a consequence, the individual will rely on a lower discount rate.

Another explanation has drawn on the concept of *anticipatory utility* (Loewenstein 1987). Individuals experience anticipatory disutility if they 'dread' future costs. In this case, they prefer to get costs 'out of the way' as soon as possible and they do not discount future costs very heavily. Harris (2012) explores how feelings of dread affect intertemporal choice, finding that anticipation of dread plays an important role in many individuals' choices about

the timing of adverse choices. Individuals also derive *anticipatory utility* if they savour future outcomes (e.g. the pleasurable anticipation of a vacation). In this example they might apply negative discount rates (Lowenstein 1987).

Behavioural insights are also relevant when turning to differences across domains. As individuals rely on different *mental accounts* (to make decisions), they are also likely to rely on different discount rates to assess losses and gains in different mental accounts (i.e. in different domains). There is also the observation that the form in which losses are experienced is relevant. 'Out-of-pocket' monetary costs are more relevant than equivalent opportunity costs (Thaler 1980), with the former being more heavily weighted. This implies that individuals are likely to have different time preferences when they focus on monetary (tradable) goods than when they focus on non-monetary (non-tradeable) goods, thus resulting in higher discount rates for the former[6]. In the Harris (2012) study, most participants preferred to postpone monetary and property losses, but sometimes chose to experience non-monetary adverse events sooner than later (the evidence is consistent with the argument that intangibles seem different to people).

Goodin (1982) argues that individuals rely on different discount rates in different domains because they find it difficult to attach monetary values to non-tradables. He argued that it is difficult to translate non-tradable goods into a monetary equivalent and it is necessary to rely on a *restricted form* of opportunity cost discounting. In this *restricted form*, changes in non-tradables are compared with future changes in the same good. For example, a 'tree life' is compared to 'tree lives' in the future[7].

With these explanations (of valence and domain), are differences in intrinsic motivation also likely to be relevant?

2.3 Is Intrinsic Motivation Relevant?

In this paper, for the first time (to our knowledge), the proposition is that intrinsic motivation is relevant. If individuals derive intrinsic value from action, are they likely to be even more 'impatient for action'?

Hardisty *et al* (2012) argue that higher discount rates for benefits than for costs is consistent with *present bias*[8]. Hardisty *et al* (*ibid* pp 348-349) argue that the received theory is the 'theory of fixed cost present bias'. The evidence suggests that '…satisfying this present bias appears to be worth $4 to people regardless of the size of the outcome under consideration'. The authors explore the impact of *magnitude effects*. With the expectation that '…impatience weighs much more heavily (in relative terms) when outcomes are small than when outcomes are large…', they compare the extent to which individuals discount large gains and large losses. While their study focuses on *magnitude effects*, here the focus is on the way intrinsic motivation influences *present bias*.

If individuals derive intrinsic value from action as well as value from a preferred outcome, total benefits are likely to be higher. However, the question is how might intrinsic motivation affect the *sign effect* (valence) and reported differences in discount rates across domain.

An established literature has indicated that changes in 'goal gradient' (an increase in individuals' perception that they are making progress achieving a goal) will increase individuals' motivation to pursue a goal (Hull 1932, 1934). The parallel (with intrinsic motivation) is that the more individuals believe they derive intrinsic value completing a goal, the more they are motivated to pursue a goal. If changes in 'goal gradient' are relevant, how will they influence the discount rate?

Urminsky and Goswami (2015 p 75) shed insight into '…the timing of task achievement and the timing of receiving the associated income…'. If an individual's motivation to pursue a goal increases the closer the individual gets to completion of a goal, it will appear to be the case that the individual is relying on a higher discount rate to assess the benefits of this investment. In a study that focused on preferences for different lottery tickets, for example, Urminsky and Goswami (*ibid* p 75) reported that subjects had a preference for lotteries that involved a shorter time to achieve the goal (i.e., a shorter time to the prize draw), even when the time involved in receiving the prize remained constant. If follows that '…estimating a traditional time discounting model…ignores the timing of goal outcomes… (and)…yield(s) an overly impatient estimate of the…time discounting factor.' The same conclusion was drawn when looking at preference in other studies (e.g., students preferred a shorter deadline to complete a specified project even when the time taken to receive any benefit remained constant).

Just as Urminsky and Goswami (*ibid* p 76) concluded that '…estimated discount rates are inflated when not separately accounting for goal gradient effects', so it follows that individuals' time discount rates will be higher when not separately accounting for intrinsic motivation. The higher the perception of the intrinsic value of action, the greater the motivation to pursue a goal and the higher the discount rate that an individual appears to employ to assess the benefits derived from the investment. The higher this discount rate, the greater the *sign effect*.

Turning to domain, it is also important to note that individuals with intrinsic motivation are usually more motivated by actions that yield non-monetary gifts and non-monetary rewards, than by monetary gifts and monetary rewards (Frey 1997). With this observation, an increase in intrinsic motivation to conserve the environment is likely to increase the difference between discount rates for benefits in different domains. However, this increase is particularly likely to

increase differences between the discount rate for non-monetary benefits in an environmental domain and monetary benefits in a financial domain.

It is also important to note the distinction that exists when behaviours are influenced by different neural systems (e.g., Loewenstein and O' Donoghue 2007). The first is the *deliberative* system. In this system, options are assessed with reference to the consequences of action. The second is the *affective (or emotional)* system. In this system, behaviour is more likely to be influenced by emotions (e.g., anger, fear). Following Frederick (2003), ethical considerations are relevant when assessing outcomes (e.g., social justice and responsibility towards future generations) and these are likely to be transmitted via the *deliberative* system (affecting perceptions of the consequences of action). Ethical considerations that influence perceptions of the intrinsic value of action are more likely to influence *affect-based preferences* and, as such, are more likely to make individuals 'impatient'. Loewenstein and O' Donoghue (2007 p 1) refer to these preferences as requiring action 'in the heat of the moment'[9].

To test the proposition that intrinsic motivation is relevant when gauging *present bias*, the intrinsic value that individuals derive from the act of protecting the environment will be measured with reference to individuals' environmental morale. In a recent study (Barile *et al* 2015), environmental morale was estimated with reference to individuals' responses to a set of questions. Individuals were asked to indicate how often (from 1 = never, to 5 = always) they took specific 'green' actions (such as save water, recycle, turn off lights, and walk, cycle or take public transport) for environmental reasons. Responses to these questions were aggregated to form an index ranging from 4 to 20. With evidence of such wide-ranging concern across so many actions, individuals with high environment morale are more likely to derive intrinsic value from action and to reveal *affect-based preferences*. The proposition is that individuals with high environmental morale will be more impatient for investment in the environment[10].

3. Testing Predictions: An Analysis of Questionnaire Responses

Here the task is to describe the questionnaire study employed to test predictions and to analyse questionnaire responses.

3.1 The Methodology

A questionnaire (reproduced in Appendix A of the paper) was designed to assess whether both valence and domain are relevant. Participants were undergraduate students of economics. While reliance on students as a data source is sometimes criticised, in this study it has positive attributes. Questionnaires were completed by students enrolled on economics taught-units (first, second and third year economics students) at the University of Bath (United Kingdom).

After a brief introduction to the study, participants were instructed that the survey was anonymous and that there were no 'right' or 'wrong' answers. After receiving a printed version of the questionnaire, students were asked to complete the survey on their own and without consulting their colleagues. The time taken to hand out the questionnaires, to complete them and to collect them again was approximately 20 minutes. In all, 450 questionnaires were collected. Data from 8 participants were excluded. Among them, 3 did not complete the study, 2 switched to the titration items back and forth more than once, and following the Hardisty-Weber response criteria, the other 3 questionnaires were dropped if respondents preferred more losses or fewer gains – i.e., preferring £10,000 immediately to £18,000 ten years from now, yet also finding it equally attractive to receive £15,000 ten years from now to £10,000 immediately. The sample was 39% female and 61% male. About 60% of respondents were first year

economics students, 18% were second year students and the remaining 22% were third year students.

The questionnaire survey was inspired by the Hardisty and Weber (2009) paper. All participants responded to six scenarios: two monetary scenarios, two environmental scenarios, and two health (life affecting) scenarios. Each domain (i.e., monetary, environmental and health) included one gain and one loss scenario. As in previous studies (e.g., Hardisty and Weber 2009; Frederick 2003), choices were made comparing an immediate option *versus* another one with a 10 years-time delay. In the monetary scenarios (one gain, one loss), respondents were asked to imagine winning (having taken) a lottery (loan) of £10,000. They had either the option of receiving (paying) the amount of money immediately or with 10 years-time delay. Using a *titration* procedure, they then answered 10 binary choice questions, where they had to express their preferences over receiving/paying £10,000 immediately or 'X' pounds at a 10-year delay. For this, and all other *titration* procedures, the scale used for the binary alternatives ranged from 1.8 to 0.9 of the present value (e.g. £18,000 to £9,000)[11], and was presented in ascending order from the smallest to the largest alternative.

Discount rates were obtained with reference to a single indifference point (where respondents switched from preferring the future option to preferring the present one). In case the *titration* procedure failed to account for a switching point, single indifference points were derived from a free-response question (that followed the *titration* procedure), where they were asked to fill in the number that would have made two different options (e.g. receiving £10,000 immediately vs. receiving £_____ 10 years from now) equally attractive to them.

In the environmental scenario, participants were asked to imagine their country's government was planning to implement a programme to reduce (increase) urban deforestation. The

government was considering whether to implement the programme immediately with a gain (loss) of 100 trees or in 10 years-time with a different gain (loss) of 'X' trees.

Finally, respondents were presented with hypothetical health scenarios (one gain, one loss). Here participants were asked to imagine their country's government was planning to implement a programme to decrease (increase) life mortality. The government was considering whether to implement the programme immediately with a gain (loss) of 100 lives, or in 10 years-time with a different gain (loss) of 'X' lives. Again, *titration* and free-response items were offered. For all scenarios presented in the questionnaire, the timescale considered was longer than that usually taken into account in similar analyses (where it ranges from a few weeks to a year). This allows a more realistic timescale where environmental outcomes are concerned. As suggested by Hardisty and Weber (2009), environmental benefits and costs are, in fact, not realized for many years and this might influence individuals' time preferences.

All participants provided demographic information (i.e., gender, and year of degree programme), as well as specific information on how often (from 1=never, to 5=always) they take particular 'green' actions for environmental reasons (such as saving water, recycling, turning off lights, and walking, cycling or taking public transport). Answers to these questions were aggregated to infer the environmental morale index (Barile *et al* 2015; Berglund 2006), ranging between 4 and 20 (Cronbach's Alpha $\cong$ 0.6).

3.2 Discussion of Results

The *titration* methodology and the free-response measures used in the survey made it possible to compute a single indifference point for each scenario. For comparisons with previous analyses (see Hardisty and Weber 2009), mean discount parameters were obtained rearranging the hyperbolic discounting formula as follows:

$$r = (FV/PV - 1)/D \quad (1)$$

where r is the discount rate, PV represents the present value of future outcomes (FV), and D the delay (in units of time (years)). The simplicity of this method makes it generally attractive.

Many studies support the notion that people discount future outcomes following hyperbolic discounting –i.e., people prefer a smaller-sooner reward over a larger-later reward as the delay occurs sooner rather than later in time (see, e.g., Thaler 1981; Harris and Laibson 2001; Loewenstein *et al* 2003). A discount rate equal to zero means that the present and future are valued equally. A positive value of r means that people prefer to receive gains immediately and postpone losses to the future. A negative value of r means that people prefer to postpone gains and experience losses now.

(i) Valence and Domain

The first objective is to consider whether the differences across valence and across domains are statistically significant. Mean discount parameters for each of the six hypothetical scenarios are presented in Figure 1, below. In Figure 1, vertical distances between discount rates for gains and for losses indicate valence effects, horizontal distances indicate differences in domain. Paired-samples *t*-tests within domain (across valence) and within valence (across domain) are fully reported in Appendix B.

In general, participants discounted monetary gains ($M = 0.14$, $SD = 0.22$) more than losses ($M = 0.04$, $SD = 0.09$), a significant difference, $t(441) = 9.8$, $p < 0.001$, corresponding to a moderate effect size ($d = 0.59$). Thus, participants indicated that getting £10,000 now was equivalent to getting £24,000 in 10 years, whereas losing £10,000 now was roughly equivalent to losing £14,000 in 10 years.

[Insert Figures 1 here]

Similarly, participants discounted tree gains (M = 0.18, SD =0.29) significantly more than losses (M = 0.05, SD = 0.19; $t(441) = 8.9$, $p < 0.001$, $d = 0.51$). Explicitly, respondents stated that they would prefer to save 277 trees in 10 years' time to 100 trees today, but would prefer to lose only 154 trees in 10 years' time to an immediate loss of 100 trees. Moreover, results show that there is a significant difference ($t(441) = 7.01$, $p < 0.001$, $d = 0.35$) in the way participants discounted human life gains (M = 0.13, SD = 0.28) and losses (M = 0.05, SD = 0.18), with gains discounted once again more than losses. Specifically, respondents revealed that saving 231 lives in 10 years' time was preferable to saving 100 lives today, though only a loss of 148 lives in 10 years' time was preferable to an immediate loss of 100 lives.

It is interesting to note that, unlike results reported by Hardisty and Weber (2009), there is also a significant difference in the way respondents discounted environmental gains versus monetary ($t(441) = 2.11$, $p < 0.05$) and health gains ($t(441) = 3.02$, $p < 0.01$). Although not predicted[12], tree gains were discounted significantly more than monetary and health gains; though the strength of the difference is relatively small in size (i.e., effect sizes range respectively from $d = 0.1$ to $d = 0.2$). By contrast, discount rates within valence (across domain) were never statistically significantly different for losses.

A 2 (valence: gains vs. losses) × 3 (domain: monetary vs. environmental vs. health) repeated-measures analysis of variance (ANOVA) confirms that (mean) discount rates differ statistically significantly across valence ($F(1, 441) = 155.1$, $p < 0.001$, $\eta^2_p = 0.26$), and domain ($F(2, 882) = 3.9$, $p < 0.05$, $\eta^2_p = 0.01$). According to Hardisty and Weber (2009), the effect of valence is stronger than that of domain: the partial eta squared, η^2_p, indicates that about 26% of the variation in (mean) discounting is due to the effect of valence, against 1% explained by domain differences. However, results show that there is also a statistically significant

interaction (although small in magnitude) between valence and domain ($F(2, 882) = 3.3$, $p < 0.05$, $\eta^2_p = 0.01$), thus suggesting that the differences in valence depend upon the differences in domain[13].

To compare these results with the results of previous analyses (e.g., Gattig and Hendrickx 2007; Hardisty and Weber 2009), the proportion of zero and negative discounting in each domain was computed. Only a few individuals (see proportions in parentheses) exhibited zero or negative discounting for monetary (0.02), environmental (0.06), and health (0.09) gains, whereas a larger proportion of individuals displayed zero or negative discounting for monetary (0.25), environmental (0.51), and health (0.59) losses. The magnitude of the proportions indicates stronger differences between the environmental/health scenarios than the monetary scenario. Indeed, zero and negative discounting occurred more often in response to the environmental and health affecting outcomes than the monetary outcomes ($p < 0.01$), and occurred more often for health outcomes than for environmental outcomes ($p < 0.05$). However, differences between proportions were less (significantly) marked for environmental and human-life affecting outcomes. Unlike results reported in Hardisty and Weber (2009), the difference between proportions is not only highly significant within valence (across domain, *ps* < 0.001), but also within domain (across valence, *ps* < 0.05 or better).

While the results in this paper provide evidence of a *sign effect*, in line with previous analyses (see, for example, Chapman 1996b; Chapman *et al* 1999; Tsukayama and Duckworth 2010), discounting also seems to be domain dependent. To further investigate this finding, the correlation within domain (across valence) and within valence (across domain) was also computed (see Table B.3 in Appendix B). Pearson correlations reveal that discounting of monetary gains is significantly correlated with tree gains and human-life gains, and discounting of monetary losses is significantly correlated with discounting of tree losses and human life losses. Likewise, discounting of tree gains is significantly correlated with discounting of

human-life gains, and tree losses are significantly correlated with human-life losses. Within-domain correlations also appear to be statistically significant, thus supporting the conclusion that, both at the individual level and averaged across individuals, discounting is influenced not only by the valence of outcomes, but also by domain differences. Specifically, within domain correlations are stronger (than within-valence correlations) in the monetary and health scenarios. This means, for example, that knowing how much an individual discounts monetary gains tells us more about how much that respondent valued monetary losses, compared to how much respondents valued environmental and health gains. In contrast to the Hardisty and Weber (2009) finding quoted above, here domain appears as a more salient contextual feature than valence.

It is also interesting to note that within valence correlations are stronger for the non-monetary environmental and health affecting scenarios. This means that knowing how much an individual discounted environmental gains (losses) reveals how much they valued health gains (losses), more than how respondents valued monetary gains (losses). Again, results show that differences between discounting were less marked between environmental and health affecting outcomes.

Furthermore, when removing zero and negative discount rates from the analysis, the *sign effect* remains highly significant ($F(1, 93) = 16.9$, $p < 0.001$, $\eta^2_p = 0.15$), the domain effect approaches significance ($F(2, 186) = 2.9$, $p = 0.053$, $\eta^2_p = 0.03$), while the interaction becomes insignificant ($F(2, 186) = 0.8$, $p > 0.1$). In particular, the effect of excluding respondents with zero or negative discounting from the analysis was to reduce the difference between discounting environmental and health affecting outcomes, which becomes statistically insignificant ($p > 0.1$), while maintaining significant the difference in discounting environmental and monetary outcomes ($p < 0.05$)[14].

(ii) Differences in 'impatience for action'

The second objective of our analysis is to consider whether those with high environmental morale are more 'impatient for action' than those with low environmental morale. To this end, the sample was split between respondents with high environmental morale and low environmental morale as follows. Initially, the index of environmental morale was grouped in three different categories, one for low environmental morale (index score < 12), one for medium environmental morale (index score = 12), and one for high environmental morale (index score > 12)[15]. About 11% of respondents (i.e., 48) exhibited low environmental morale, 6% showed medium environmental morale (i.e., 27), while the majority of participants, 83% (i.e., 367), displayed high environmental morale. With only a small sample size of respondents with medium environmental morale, their responses are included in the responses of respondents with high environmental morale[16].

Figure 2 reports mean discount rates for each scenario of the questionnaire, but this time they are conditioned upon low (see panel a) of Figure 2) and high (see panel b) of Figure 2) environmental morale. As before, vertical distances between discount rates for gains and for losses indicate valence effects. Horizontal distances indicate domain effects for the two sub-samples. Figure 2 shows that differences between high and low environmental morale seem to be relevant. Generally, the difference between the discount rate for gains and for losses is greater when there is high environmental morale than when there is low environmental morale. Perhaps predictably this effect is most pronounced for the 'environmental scenario'. Those with high environmental morale are more 'impatient' for investment in the environment than those with low environmental morale[17]. Paired-samples *t*-tests within domain (across valence)

and within valence (across domain) for both sub-samples or respondents are fully reported in Appendix B.

[Insert Figures 2 here]

Before focussing directly on *present bias*, it is helpful to consider whether there is a substantial difference in the way individuals discount environment outcomes with respect to other domains. Considering the sub-set of individuals with high/medium environmental morale (see Figure 2, panel b)), paired-samples *t*-tests reveal that respondents discounted gains more than losses in all domains ($p < 0.001$ for each pair comparison within domain (across valence)). Again, environmental gains were discounted significantly more than monetary and health gains, with a stronger effect resulting from the comparison between environmental and health gains ($p < 0.01$). In contrast, although monetary losses were discounted slightly less than environmental and health losses, there are no significant differences between mean discount parameters within valence (across domain) ($p > 0.1$)[18].

A different pattern of preferences is found amongst the sub-set who exhibited low environmental morale (see Figure 2, panel a)). Again, paired-samples *t*-tests indicate that participants generally discounted monetary, environmental (only significant at 10%) and health gains more than losses. However, even though environmental gains were discounted more than monetary and health saving gains (not statistically significant, $p > 0.1$), there is a stronger effect when comparing environmental and monetary gains. Furthermore, low environmental morale led individuals to discount environmental losses markedly (though not statistically significantly, $p > 0.1$) more than monetary and health losses.

Figure 2 reports subjective discount rates over valence and domain. When intrinsic motivation is relevant, individuals have a psychological desire to receive gains and losses

immediately. In the case of gains, individuals have a preference for benefits immediately (because their perception of the intrinsic value of action depends on the interval over which their action is relevant). According to Hardisty *et al* 2012, alongside other considerations that suggest that there is *present bias*[19], the greater the intrinsic value of action the greater the 'impatience for action' (as compared to the psychological tendency to get costs 'out of the way'). *Present bias* is evident the higher the discount rate for benefits and the lower the discount rate for costs. 'In the case of gains people want the gain immediately…(and)… the resulting discount rate is high…In the case of losses, people want to get the loss over with immediately …(and) … the resulting discount rate is low' (*ibid* p 350). When referring to the results that have already been presented, it is greater the greater the difference between discount rates for benefits and discount rates for costs.

The question is whether 'impatience for action' (defined as the vertical distance between mean discount parameters across valence) is statistically different when high/medium environmental morale individuals consider investment in the environment and when low environmental morale individuals consider investment in the environment. Focusing on environmental outcomes, the difference between discount rates across valence is significantly more marked among those who exhibited high environmental morale (*difference* = 12.8%; $t(366) = 8.8$, $p < 0.001$, $d = 0.55$) than for those with low environmental morale (*difference* = 8.2%; $t(47) = 1.9$, $p < 0.1$, $d = 0.27$)[20], and it is considerably higher and significantly stronger for investment in the environment than for financial and life investments. Indeed, Cohen's *d* reveals that the difference in discount rates is stronger for those with high environmental morale, indicating that the discount rates for environmental gains are nearly 0.55 standard deviations greater relative to the discount rates for losses among those with high environmental morale[21]. Therefore, it appears that the evidence is also consistent with the proposition that high environmental morale is associated with a more *affective-based* response. The evidence

is consistent with the proposition that, other things equal, the more individuals derive intrinsic value from action the more they are 'impatient for action'.

4. Conclusions

The first objective in this paper was to explore the different discount rates that individuals reveal over valence and over domain. The evidence reported in this paper indicates that individuals rely on different discount rates across valence *and* across different domains. Differences across valence were relevant and there were also differences across financial, environmental (trees) and health (life-affecting) domains. Discount rates were much higher for gains than for losses, and differences across valence were slightly different in different domains. The result that individuals rely on different discount rates is consistent with results reported in other papers, but the analysis in this paper also makes a contribution when it focuses on the relative importance of domain and valence. While Hardisty and Weber (2009) argued that valence is more important than domain, the evidence in this paper is that domain is a more salient contextual feature than valence.

The second (more novel) objective was to question whether individuals are likely to employ a higher discount rate for the benefits of investment if they also derive intrinsic value from *action*. The analysis focused on the relevance of perceptions of intrinsic value derived from actions that conserve the environment. Will intrinsic motivation increase the *sign effect* (valence)? And will intrinsic motivation increase differences between the discount rate for benefits from investment in the environment and the discount rate for benefits from investment in financial assets (domain) – the environment versus money?

With evidence that individuals rely on higher discount rates for benefits and lower discount rates for losses, Hardisty *et al* (2012) argue that this is consistent with *present bias*.

Hardisty *et al* (*ibid*) consider the impact of *magnitude effects* on *present bias* but, in this paper, the argument is that intrinsic motivation is likely to increase *present bias* (by increasing the *sign effect*). If the perception of intrinsic value from action increases individuals' motivation to pursue their goal, the greater the perception of intrinsic value the greater the discount rate employed to assess benefits derived from investment. The second argument is that, if this observation is likely to influence differences in discount rates across domains, it is likely to be particularly relevant when comparing the non-monetary benefits derived from investment in the environment and the monetary benefits derived from financial investments.

With reference to a received indicator of intrinsic motivation, the evidence in this paper is that differences between discount rates across valence are significantly higher for individuals with measured high/medium environmental morale than for individuals with measured low environmental morale. The evidence is consistent with the argument that intrinsic motivation is one dimension of time preference.

Cost-benefit analysis already faces the question of how to respond to evidence that individuals rely on more than one discount rate. Is it appropriate to continue to rely on one discount rate and to discount exponentially? While some argue that the appropriate discount rate is the rate that a 'rational' individual (free of cognitive bias) would rely on, others argue that, in any assessment of individuals' welfare, it is not appropriate to rely on a rate of discount that is at odds with individuals' stated time preferences[22]. Robinson and Hammitt (2011 p 25) argue that '…in choosing a discount rate or set of rates, as well as a functional form…analysts must be clear about what, conceptually, they intend to represent for review by decision makers.'

The conclusions in this paper are also relevant for other questions. Intrinsic motivation might be relevant when assessing welfare changes contingent on government intervention (e.g. Frey 1997; Jones *at al* 1998). The impact of government projects is often greater (lower) than

anticipated when they enhance (demean) individuals' perceptions of the intrinsic value of action. In this paper it is also the case that *present bias* for government intervention might be greater (lesser) depending on the extent to which government intervention will increase (decrease) intrinsic value derived from action.

More generally, if individuals derive intrinsic value when they express identity, to themselves and/or to others, (Brennan and Lomaksy 1993), they are also likely to be more motivated to pursue the goals they choose to express identity. The more that their welfare depends on *affect-based preferences*, the more difficult it is to wait. The more they derive intrinsic value when expressing a 'green' identity, the more they are 'impatient for action' to conserve the environment.

In all of this, it is important to acknowledge the qualifications that accompany these conclusions. The analysis does not control for a number of potentially confounding factors (the order of the questions, the scale of the titration procedure, inclusion of adults into the sample population, and the use of different scenarios) and this might affect the robustness of the results. The unbalanced nature of sample sizes limits the extent to which further statistical analysis is possible. The questionnaire focused on economics students, comfortable with the concept of discounting. As analysis depends on student response, it is also difficult to allow for full effect of differences in socio/economic/demographic variables (e.g. differences in age, finance, occupation and marital status). Having said this, Alm and Jacobson (2007 p 143), with reference to results reported by Plott (2007), note: '…there is no reason to believe that the cognitive processes of students are different from those of "real" people'.

Here the overarching conclusions are: (i) intrinsic motivation over action is relevant when explaining established differences in discount rates across valence and across domain, and (ii) the more individuals derive intrinsic value from action the more they are susceptible to

present bias. When individuals derive intrinsic value from action… *if it's worth doing, it's worth doing now!*

Endnotes

[2] While governments have usually relied on a single discount rate, there are a few examples of willingness to rely on more than one discount rate (Henderson and Bateman 1995).

[3] With evidence that tax morale (the intrinsic value of reporting income for taxation honestly) is relevant when explaining why individuals are more willing to report income for taxation more honestly than anticipated (e.g. Torgler 2005), will environmental morale prove relevant when anticipating the urgency with which individuals require investment in the environment? Will intrinsic motivation be a determinant of time preference?

[4] In this paper there are three domains where respondents make choices over 'financial', 'environmental' and 'health' gains and losses. Just as the term 'financial' is used in our research to describe time preferences over monetary outcomes, the terms 'environmental' and 'health' are used respectively as a shorthand to describe choices related to tree affecting outcomes (e.g., tree-saving), and life affecting outcomes (e.g., life-saving).

[5] Some studies focus on the *sequence* of health and monetary outcomes. Guyse *et al* (2002) compare environmental outcomes (i.e. water and air quality) with preferences for *sequences* of health and monetary outcomes in short (5-years) and long (50 years) time horizons. They found that participants prefer constant or increasing sequences for water and air quality improvement (as well as health outcomes), and decreasing sequences for monetary gains, suggesting higher discounting for monetary payoffs. However, like Bohm and Pfister's research (2005), Guyse *et al* (*ibid*) do not control for other confounding factors, such as the valence of the outcomes that can generate possible gain/loss asymmetries observed in the monetary domain. In addition,

Bhom and Pfister's study presents scenarios that referred to losses imposed on others, which may bias respondents' perception of the tasks and therefore their conclusions.

[6] In Kahneman and Tversky (1979), the shape of the value function implies that if 'out-of-pocket' costs are viewed as losses and opportunity costs are viewed as foregone gains, the former will be more heavily weighted.

[7] Goodin (1982) also suggested that individuals are likely to report negative discount rates (attaching more weight to future consumption) when the stock of non-tradables is depleting. For further discussion of theoretical research see Krantz and Kunreuther (2007).

[8] See O'Donoghue and Rabin (2015) for a recent discussion.

[9] Individuals are more impatient the more they are tempted to call for immediate action. Tsukayama and Duckworth (2010 p 72) define temptation as 'the visceral attraction to and enjoyment of a reward, regardless of the associated harm'.

[10] Of course, following Tsukayama and Duckworth (2010), it might also be the case that those with higher environmental morale will also be more 'impatient for action' that will improve the environment than for action that will improve monetary and health outcomes.

[11] This scale adopted here is slightly different from that used in Hardisty and Weber (2009) that ranges roughly from 1.6 to 0.9. In order to prevent confusion among respondents, integer numbers changing by steps of £1,000 (100 for environmental and health scenarios) were preferred to a scale changing by steps of £100 (or 10).

[12] Previous theories and findings (e.g., Böhm and Pfister 2005; Gattig and Hendrickx 2007) suggest that discount rates should be lower for environmental outcomes. Of course, the previous literature generally did not explore environmental gains (rather, they focussed on losses).

[13] Note that the sample size used in this study is much bigger than those used in the Hardisty & Weber (2009) paper, which may explain cases where that paper found non-significant results.

[14] Estimated (marginal) means within domains were 0.12 (*SD* = 0.015), 0.19 (*SD* = 0.026), and 0.18 (*SD* = 0.031), respectively for the monetary, environmental and health scenarios.

[15] By dichotomizing the environmental morale scores at a different point (e.g., the median 15) part of the information about respondents was lost (i.e., part of the respondents who stated they undertook pro-environmental behaviours at a medium, or higher, level was bunched into the group of those who were never or rarely contributing to pro-environmental activities). Therefore, according to previous analyses (see e.g. Tsukayama and Duckworth 2010), it was decided to identify the splitting point at the mid-point of the scale (i.e., 12) as, from a theoretical point of view, this represents the middle response (i.e., the sum of the mid-point category - 3 = sometimes - of each single item forming the environmental morale index).

[16] This not only allowed us to control for problems related to departure from normality (thus providing more robust results); but also helped us to make a clear-cut point between low environmental morale (i.e., those who stated they never, or rarely, undertook pro-environmental behaviour for environmental reasons), and high/medium environmental morale (i.e., those who stated they sometimes, often, or always, undertook environmentally-friendly behaviours for environmental reasons).

[17] In Figure 2 the discount rate for gains is higher for respondents with low environmental morale than for those with high environmental morale, but this difference is not statistically significant ($t(440) = 0.906$, $p > 0.1$). In this paper 'impatience' depends on the difference in the *sign effect* (Frederick, Loewenstein and O'Donoghue 2002) for high and for low environmental morale individuals.

[18] These results remain robust even when restricting the analysis to the sub-set of individuals with high environmental morale.

[19] The other considerations include uncertainty and the opportunity cost of investment (returns are required earlier, rather than later, because they can be invested elsewhere).

[20] The Pearson's correlation coefficient within discount rates (across valence) is respectively 0.50 and 0.26 ($ps < 0.001$) for those with low environmental morale and those with high environmental morale.

[21] Although Cohen's *d* seems to be stronger for monetary outcomes (*d* = 0.61 *versus d* = 0.55 for environmental investments – see Table B.1 in Appendix B), this might be related to the fact that zero discounting occurred more often in response to the environmental outcomes than the monetary outcomes, thus slightly lowering the effect size in the environmental domain. In fact, Person's correlation coefficients between discount rates are 0.31, 0.26, and 0.41, (*ps* < 0.001) respectively for monetary, environmental and life affecting outcomes. This suggests that differences in discount rates for gains and losses are more marked for environmental outcomes.

[22] Sugden (2005) argues that shadow prices should be based on preferences expressed in markets.

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APPENDIX A

QUESTIONNAIRE

University of Bath
Individuals' time preferences

The purpose of this questionnaire is to gather information on individuals' time preferences. The questionnaire is divided into two different sections. In 'SECTION 1' you are requested to answer questions about hypothetical scenarios regarding time preferences in different contexts. In 'SECTION 2' you are asked to provide general information about yourself and to state your opinion on particular issues.

In the questionnaire you will find questions with the following format:

For each pair of values, please select the answer that best reflects your personal preferences.

A.	✓	50 apples	or		45 apples
B.		50 apples	or		50 apples
C.		50 apples	or		55 apples
D.		50 apples	or		60 apples
E.		50 apples	or		65 apples
F.		50 apples	or		70 apples

For these questions you are supposed to tick only ONE box for each pair of values, i.e.:

A.	✓	50 apples	or		45 apples
B.	✓	50 apples	or		50 apples
C.		50 apples	or	✓	55 apples
D.		50 apples	or	✓	60 apples
E.		50 apples	or	✓	65 apples
F.		50 apples	or	✓	70 apples

To answer all the other questions, please tick ONE of the boxes next to the answer(s); or, when appropriate, write your answer in the space provided.

I would be very grateful for your contribution to this study. All responses will remain anonymous. Thank you for your help.

SECTION 1

Q1) Imagine you won a lottery, worth £10,000. You have the option of either receiving the amount of money immediately or receiving a different amount of money "X" 10 years from now. Would you prefer to receive £10,000 immediately or "X" pounds 10 years from now?

For each pair of values, please select the answer that best reflects your personal preferences.

A.		£10,000 immediately	or		£9,000 10 years from now
B.		£10,000 immediately	or		£10,000 10 years from now
C.		£10,000 immediately	or		£11,000 10 years from now
D.		£10,000 immediately	or		£12,000 10 years from now
E.		£10,000 immediately	or		£13,000 10 years from now
F.		£10,000 immediately	or		£14,000 10 years from now
G.		£10,000 immediately	or		£15,000 10 years from now
H.		£10,000 immediately	or		£16,000 10 years from now
I.		£10,000 immediately	or		£17,000 10 years from now
J.		£10,000 immediately	or		£18,000 10 years from now

Please fill in the number that would make the following two options equally attractive to you:

A. Receiving £10,000 immediately.
B. Receiving £_____ 10 years from now.

Q2) Imagine you have taken a loan of £10,000. You have the option of either repaying the amount of money immediately or delaying your payment by returning a different amount of money "X" 10 years from now. Would you prefer to pay £10,000 immediately or "X" pounds 10 years from now?

For each pair of values, please select the answer that best reflects your personal preferences.

A.		£10,000 immediately	or		£9,000 10 years from now
B.		£10,000 immediately	or		£10,000 10 years from now
C.		£10,000 immediately	or		£11,000 10 years from now
D.		£10,000 immediately	or		£12,000 10 years from now
E.		£10,000 immediately	or		£13,000 10 years from now
F.		£10,000 immediately	or		£14,000 10 years from now
G.		£10,000 immediately	or		£15,000 10 years from now
H.		£10,000 immediately	or		£16,000 10 years from now
I.		£10,000 immediately	or		£17,000 10 years from now
J.		£10,000 immediately	or		£18,000 10 years from now

Please fill in the number that would make the following two options equally attractive to you:

A. Paying £10,000 immediately.
B. Paying £_____ 10 years from now.

Q3) Imagine your country's government is planning to implement a programme to reduce urban deforestation. In addition to abating air and water pollution; trees absorb carbon dioxide, which contributes to climate change. The government is considering whether to implement the programme immediately to save 100 trees, or 10 years from now to save a different number "X" of trees. Would you prefer to save 100 trees immediately or "X" trees 10 years in the future?

For each pair of values, please select the answer that best reflects your personal preferences.

A.		100 trees immediately	or		90 trees 10 years from now
B.		100 trees immediately	or		100 trees 10 years from now
C.		100 trees immediately	or		110 trees 10 years from now
D.		100 trees immediately	or		120 trees 10 years from now
E.		100 trees immediately	or		130 trees 10 years from now
F.		100 trees immediately	or		140 trees 10 years from now
G.		100 trees immediately	or		150 trees 10 years from now
H.		100 trees immediately	or		160 trees 10 years from now
I.		100 trees immediately	or		170 trees 10 years from now
J.		100 trees immediately	or		180 trees 10 years from now

Please fill in the number that would make the following two options equally attractive to you:

A. Saving 100 trees immediately.
B. Saving _____ trees 10 years from now.

Q4) Imagine your country's government wants to ameliorate public transport by implementing the construction of new railways, highways and subways. This will certainly favour connections but will also contribute to an increase of urban deforestation. The government is considering whether to implement the programme immediately with a loss of 100 trees or 10 years from now for a different loss of "X" trees. Would you prefer to lose 100 trees immediately, or "X" trees 10 years in the future?

For each pair of values, please select the answer that best reflects your personal preferences.

A.		100 trees immediately	or		90 trees 10 years from now
B.		100 trees immediately	or		100 trees 10 years from now
C.		100 trees immediately	or		110 trees 10 years from now
D.		100 trees immediately	or		120 trees 10 years from now
E.		100 trees immediately	or		130 trees 10 years from now
F.		100 trees immediately	or		140 trees 10 years from now
G.		100 trees immediately	or		150 trees 10 years from now
H.		100 trees immediately	or		160 trees 10 years from now
I.		100 trees immediately	or		170 trees 10 years from now
J.		100 trees immediately	or		180 trees 10 years from now

Please fill in the number that would make the following two options equally unattractive to you:

A. Losing 100 trees immediately.

B. Losing _____ trees 10 years from now.

Q5) Imagine your country's government is planning to implement a programme to reduce population's mortality by providing high quality health care and promoting healthy lifestyles. The government is considering whether to implement the programme immediately to save 100 lives or 10 years from now to save a different number "X" of lives. Would you prefer to save a certain 100 lives immediately or a certain "X" lives 10 years in the future?

For each pair of values, please select the answer that best reflects your personal preferences.

A.		100 lives immediately	or		90 lives 10 years from now
B.		100 lives immediately	or		100 lives 10 years from now
C.		100 lives immediately	or		110 lives 10 years from now
D.		100 lives immediately	or		120 lives 10 years from now
E.		100 lives immediately	or		130 lives 10 years from now
F.		100 lives immediately	or		140 lives 10 years from now
G.		100 lives immediately	or		150 lives 10 years from now
H.		100 lives immediately	or		160 lives 10 years from now
I.		100 lives immediately	or		170 lives 10 years from now
J.		100 lives immediately	or		180 lives 10 years from now

Please fill in the number that would make the following two options equally attractive to you:

A. Saving 100 lives immediately.
B. Saving _____lives 10 years from now.

Q6) Imagine your country's government is planning to expand manufacturing industries. This will encourage economic growth but will also increase the population's exposure to pollution and the risk of cancer deaths. The government is considering whether to implement the programme immediately with a loss of 100 lives or 10 years from now for a different loss of "X" lives. Would you prefer to lose a certain 100 lives immediately or a certain "X" lives 10 years in the future?

For each pair of values, please select the answer that best reflects your personal preferences.

A.		100 lives immediately	or		90 lives 10 years from now
B.		100 lives immediately	or		100 lives 10 years from now
C.		100 lives immediately	or		110 lives 10 years from now
D.		100 lives immediately	or		120 lives 10 years from now
E.		100 lives immediately	or		130 lives 10 years from now
F.		100 lives immediately	or		140 lives 10 years from now
G.		100 lives immediately	or		150 lives 10 years from now
H.		100 lives immediately	or		160 lives 10 years from now

I.		100 lives immediately	or		170 lives 10 years from now
J.		100 lives immediately	or		180 lives 10 years from now

Please fill in the number that would make the following two options equally attractive to you:

A. Losing 100 lives immediately.
B. Losing _____lives 10 years from now.

SECTION 2

Q7) Gender:

Male…….....
....
Female…….....
...

Q8) Year of Degree Programme:

First…….....
....
Second……
…..
Third……
….

Q9) Please indicate how often you take each action for environmental reasons:

a) Save water when taking a shower or brushing your teeth:

Never……....
...
Rarely……
…...
Sometimes……
...
Often……
…
Always……
….

b) Recycle:

Never……....
...
Rarely……
…...

Sometimes…… ☐
Often…… ☐
Always…… ☐

c) Turn off lights you are not using:

Never…….... ☐
Rarely…… ☐
Sometimes…… ☐
Often…… ☐
Always…… ☐

d) Walk, cycle or take public transport:

Never…….... ☐
Rarely…… ☐
Sometimes…… ☐
Often…… ☐
Always…… ☐

Thank for taking the time to complete this questionnaire!

APPENDIX B

Table B.1: Paired-samples t-tests within domains (across valence)

	***t*-test; Effect Size (*d*)**	**Monetary (gains/losses)**	**Environment (gains/losses)**	**Health (gains/losses)**
Full	***t***	9.87	8.95	7.01
	***p*-value**	0.000***	0.000***	0.000***
	d	0.59	0.51	0.35
High EM	***t***	9.54	8.82	6.33
	***p*-value**	0.000***	0.000***	0.000***
	d	0.61	0.55	0.35
Low EM	***t***	2.85	1.92	3.04
	***p*-value**	0.006***	0.061*	0.004***
	d	0.54	0.27	0.40

Notes: *** significant at the 1% level, * significant at 10%. Full = full sample of respondents. High EM = sub-sample of respondents with high/medium environmental morale (EM). Low EM = sub-sample of respondents with low environmental morale (EM).

Table B.2: Paired-Samples t-tests within valence (across domain)

	***t*-test; Effect Size (*d*)**	**Monetary vs. Environment**	**Monetary vs. Environment**	**Monetary vs. Health**	**Monetary vs. Health**	**Environment vs. Health**	**Environment vs. Health**
		gains	*losses*	*gains*	*losses*	*gains*	*losses*
Full	***t***	2.11	1.24	0.94	0.53	3.02	0.67
	***p*-value**	0.035**	0.216	0.346	0.596	0.003***	0.498
	d	0.12	0.07	0.06	0.03	0.16	0.03
High EM	***t***	1.99	0.65	1.16	0.64	3.23	0.036
	***p*-value**	0.047**	0.511	0.246	0.520	0.001***	0.971
	d	0.12	0.04	0.07	0.04	0.47	0.00
Low EM	***t***	0.72	1.25	0.22	0.13	0.20	1.55
	***p*-value**	0.471	0.214	0.823	0.890	0.840	0.127
	d	0.08	0.25	0.04	0.02	0.03	0.23

Notes: *** significant at the 1% level, ** significant at the 5% level. Full = full sample of respondents. High EM = sub-sample of respondents with high/medium environmental morale (EM). Low EM = sub-sample of respondents with low environmental morale (EM).

Table B.3: Pearson correlations of discount parameters

Outcome	£+	£-	Trees+	Trees-	Human Lives+	Human Lives-
£+	-					
£-	0.28***	-				
Trees+	0.25***	0.11**	-			
Trees-	0.08	0.22***	0.31***	-		
Human Lives+	0.21***	0.19**	0.35***	0.28***	-	
Human Lives-	0.20***	0.22***	0.18***	0.43***	0.47***	-

Notes: *** significant at the 1% level, ** significant at the 5% level.

Figure 1: Mean discount parameters for monetary, environmental, and health affecting gains and losses. Error bars are ± SE (Standard Errors).

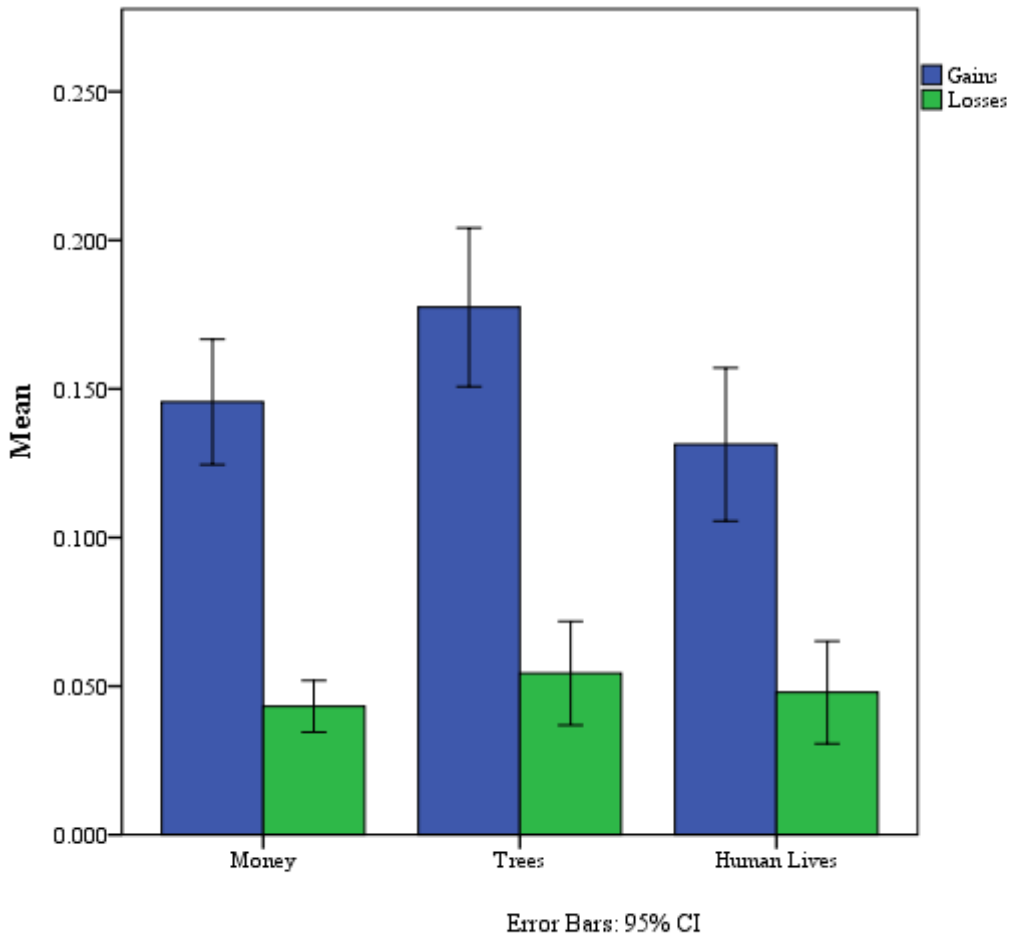

Figure 2: Mean discount parameters for monetary, environmental, and health affecting gains and losses. Error bars are ± SE (Standard Errors). Panel a) reports data for respondents with low environmental morale (Low EM), and panel b) refers to respondents with high/medium environmental morale (High EM).