Nijmegen School of Management
Department of Economics and Business Economics
Master's Thesis Economics (MAN-MTHEC)

An empirical analysis of ESG and time preferences

By Kim Otte (s4702794)

Nijmegen, 28 June 2023

Program: Master's Program in Economics
Specialisation: Financial Economics
Supervisor: Dr. J. T. G. Goossens

Radboud Universiteit

Abstract

This paper empirically analyses the relation between ESG preferences and time preferences. The theory suggests that people with a low time preferences, thus who are more patient, have higher ESG preferences. This relation is tested by data from the DHS survey and the LISS panel. The analysis is divided into two parts, the analysis that looks at the DHS data set and the analysis that looks at the LISS panel data set. The analysis of the DHS data set focuses on the environmental part of the investor's ESG preferences in relation with the time preferences. The analysis of the LISS panel data set focuses on the social and governmental part of the investor's ESG preferences in relation with the time preferences. This paper shows a significant negative relation between Environmental preferences and time preferences. This relation only holds for green investments, and it was not seen regarding green savings. There was no significant relation between Social and Governmental preferences and time preferences.

Table of Contents

1 Introduction

Participation in sustainable investing can be a time consuming and costly matter for firms. There is a possibility that the investment will only pay off in the long-, and not in the short-term. Hence, it is important to know if sustainable investments will scare off impatient investors. It is evenly important to know if investors with high environmental, social, and governmental (ESG) preferences are also more patient, thus that they are willing to wait for the investment to pay off.

One of the most common propositions in literature is that a reduction in the rate of time preferences increases the equilibrium stock of a regeneratable resource. In other words, if people are more patient, the amount of stocks in regeneratable resources (ESG resources) will increase (Musu, 1994; Newell & Siikamäki, 2015; Pearce & Turner, 1989).

However, this proposition has not been researched empirically, yet. This paper will try to test the relation between ESG and time preferences empirically on a micro level. Leading to the following research question: *Is there a relation between ESG preferences and time preferences of investors?*

This paper has the following structure: first a summary of the relevant literature. The first subject that will be explained in the literature is the ESG preferences and how these can be measured. Next, the time preferences will be explained and how these can be measured. Then, the literature combining ESG and time preferences will be explained, leading to the hypotheses and the expected model to describe the relation between ESG and time preferences. Hereafter, the data and the analysis are described, followed by the analysis itself. To end this paper, a conclusion and discussion will be provided.

2 Literature review

The literature review will consist of three parts. First the literature about ESG preferences will be reviewed. Hereafter the literature about time preferences will be reviewed. To end the literature review, the literature about both ESG preferences and time preferences will be reviewed, leading to the hypotheses of this research.

2.1 ESG preferences

There is a difference between a traditional investor and an ESG investor. Traditional mean-variance investors mainly focus on the financial payoff of the investment, while ESG investors value both the financial and ESG payoffs (Chen & Xie, 2022). Some literature claims that ESG investors mainly look at the ESG scores available (Cao, Titman, Zhan, & Zhang, 2022). There is a wide variety in ESG scores, which do not always agree with each other. The main dimension that they disagree on is the environmental dimension. This can be a problem when using ESG scores for research, because this environmental dimension is thought to have a positive relation with stock prices (Gibson Brandon, Krueger, & Schmidt, 2021).

The effect of ESG ratings on the firm's performance has been researched extensively. The first main effect that is shown in research, is that investors are willing to pay more for greener firms (thus with a high ESG rating), which results in a lower cost of capital (Pastor, Stambaugh, & Taylor, 2021). The other side of this, is the lower expected returns for investors. Pastor et al. (2021) provides an explanation that investors enjoy holding high ESG-rated assets, in particular green assets, because of the hedging of the climate risk. Climate risk is higher when you invest in 'brown' assets, because of possible new government regulations that penalize the brown firms. The social impact of ESG investors is also considered in this research. Research has shown that ESG investors can lead to greener firms and it can trigger more real investments by green firms (Cornell, 2021; Pastor et al., 2021).

How to measure the ESG preferences?

Previous literature has looked at stocks with high rated ESG scores and stocks without this score to measure the ESG preference (Cao et al., 2022). This research will focus more on the dimensions contained by the ESG scores, the Environmental, Social, and Governmental dimensions. Environmental preferences can be measured by green savings and investments. Governmental and social preferences can be measured by political preferences, in other words if someone is a democrat (left winged) or a republican (right winged). A democrat has generally high ESG preferences, republicans have generally low ESG preferences (Blomqvist & Stradi, 2022).

2.2 Time preferences

The following definition for time preference will be used in this research: 'The preference for immediate utility over delayed utility'. Time preferences can be defined by a few determinants, such as the time discount rate but also by measuring impulsivity and the financial time horizon. A higher rate of time discounting, being more present biased and a high time preference all mean that someone prefers their utility now and is thus less patient. Our definition captures all these determinants (Frederick, Loewenstein, & O'Donoghue, 2002; Hurwitz & Sade, 2019; Khwaja, Silverman, & Sloan, 2007; Laibson, 1997).

There have been different models in the literature that deal with time discounting, such as the exponential discounted utility model and the hyperbolic discounting model.

The exponential discounted utility model yields the following intertemporal utility:

$$U_t(C_t, \dots, C_T) = \sum_{k=0}^{T-t} D(k)u(C_{t+k})$$

Where $D(k) = (\frac{1}{1+\rho})^k = \delta^k$

EQUATION 1. EXPONENTIAL DISCOUNTED UTILITY

D(k) is the discount function, with ρ as the discount rate, also called someone's pure rate of time preference. T describes the planning horizon, *t* is the current time and $u(C_{t+k})$ denotes the utility of consuming *C* at time *t+k*.

This exponential discounted utility model assumes a constant discount rate, and thus constant discounting. Empirical research has shown that individuals do not have a constant discount rate, but they have a declining rate of time preference, thus the discount rate decreases (Laibson, 1997). This is shown in the hyperbolic discounting model.

$$D(k) = \begin{cases} 1 \; if \; k = 0 \\ \beta\delta^k \; if \; k > 0 \end{cases}$$

EQUATION 2. HYPERBOLIC DISCOUNTING MODEL

The β describes the impulsivity of an investor, i.e., the present bias factor.

How to measure time preferences?

A way to measure someone's time discounting is asking for their patience and how willing they are to give up something now that is beneficial in the future.

But there are also other factors that can portray the time preference of an individual or can help form that preference.

One of those factors is smoking. Smoking does not necessarily indicate a high exponential discount rate. But it does show a high impulsivity and a low planning horizon and ideas such as dual selves (the future you is not the same person as you now), thus it does show a high hyperbolic discount rate (Hurwitz & Sade, 2019; Khwaja et al., 2007). Also factors such as paying your bill on time, flossing your teeth consistently, being on time for meetings, saving money and having unpaid credit-card balances are good estimators for the hyperbolic discount rate (Frederick et al., 2002).

To measure the time preferences, this paper will focus on people's spending and saving preferences as well as if they have smoked.

2.3 ESG and time preferences

There have been some studies on the relation between time preferences and sustainability. Musu (1994) studied the effect of time preferences on the stock of capital and on the stock of environment. He found that a decrease in time preference causes an increase in both the stock of capital equilibrium and the stock of environment equilibrium, if the environmental improvement is higher than the emission coefficient. From this he concludes that a decrease in time preferences can cause an increase in environmentally friendly stocks. Newell and Siikamäki (2015) examined the role of discount rates on energy efficiency decisions. They find that discount rates are heterogeneous and a systematical influence on the willingness to pay for an energy efficient decision. Faccioli et al (2016) studied the time sensitivity of social preferences under environmental time-persistent effects. They found that preferences concerning sustainability issues are time insensitive, individuals show insignificant differences in preferences for benefits they can experience within their own lifetimes compared to those which occur in the longer term (Faccioli, Hanley, Torres, & Font, 2016).

This leads to the expectation that there is a negative relation between ESG preferences and time preferences of an investor, meaning that people that are more impatient have less ESG preferences. Thus, we hypothesise the following:

H0: There is no relation between the ESG preferences and the time preference of the investor.

Ha1: There is a negative relation between the ESG preferences and the time preference of the investor.

The ESG preferences will be measured by questions about people's green savings and green investments as well as their political preferences. The time preferences will be measured by the saving and spending behaviour as well as if they have ever smoked.

The first step to show the relation between the time and the ESG preferences, is by investigating the relation between the discount function and the ESG preference. This can be shown by the following formula, where D_{it} describes the discount function, ESG_{it} describes the ESG preference, X_{it} describes the control variables and ε_{it} the error term of investor i at time t.

$$D_{it} = a + b * ESG_{it} + c * X_{it} + \varepsilon_{it}$$

EQUATION 3. MODEL FOR TIME DISCOUNTING AND ESG PREFERENCES

This formula will be empirically tested, to see if there is a significant relation. The null hypothesis will expect b to not differ from zero, and the alternative hypothesis expect b to differ significantly from zero.

The end goal of this research question is to get a discounting model that includes the relation with the ESG preferences.

3 Methodology

3.1 Data

The data used in this research is obtained from the DHS survey and the LISS panel. The DHS survey data will be used to describe the relation between the Environmental preferences of the ESG preferences and time preferences of investors, while the LISS panel data will be used to describe the relation between Social and Governmental preferences of the ESG preferences and time preferences of investors.

The DHS (De Nederlandsche Bank Household Survey) is a panel data survey of the Dutch central bank where Dutch households are asked to participate yearly. This survey contains questions about a variety of themes, including household information, income, and psychological questions. The LISS (Longitudinal Internet studies for the Social Sciences) panel is a panel data survey with around 7500 members from 5000 households who answer different surveys every month. The surveys contain questions about a variety of topics, including health, politics, values, and their economic situation.

The following questions are used from the DHS survey:

- Time preferences:

  Some people spend all their income immediately. Others save some money in order to have something to fall back on. Please indicate what you do with money that remains after having paid for food, rent, and other necessities, where 1 means 'I spend all my money immediately' and 7 means 'I save as much as possible'.

- Environmental preferences (Green savings):

  Were green savings or deposit accounts part of your savings or deposit accounts? Yes/No

- Environmental preferences (Green investments):

  Were green investments part of your investments in mutual funds? Yes/No

The data of DHS for these questions is available from 2017 until 2022. The DHS data will be used to analyze the relation between the Environmental preferences of an investor and time preferences.

The data from the LISS panel will contain the same years as the DHS data, thus from 2017 until 2022. The LISS panel data will be used to explain the relation between the Social and Governmental preferences of an investor and the time preferences. This will be captured by the following questions:

- Time preferences (smoked):

  Have you ever smoked (even if it was long ago)? Yes/No
- Social and Governmental preferences (Politics):

  If parliamentary elections were held today, for which party would you vote?

The political parties are divided into three sections, left, centre and right winged. The left winged, also called the Democrats are the following Dutch parties: SP, GroenLinks, PvdA, BIJ1, DENK and Partij voor de Dieren. The parties in the centre are: ChristenUnie, 50PLUS, D66 and Volt. The right winged, also called Republicans are: VVD, Forum voor Democratie, CDA, PVV, SGP, JA21 and BBB (Bonjour, 2013; "Politieke partijen," n.d.).

3.2 Analysis

Both the DHS survey and the LISS panel are panel data, which entails that it contains an individual that is measured repeatedly over time, consisting of multiple variables. Because of this, a 'normal' OLS regression will not be used. The Breusch-Pagan Lagrange Multiplier Test will show if a pooled OLS regression will be a good fit for the data or that a Fixed or Random Effects model is the best option. If the test shows that a pooled OLS regression is not the best fit, the Hausman test will be used to see if the Fixed or Random Effects model is the best fit. The Hausman test will check if there is a correlation between the unique errors and the variables in the model. In the null hypothesis the preferred model is the Random Effects model, the alternative hypothesis is that the preferred model is the Fixed Effects model. A Random Effects model, or a variance components model, is a model that takes into account the fact that some factors affecting the outcome may randomly vary across individuals. A Fixed Effects model, also called the diff-in-diff model, assumes that the independent variable has a fixed or constant relation with the dependent variable across all observations (Clark & Linzer, 2015; Date, 2022; Wooldridge, 2020).

If the Fixed Effects model is the best fit, than the Pesaran CD test will be used to check for cross sectional dependency (Wooldridge, 2020).

In all cases, the Augmented Dickey-Fuller test will be used to check if the unit root is present in the time series, thus to check if there is a case of stationarity. If there is a case of stationarity, a robust standard error will be used. Literature has shown that the best standard error to use in this situation, is the heteroscedasticity-consistent standard error 3 (HC3) (Long & Ervin, 2000; Wooldridge, 2020).

As a robustness check, the OLS regression with time fixed effects will also be done. This will be done to check if the separate years have a significant effect on the time preferences, and if this thus needs to be taken into account.

The analysis will consist of two parts, since both data sets will be analyzed separately. Both data sets have unique numbers assigned to each household member, by which we can compare them over time within the same data set. These unique numbers are not the same in the both data sets, so there is no one-to-one comparison possible between the DHS data and the LISS panel data.

Based on previous literature, the following demographics are used as control variables: age (birthyear, since it is a panel data over time), gender, amount of children, education (highest level of education attended) and if the participant has a partner (Dohmen et al., 2011; Norrgren, 2023; Padilla, 2012).

4 Analysis

The analysis is divided into two parts, the analysis that looks at the DHS data set and the analysis that looks at the LISS panel data set. The analysis of the DHS data set focuses on the environmental part of the investor's ESG preferences in relation with the time preferences, reflected in the spending preferences of the investor. The analysis of the LISS panel data set focuses on the social and governmental part of the investor's ESG preferences in relation with the time preferences, reflected in the smoking habit of the investor.

4.1 DHS Analysis

There are 1141 respondents that answered the questions about their Environmental preferences, time preferences and the control variables for the years 2017 until 2022, which leads to a total amount of 6846 responses that are taken into account in this analysis. Of these respondents, 654 are men and 487 are women. The birthyears range between 1925 and 2000. The number of children that they have range between 0 to 6 children. 2040 responses indicate that they have no partner, 4806 times they do have a partner. The highest level of education attended of the respondents range from primary education to university education. The summary statistics of these control variables can be found in table 1. The gender of the participant is the only control variable that is consistent over the 6 years and are therefore divided by the 6 years, the rest of the variables can fluctuate over time and are therefore not divided by 6.

Variable	Answer	N (%)
Gender	Male	654 (57.3%)
	Female	487 (42.7%)
Number of children	0	5142 (75.1%)
	1	690 (10.1%)
	2	768 (11.2%)
	3	204 (3.0%)
	4	18 (0.3%)
	5	6 (0.1%)
	6	18 (0.3%)
Partner	No	2040 (29.8%)
	Yes	4806 (70.2%)

Education level	Primary education	36 (0.5%)
	Special education	6 (0.1%)
	Pre-vocational education (VMBO)	1560 (22.8%)
	Pre-university education (HAVO/VWO)	594 (8.7%)
	Senior vocational training or training through apprentice system (MBO)	1728 (25.2%)
	Vocational colleges (HBO)	1854 (27.1%)
	University education (WO)	1068 (15.6%)

TABLE 1. SUMMARY STATISTICS CONTROL VARIABLES DHS. *SOURCE: AUTHOR CALCULATIONS*

Variable / Question	Answers	N (%)
Environmental preferences (No green savings) Were green savings or deposit accounts part of your savings or deposit accounts?		
	1 (yes)	235 (3.4 %)
	2 (no)	6611 (96.6%)
Environmental preferences (No green investments) Were green investments part of your investments in mutual funds?		
	1 (yes)	180 (2.6%)
	2 (no)	6666 (97.4%)
Time preferences Some people spend all their income immediately. Others save some money in order to have something to fall back on. Please indicate what you do with money that remains after having paid for food, rent, and other necessities, where 1 means ‘I spend all my money immediately’ and 7 means ‘ I save as much as possible’.		
	1	46 (0.7%)
	2	114 (1.7%)
	3	250 (3.7%)
	4	1111 (16.2%)
	5	2277 (33.3%)
	6	2083 (30.4%)
	7	965 (14.1%)

TABLE 2. SUMMARY STATISTICS DHS ANALYSIS. *SOURCE: AUTHOR CALCULATIONS*

Table 2 shows the summary statistics of the Environmental preferences questions and the time preferences question of the DHS data set. In the Environmental preferences questions, it shows that the majority of the respondents does not have green savings and/or green investments (96.6% and 97.4%).

In the analysis regarding Environmental preferences and time preferences of participants, equation 3 is taken into account where the ESG preferences are represented by the Environmental preferences. The time preferences are represented by the question about the spending and/or savings preferences.

A pooled OLS regression for this relation shows the following results:

	Coefficients (Std. error)	Coefficients (Std. error)
Constant	25.2298008*** (2.0066)	25.1927028*** (2.0035)
Environmental preferences (No green savings)	-0.2084317** (0.0769)	
Environmental preferences (No green investments)		-0.3224194*** (0.0878)
Birthyear	-0.0100173*** (0.0010)	-0.0098827*** (0.0010)
Gender	0.0403990 (0.0290)	0.0438138 (0.0290)
Number of children	0.0339124 . (0.0174)	0.0364743* (0.0174)
Education level	-0.0087037 (0.0102)	-0.0099503 (0.0102)
Partner	0.0986958** (0.0321)	0.0984856** (0.0321)
R^2	0.019422	0.020301
Adjusted R^2	0.018562	0.019442
Number of observations	6846	6846

'***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

TABLE 3. POOLED OLS REGRESSION ENVIRONMENTAL PREFERENCES AND TIME PREFERENCES. *SOURCE: AUTHOR CALCULATIONS*

This pooled OLS regression in table 3 shows that if someone has no green savings and/or green investments, so the lower their ESG preference, the more time preference they have, thus the more impatient they are, since they are inclined to spend their money immediately. This effect is significant. However, not all the control variables are significant, only the birthyear, number of children and the presence of a partner. This indicated that the older you are, if you have more children and if you have a partner, the less time preference you have, thus the more patient they are. This is in line with the literature (Dohmen et al., 2011; Norrgren, 2023; Padilla, 2012). The R-squared is quite low, indicating that the fit of the model is not great. However, the Breusch-Pagan Lagrange Multiplier Test is significant, indicating that a pooled OLS regression cannot be used. The Hausman test is not significant, indicating that a Random Effects model is the right model for this data. As a robustness check, the OLS regression with time fixed effects has also been done. This can be found in Appendix B, table B.1. This test showed that the separate years do not have a significant effect on the time preferences, which is why this has not been taken into account in this analysis besides using a Random Effects model. This Random Effects model already keeps the effect of the passing of time in their mind.

	Coefficients (Std. error)	Coefficients (Std. error)
Constant	24.9721063*** (3.8387)	25.0771000*** (3.8370)
Environmental preferences (No green savings)	-0.0468836 (0.0717)	
Environmental preferences (No green investments)		-0.1962356* (0.0892)
Birthyear	-0.0100529*** (0.0020)	-0.0099533*** (0.0020)
Gender	0.0415868 (0.0556)	0.0430772 (0.0556)
Number of children	0.0338462 (0.0334)	0.0354382 (0.0334)
Education level	-0.0069463 (0.0195)	-0.0085751 (0.0195)
Partner	0.0978645 (0.0616)	0.0981481 (0.0616)
R^2	0.0051401	0.0057804
Adjusted R^2	0.0042673	0.0049081
Number of observations	6846	6846

'***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

TABLE 4. RANDOM EFFECTS MODEL ENVIRONMENTAL PREFERENCES AND TIME PREFERENCES. *SOURCE: AUTHOR CALCULATIONS*

The Random Effects model in table 4 shows that if someone has no green investments, so the lower their ESG preference, the more time preference they have, since they are inclined to spend their money immediately. This effect is weakly significant. The Environmental preferences considering green savings however, did not show a significant effect. Also, not all the control variables are significant, only the birthyear. This indicates that the older you are the less time preference you have. The R-squared is quite low, indicating that the fit of the model is not great.

The augmented Dickey-Fuller test shows that this is a stationary data set. Furthermore, the Breusch-Pagan test shows that there is heteroscedasticity. To account for this, a robust standard error is used. Literature has shown that the best standard error to use in this situation, is the heteroscedasticity-consistent standard error 3 (HC3) (Long & Ervin, 2000).

	Coefficients (Std. error)	Coefficients (Std. error)
Constant	24.9721063*** (3.6846)	25.0771000*** (3.6802)
Environmental preferences (No green savings)	-0.0468836 (0.0939)	
Environmental preferences (No green investments)		-0.1962356* (0.0775)
Birthyear	-0.0100529*** (0.0019)	-0.0099533*** (0.0019)
Gender	0.0415868 (0.0563)	0.0430772 (0.0562)
Number of children	0.0338462 (0.0339)	0.0354382 (0.0339)
Education level	-0.0069463 (0.0190)	-0.0085751 (0.0189)
Partner	0.0978645 (0.0647)	0.0981481 (0.0646)
R^2	0.0051401	0.0057804
Adjusted R^2	0.0042673	0.0049081
Number of observations	6846	6846

'***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

TABLE 5. RANDOM EFFECTS MODEL ENVIRONMENTAL PREFERENCES AND TIME PREFERENCES INCLUDING HC3. *SOURCE: AUTHOR CALCULATIONS*

Table 5 shows that the coefficients of the Random Effects model remain the same when the HC3 is used, but the standard errors did increase. This model merely shows a significant relation between the time preferences and Environmental preferences considering green investments and the birthyear, but does not show a significant relationship between the time preferences and the Environmental preferences considering green saving or the other control variables.

4.2 LISS Panel analysis

There are 956 respondents that answered the questions about their Social and Governmental preferences and time preferences, as well as the control variables for the years 2017 until 2022, which leads to a total amount of 5736 responses that are taken into account in this analysis. Of these respondents, 514 are men and 442 are women. The birthyears range between 1926 and 2000. The number of children that they have range between 0 to 6 children. 1518 times the respondents indicate that they do not have a partner, 4218 times they indicate that they do have a partner. The highest level of education attended of the respondents range from primary education to university education. The summary statistics of these control variables can be found in table 6. The gender of the participant is the only control variable that is consistent over the 6 years and are therefore divided by the 6 years, the rest of the variables can fluctuate over time and are therefore not divided by 6.

Variable	Answer	N (%)
Gender	Male	514 (53.77%)
	Female	442 (46.23%)
Number of children	0	4191 (73.06%)
	1	621 (10.82%)
	2	638 (11.12%)
	3	228 (3.97%)
	4	49 (0.85%)
	5	7 (0.12%)
	6	2 (0.03%)
Partner	No	1518 (26.5%)
	Yes	4218 (73.5%)
Education level	Primary education	126 (2.2%)
	Pre-vocational education (VMBO)	1205 (21.0%)
	Pre-university education (HAVO/VWO)	394 (6.9%)
	Senior vocational training or training through apprentice system (MBO)	1383 (24.1%)
	Vocational colleges (HBO)	1696 (29.6%)
	University education (WO)	932 (16.2%)

TABLE 6. SUMMARY STATISTICS CONTROL VARIABLES LISS PANEL. *SOURCE: AUTHOR CALCULATIONS*

Variable / Question	Answers	N (%)
Time preferences (smoked): Have you ever smoked (even if it was long ago)?		
	1 (yes)	3400 (59.3%)
	2 (no)	2336 (40.7%)
Social and Governmental preferences (Politics) If parliamentary elections were held today, for which party would you vote?		
	0 (Left/Democrats)	1831 (31.9%)
	1 (Middle)	1182 (20.6%)
	2 (Right/Republicans)	2723 (47.5%)

TABLE 7. SUMMARY STATISTICS LISS PANEL ANALYSIS. *SOURCE: AUTHOR CALCULATIONS*

Table 7 shows the summary statistics of the Social and Governmental preferences questions and the time preferences question of the LISS panel data set. The majority of the respondents (47.5%) would vote for a right winged party if elections were held today. Also, 59.3% of the respondents indicate that they have ever smoked.

In the analysis regarding Social and Governmental preferences and time preferences of participants, equation 3 is taken into account where the ESG preferences are represented by the Social and Governmental preferences. The time preferences are represented by the question if they have ever smoked.

A pooled OLS regression for this relation shows the following results:

	Coefficients (Std. error)
Constant	-11.451*** (0.9428)
Social and Governmental preferences (Politics)	0.0079855 (0.0080)
Birthyear	0.0064584*** (0.0005)
Gender	0.10699*** (0.0127)
Number of children	0.050099*** (0.0077)
Education level	0.0091721* (0.0046)
Partner	-0.029802* (0.0145)
R^2	0.080014
Adjusted R^2	0.079051
Number of observations	5736

'***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

TABLE 8. POOLED OLS REGRESSION SOCIAL AND GOVERNMENTAL PREFERENCES AND TIME PREFERENCES. *SOURCE: AUTHOR CALCULATIONS*

The pooled OLS regression in table 8 shows that the more political right winged someone is, so the lower their ESG preference, the less time preference they have. This effect however is not significant. The control variables are however significant, indicating that the younger you are, if you are a female, if you have more children, the higher education level and if you do not have a partner, the less time preference you have, so they are more patient. The R-squared is quite low, indicating that the fit of the model is not great. The relation that the younger you are, the less time preferences you have, is in contradiction with previous literature, that showed that the older you are, you have less time preferences (Dohmen et al., 2011; Norrgren, 2023; Padilla, 2012).

But the Breusch-Pagan Lagrange Multiplier Test is significant, indicating that a pooled OLS regression cannot be used. The Hausman test is not significant, indicating that a Random Effects model is the right model for this data. As a robustness check, the OLS regression with time fixed effects has also been done. This can be found in Appendix B, table B.2. This test shows that the separate years do not have a significant effect on the time preferences, which is why this has not been taken into account in this analysis besides using a Random Effects model. This Random Effects model already keeps the effect of the passing of time in their mind.

	Coefficients (Std. error)
Constant	-9.83450974*** (1.4886)
Social and Governmental preferences (Politics)	0.00365554 (0.0037)
Birthyear	0.00563636 *** (0.0007)
Gender	0.09943969*** (0.0201)
Number of children	0.05479416*** (0.0118)
Education level	0.01348560. (0.0072)
Partner	-0.04437825. (0.0229)
R^2	0.1959
Adjusted R^2	0.19506
Number of observations	5736

‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1

TABLE 9. RANDOM EFFECTS MODEL SOCIAL AND GOVERNMENTAL PREFERENCES AND TIME PREFERENCES. *SOURCE: AUTHOR CALCULATIONS*

This Random Effects model in table 9 shows no significant relation between the Social and Governmental preferences and time preferences. The control variables are however still significant, indicating that the younger you are, if you are a female, if you have more children, the higher education level and if you do not have a partner, the less time preference you have. The R-squared increased in comparison to the pooled OLS regression, indicating that the fit of the Random Effects model is better than the pooled OLS regression.

The augmented Dickey-Fuller test shows that this is a stationary data set. Furthermore, the Breusch-Pagan test shows that there is heteroscedasticity. To account for this, a robust standard error is used. Literature has shown that the best standard error to use in this situation, is the heteroscedasticity-consistent standard error 3 (HC3) (Long & Ervin, 2000).

	Coefficients (Std. error)
Constant	-9.83450974*** (1.4960)
Social and Governmental preferences (Politics)	0.00365554 (0.0047)
Birthyear	0.00563636 *** (0.0008)
Gender	0.09943969*** (0.0202)
Number of children	0.05479416*** (0.0123)
Education level	0.01348560· (0.0072)
Partner	-0.04437825· (0.0231)
R^2	0.1959
Adjusted R^2	0.19506
Number of observations	5736

‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1

TABLE 10. RANDOM EFFECTS MODEL SOCIAL AND GOVERNMENTAL PREFERENCES AND TIME PREFERENCES INCLUDING HC3. *SOURCE: AUTHOR CALCULATIONS*

Table 10 shows that the coefficients of the Random Effects model remain the same when the HC3 is used, but the standard errors did increase. This model still does not show a significant relation between the time preferences and the Social and Governmental preferences, but does show a significant relationship between the time preferences and the control variables.

5 Conclusion & Discussion

This paper analyses the relation between time preferences and ESG preferences. The analysis was divided into two parts, first the relation between time preferences and Environmental preferences, hereafter the relation between time preferences and Social and Governmental preferences.

The analysis of the Environmental preferences, showed that if someone has higher Environmental preferences, they have lower time preferences, and are thus more patient. This relation only holds for green investments, and it was not seen regarding green savings.

The analysis of Social and Governmental preferences did not show a significant relation between these preferences and time preferences, represented by their political preference and if they have smoked.

This paper shows that investors are willing to wait longer for their green investments to pay off, which has implications for policymakers in firms. They should take into account that a longer pay-off time will not have a discouraging effect on investors. Investors are willing to wait in return for a greener investment.

This paper leaves room for future research. Given that this paper only focuses on the Environmental preferences and Social and Governmental preferences separately, one may wonder about the possibility of combining these preferences into complete ESG preferences. Validated questionnaires are needed to be able to combine all the preferences into the ESG preferences and study the relation between those preferences and time preferences, which may lead to more accurate results.

In addition, this paper only takes 6 years into account, since green investments and savings is a relative new subject, leading to only 6 years of data. Further research could look at a longer time span, by which the data sets will also increase, leading to more accurate results. Something that is also caused by the relative new subject of green investments and savings, is that the amount of people that do have these investments and/or savings, is low. This led to a skewed result in the amount of people that answered those questions. Further research could look into questions that are not so skewed regarding the Environmental preferences.

6 Endnote

In this paper use is made of data of the DNB Household Survey administered by Centerdata (Tilburg University, The Netherlands).

In this paper we make use of data of the LISS (Longitudinal Internet studies for the Social Sciences) panel administered by Centerdata (Tilburg University, The Netherlands).

7 Bibliography

Blomqvist, A., & Stradi, F. (2022). Responsible investments: an analysis of preference–the influence of local political views on the return on ESG portfolios. *European Journal of Finance*. https://doi.org/10.1080/1351847X.2022.2137423

Bonjour, S. (2013). Governing diversity: Dutch political parties' preferences on the role of the state in civic integration policies. *Citizenship Studies*, *17*(6–7), 837–851. https://doi.org/10.1080/13621025.2013.834136

Cao, J., Titman, S., Zhan, X., & Zhang, W. (2022). ESG Preference, Institutional Trading, and Stock Return Patterns. *Journal of Financial and Quantitative Analysis*. https://doi.org/10.1017/S0022109022000916

Chen, Z., & Xie, G. (2022). ESG disclosure and financial performance: Moderating role of ESG investors. *International Review of Financial Analysis*, *83*. https://doi.org/10.1016/j.irfa.2022.102291

Clark, T. S., & Linzer, D. A. (2015). Should I Use Fixed or Random Effects? *Political Science Research and Methods*, *3*(2), 399–408. https://doi.org/10.1017/psrm.2014.32

Cornell, B. (2021). ESG preferences, risk and return. *European Financial Management*, *27*, 12–19. https://doi.org/10.1111/eufm.12295

Date, S. (2022). Understanding the Fixed Effects Regression Model. *Towards Data Science*. Retrieved from https://towardsdatascience.com/understanding-the-fixed-effects-regression-model-d2fccc2cc27e

Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J., & Wagner, G. G. (2011). Individual risk attitudes: Measurement, determinants, and behavioral consequences. *Journal of the European Economic Association*, *9*(3), 522–550. https://doi.org/10.1111/j.1542-4774.2011.01015.x

Faccioli, M., Hanley, N., Torres, C., & Font, A. R. (2016). Do we care about sustainability? An analysis of time sensitivity of social preferences under environmental time-persistent effects. *Journal of Environmental Management*, *177*, 356–364. https://doi.org/10.1016/j.jenvman.2016.03.039

Frederick, S., Loewenstein, G., & O'Donoghue, T. (2002). Time discounting and time preference:

A critical review. *Journal of Economic Literature*, *40*(2). https://doi.org/10.1257/002205102320161311

Gibson Brandon, R., Krueger, P., & Schmidt, P. S. (2021). ESG Rating Disagreement and Stock Returns. *Financial Analysts Journal*, *77*, 104–127. https://doi.org/10.1080/0015198X.2021.1963186

Hurwitz, A., & Sade, O. (2019). An investigation of time preferences, life expectancy, and annuity versus lump sum choices: Can smoking harm long-term saving decisions? *Journal of Economic Behavior and Organization*, *180*, 812–825. https://doi.org/10.1016/j.jebo.2019.05.011

Khwaja, A., Silverman, D., & Sloan, F. (2007). Time Preference, Time Discounting, and Smoking Decisions. *Journal of Health Economics*, *26*(5), 926–949.

Laibson, D. (1997). Golden Eggs and Hyperbolic Discounting. *The Quarterly Journal of Economics*, *112*(2), 443–477.

Long, J. S., & Ervin, L. H. (2000). Using Heteroscedasticity Consistent Standard Errors in the Linear Regression Model. *American Statistician*, *54*(3), 217–224. https://doi.org/10.1080/00031305.2000.10474549

Musu, I. (1994). Sustainable economy and time preference. *Structural Change and Economic Dynamics*, *5*(1), 81–86.

Newell, R. G., & Siikamäki, J. (2015). Individual Time Preferences and Energy Efficiency. *American Economic Review*, *105*(5), 196–200.

Norrgren, L. J. (2023). The highly educated live longer: The role of time preference, cognitive ability, and educational plans. *Health Economics*. https://doi.org/10.1002/hec.4688

Padilla, M. P. (2012). *Risk Aversion , Time Preferences and the Effects of Crime and Violence*.

Pastor, L., Stambaugh, R. F., & Taylor, L. A. (2021). Sustainable Investing in Equilibrium. *Journal of Financial Economics*. Retrieved from http://www.nber.org/papers/w26549

Pearce, D., & Turner, K. (1989). *Economics of Natural Resources and the Environment*.

Politieke partijen. (n.d.). Retrieved April 28, 2023, from Rijksuniversiteit Groningen website: https://www.rug.nl/research/dnpp/politieke-partijen/

Wooldridge, J. M. (2020). *Introductory econometrics: a modern approach* (6th ed.). Cencage

Learning.

8 Appendix A

DHS questions on ESG preferences:

GROENBEL1

Green investments are investments in funds that participate in projects for environmental protection. Such investments are subject to a special exemption on the capital gains tax. In addition, **green** investments give entitlement to an additional tax rebate.

Were **green** investments part of your investments in mutual funds?

1 yes..GROENBEL2
2 no..BZ13

DNB Household Survey 2021, March 2022 119

GROENSPA1

Several banks in the Netherlands offer **green** savings products. Banks then offer products in which the money is invested in **green** (sustainable) projects (with or without tax benefit).

Were **green** savings or deposit accounts part of your savings or deposit accounts on 31 December 2020?

Do not include investments in mutual funds here. These have already been reported.

1 yes..GROENSPA2
2 no..PERS1

DHS questions on time preference:

UITGEVEN

Some people spend all their income immediately. Others save some money in order to have something to fall back on.
Please indicate what you do with money that remains after having paid for food, rent, and other necessities, where 1 means 'I spend all my money immediately' and 7 means ' I save as much as possible'.

spend immediately						save as much as possible
1	2	3	4	5	6	7.............................PLANNEN

LISS panel data

Time preference questions

all respondents
ch21n125
The next few questions are about smoking and drinking.

Have you ever smoked (even if it was long ago)?

Answer type: Radio buttons
Categories:
1. yes
2. no

ESG preference questions

cv22n308
If parliamentary elections were held today, for which party would you vote?

Answer type: Radiobuttons
Categories:
1. [*if cv22n243=0*: I would not vote]
2. VVD (liberal party)
5. D66 (social-liberal party)

3. PVV (Wilders freedom party)
4. CDA (Christian democrat party)
7. SP (socialist party)
8. PvdA (labor party)
6. GroenLinks (green party)
14. Forum voor Democratie (Party for Democracy)
10. Partij voor de Dieren (animal welfare party)
9. ChristenUnie (Christian union party)
17. Volt Nederland
18. JA21 (Right Answer 2021)
12. SGP (Christian Reformed party)
13. DENK
11. 50PLUS (fifty plus party)
19. BBB (Farmer–Citizen Movement)
20. BIJ1
15. Blank
16. Other party
-9 I don't know
-8 I prefer not to say

9 Appendix B

	Coefficients (Std. error)	Coefficients (Std. error)
Constant	25.206284*** (2.0072)	25.171244*** (2.004)
Environmental preferences (Green savings)	-0.208459** (0.0770)	
Environmental preferences (Green investments)		-0.323241*** (0.0878)
Birthyear	-0.010017 *** (0.0010)	-0.009882*** (0.0010)
Gender	0.040399 (0.0290)	0.043819 (0.0290)
Number of children	0.033912· (0.0174)	0.036481* (0.0175)
Education level	-0.008704 (0.0102)	-0.009959 (0.0102)
Partner	0.098696** (0.0322)	0.098488** (0.0321)
2017	-0.001168 (0.0484)	-0.003762 (0.0483)
2018	0.028046 (0.0484)	0.027762 (0.0483)
2019	0.048606 (0.0484)	0.048460 (0.0483)
2020	0.013075 (0.0484)	0.009950 (0.0483)
2021	0.052805 (0.0484)	0.050859 (0.0483)
R^2	0.01976	0.02065
Adjusted R^2	0.01819	0.01908
Number of observations	6846	6846

TABLE B.1 OLS REGRESSION WITH TIME DUMMIES DHS DATA SET. *SOURCE: AUTHOR CALCULATIONS*

	Coefficients (Std. error)
Constant	-11.48*** (0.9433)
Social and Governmental preferences (Politics)	0.008154 (0.0072)
Birthyear	0.006467 *** (0.0005)
Gender	0.1073*** (0.0127)
Number of children	0.05023*** (0.0077)
Education level	0.009324* (0.0047)
Partner	-0.02938* (0.0145)
2017	0.03529 (0.0220)
2018	0.006538 (0.0215)
2019	0.02344 (0.0219)
2020	0.02244 (0.0220)
2021	0.007948 (0.0217)
R^2	0.08061
Adjusted R^2	0.07884
Number of observations	5736

TABLE B.2 OLS REGRESSION WITH TIME DUMMIES LISS PANEL DATA SET. *SOURCE: AUTHOR CALCULATIONS*