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**Title:** In Search of Determinants of Time-Discounting in Monetary Choices : Personal Characteristics Matter Only a Little

Year: 2022

Version: Published version

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### Please cite the original version:

Vargová, L., & Adamkovič, M. (2022). In Search of Determinants of Time-Discounting in Monetary Choices : Personal Characteristics Matter Only a Little. Studia Psychologica, 64(3), 313-328. https://doi.org/10.31577/sp.2022.03.856 Studia Psychologica, Vol. 64, No. 3, 2022, 313-328 https://doi.org/10.31577/sp.2022.03.856

## In Search of Determinants of Time-Discounting in Monetary Choices: Personal Characteristics Matter Only a Little



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Time-discounting in monetary choices is determined by aspects related to the reward, contextual factors and characteristics of a person. In the present study, we used three datasets ( $N_{data1}$  = 419;  $N_{data2}$  = 485;  $N_{data3}$  = 240) to examine how well personal characteristics (sociodemographic, financial situation, self-control, cognitive abilities, negative experiencing, and trustfulness) predict time-discounting in both hypothetical and real reward scenarios. The results of the regression analyses indicate that the characteristics of a person only explain a small proportion of the variance in time-discounting ( $R^2$  ranged from .10 to .19). The only substantive predictors of time-discounting in monetary choices were financial literacy and the general tendency to delay gratification. We conclude that there remains much work to be done in explaining what determines time-discounting. However, shifting the focus from personal characteristics to the characteristics of reward and contextual factors could be of interest.

Key words: time-discounting, delay discounting, monetary choices, predictors of time-discounting, personal characteristics

#### Introduction

In a range of situations, people choose between an immediate benefit or a future advantage. For instance, a few days before an important exam, a student could either go to a party and have a good time or study for the exam ensuring a better score. One of the phenomena related to this present-future trade-off is delay discounting in monetary choices. This has been widely studied in both economic and psychological literature (Madden et al., 2003; Ruggeri et al., 2021). Delay discounting (otherwise known as time-discounting, intertemporal discounting or inter-

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The data and analytic code are freely available at https://osf.io/yp85k/

Received August 20, 2021



temporal choice) can be described as a person's preference for a smaller-sooner reward relative to a reward that is larger but more distal in time (e.g., Pepper & Nettle, 2017). A substantial body of literature has focused on the consequences of this (e.g., health issues, stress, various types of addiction, risky behavior; Amlung et al., 2016; Daugherty & Brase, 2010; Fields et al., 2014; Mishra & Lalumière, 2016) as well as on the antecedents/ determinants (e.g., cognitive factors, personality traits, sociodemographic differences or contextual characteristics; Adamkovič, 2020; Hirsh et al., 2008; Hirsh et al., 2010; Huffman et al., 2019; Steinberg et al., 2009). In a recent paper, Bačová and Šrol (2021) found that cognitive predictors accounted for a relatively low percentage (about 12%) of the variance in delay discounting in monetary choices. The authors have concluded that there may be more important factors determining one's time-discounting and have called for further research on the topic. In an attempt to expand on their research, we have used the available data and computed several regression models combining potential sociodemographic, cognitive and personality-related predictors of time-discounting in monetary choices. The current study thus aims to explore the proportion of variance in delay discounting in monetary choices that can be explained by a set of these predictors as well as how much the results differ when different delay discounting tasks are used as the dependent variable.

#### On the (Non)Cognitive Predictors of Time-Discounting in Monetary Choices

Bačová and Šrol (2021) have provided a comprehensive overview of the most important cognitive determinants of time-discounting in monetary choices and discuss the issue from the perspective of rational thinking and decision-making in particular. The current paper extends their effort and lists the other main factors that could influence delay discounting in monetary choices. To summarize these factors systematically, we have divided them into three main categories: 1) characteristics of a person, 2) context of the situation, and 3) aspects related to the reward/task. The characteristics of a person include a) sociodemographic characteristics such as gender (Silverman, 2003), age (Read & Read, 2004), perspectives about the future (Hurwitz & Sade, 2020; Kim et al., 2020), b) objective socioeconomic status in terms of income/ wealth and education (Brown et al., 2015) and subjective socioeconomic status (Liu et al., 2012); c) self-control in terms of willpower (Basile & Toplak, 2015; Waegeman et al., 2014), general delay of gratification tendency (Odum, 2011a), risk-seeking tendency (Epper & Fehr-Duda, 2012; Fields et al., 2015), frugality and spendthrift (Frederick et al., 2002; Prelec & Leowenstein, 1997), and neuroticism (Manning et al., 2014); d) cognitive factors such as susceptibility to bias (Stanovich et al., 2016), cognitive reflection (Białek et al., 2019; Frederick, 2005, Littrell et al., 2020), cognitive abilities (e.g., intelligence; Shamosh & Gray, 2008), working memory, information processing (Shamosh et al., 2008), abstract thinking (Malkoc et al., 2010); e) negative experiencing such as persistent negative affect (Lerner et al., 2013) or stress (Haushofer & Fehr, 2014); and f) trustfulness (Farah & Hook, 2017; Kidd et al., 2013). The contextual factors concern a) momentary scarcity (Hamilton et al., 2018; Griskevicius et al., 2011); b) perceived reliability of the environment (Kidd et al., 2013), c) acute stress (Malesza, 2019); d) acute emotional state (Liu et al., 2013), and e) stability of social relationships (Holmes et al., 2020). The factors related to the reward/task cover a) whether the reward is real or hypothetical (Hinvest & Anderson, 2010); b) size of the reward, time interval or lucrativeness of the re-

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ward (Harman et al., 2020), and d) the nature of the time-discounting task (description-experience gap; Koritzky & Yechiam, 2010).

# Differences between the Study by Bačová and Šrol (2021) and the Present Study

Even though the current study is an extension of the one done by Bačová and Šrol (2021) and not a replication, it is important to note the most significant differences and overlaps. The former study specifically focused on cognitive variables - cognitive ability, cognitive reflection, scientific reasoning, objective and subjective numeracy, analytic and intuitive thinking, and bias susceptibility. As such, they explored the effect of cognitive predictors on time-discounting in more depth. Besides cognitive variables (cognitive reflection, working memory and financial literacy), the current study also includes demographic characteristics, financial situation, self-control, negative experiencing and trustfulness as predictors of time-discounting. It is necessary to highlight that Bačová and Šrol (2021) modified the instruction for the time-discounting task to eliminate potential environmental sources

that would justify the preference for smaller-immediate reward (e.g., doubting that the future reward would be delivered as promised; see Frederick et al., 2002) and thus their measure could be considered "a pure measure of rational delay discounting" (p. 132). No such modification has been done in this study. In order to make the results more robust, we used three different variations of the time-discounting measurement - Staircase module of time preferences (Falk et al., 2016), a 27-item monetary choice questionnaire (Kaplan et al., 2016), and a choice involving a real monetary reward (ranging from 6 euro immediately to 12 euro in a month). Furthermore, three samples ( $N_{total}$  = 1134) were used to cross-validate the results.

#### **Data and Participants**

The present data comes from three data collections that were conducted for the purposes of the research grant APVV-15-0404 "Psychological causes and consequences of poverty". As such, some parts of these data have already been published elsewhere. In the current study, three separate datasets

	Data 1 (N = 419)	Data 2 ( <i>N</i> = 485)	Data 3 ( <i>N</i> = 240)	Total (N = 1144)
Gender (% female)	51.07	50.31	82.03	57.26
Age (SD)	40.23 (11.86)	39.62 (11.48)	34.41 (9.94)	38.75 (11.53)
Education (%)				
Without final exam	13.13	12.99	0.42	10.40
With final exam	52.74	52.78	47.5	51.66
University degree	34.13	34.23	52.08	37.94
Economic status (% employed)	63.96	62.68	66.67	63.99
Data collection procedure	Online (specialized agency)	Online (specialized agency)	In-person (experimental design)	-

Table 1 Descriptive characteristics of the sample

were analyzed. In total, the sample consists of 1144 participants ( $N_1 = 419$ ;  $N_2 = 485$ ,  $N_3 =$ 240) of working age (mean age: 38.75 ± 11.53; age range: 18-62 years) with about 57% of the sample being female. About 10% of the sample had finished secondary school without the school-completion exam while about 53% had finished secondary school with it. About 38% of the sample had a university degree. At the time of the data collection, 64% of the sample was employed. The average equivalized net household income of the sample was 599 ± 327 euro per month. For a more detailed description of the sample see Table 1.

#### Measures

Given the main goal of the study, three distinct measures of time-discounting were modeled as the dependent variables. The list of predictors consisted of gender, age, education, economic status, health, household income, subjective SES, self-control, delay of gratification, risk preference, frugality, spendthrift, cognitive reflection, working memory, financial literacy, perceived stress, negative affect, shame, financial hassles, cognitive load, perceived reliability of the environment, and family functioning. Please note that 1) there were five time-discounting measures altogether across the three datasets (only the Staircase module of time preference was administered in each data collection and, therefore, only this module was used for the current analysis) and 2) that the list of predictors (slightly) varies across the datasets. For a comprehensive overview of all the measures (except for sociodemographic characteristics) see Table 2.

#### **Statistical Analysis**

The initial data handling (i.e., screening for improbable values, removal of careless par-

ticipants, recoding of reverse-coded items, equivalization of household income and calculating the time-discounting scores) was done in the process of general data management for the purposes of project APVV-15-0404. For this study, the reliability of the measures was firstly estimated using the omega total coefficient. Then, the descriptive statistics and correlation matrices were calculated for all datasets. For the main analysis, we calculated several hierarchical regression models using the time-discounting measures as the dependent variables and the previously mentioned determinants as the predictors. The predictors were added in blocks (consisting of similar variables) to examine the increase in explained variance in time-discounting in several steps. The blocks were constructed as follows. The first block included the core demographic variables such as gender, age, education, employment, and subjective health. The second block contained factors related to the financial situation - household income and subjective SES. The third block covered the factors related to self-control; self-control, general delay of gratification tendency, risk preference, frugality, and spendthrift. The fourth block included cognitive factors such as cognitive reflection, working memory and financial literacy. The fifth block involved negative experiencing - perceived negative affect, stress, actual financial hassles, and cognitive load. The sixth block concerned trustfulness in the form of the perceived reliability of the environment. Both the standard OLS regressions as well as regressions with latent variables were estimated. The regressions with latent variables were calculated using lavaan (Rosseel, 2012) with the MLR estimator (initially, we aimed to treat the variables as ordinal and use the WLSMV estimator but due to several convergence issues, we stuck with the MLR estimator). Here the results obtained from the latent variables regressions are

Time-discounting measure TD staircase	M	SD	Wtotal	Potential	Higher value indicates	Reference	Notes
TD staircase	s			range			
	10 /2	10.61	,	1 - 27	Licher nationce (lecc	Ctaircace Time	E.a. "Would vou rather receive 100 euros today or 150.1 euros in 13
	10.47	TOOT		7C - T			Liby would you ratifet receive too earlos today of too.t earlos in 12
	17.45	10.91			discounting)	Preference (Falk et	months ?"
	11.20	7.76				al., 2016)	
	21 E.A	6 00			Hinher nationce (less	27-itam Monatan	The discount rate narameter (b) was obtained automatically using the
		8					rife discontructere paratricter (n) was obtained automaticany using the
					aiscounting		
						Questionnaire	(given the other two TD measures) interpretation, the scores were
						(Kaplan et al.,	recoded so that a higher score represented higher patience. Due to
						2016)	problems with convergence when estimating the regression models, the
							original scores (k) were multiplied by 100.
							E ø "Would vou nrefer 5.4€ todav or 55€ in 117 davs?"
		ļ		•			
Monetary reward	2.41	1.45		1-4	Higher patience (less		Real financial incentives. A participant was asked to choose between the
					discounting)		alternatives:
							1) 6 euro immediatelv
							2) 0 outro in 10 dout
							3) 10 euro in 20 days
							4) 12 euro in a month
Determinants of time-disco	ounting						
Subjective health	2.41	0.89		1-5	Better health		Subjective evaluation of health (single item). E.g. "How would you
							evaluate your health generally ?"
Equivalized household	561	295	,	,			Equivalization coefficients: 1 = head of the household; 0.5 = every other
income	909	328					adult person; 0.3 = every person U18.
	647	368					
Subjective SES	5.03	1.69	,	1 - 10	Higher SES	MacArthur Scale of	Subiective assessment of SES on a visual scale.
•	4.75	1.60			0	Subjective Social	
		8					
	5.19	1.61				status (סומנוו פּנ מו., 2012)	
Self-control	42.99	7.20	.82	13 - 65	Higher self-control	Self-Control Scale	E.g., "I never allow myself to lose control."
	43.28	6.78	.79			(Tangney et al.,	
	44 54	7.65	78			2004)	

Table 2 continues

	Notes	E.g., "I don't understand why people save their money when they could	enjoy it right now."			when at the same time there is a 50 percent chance of winning nothing, or would you rather have 50 euro as a sure payment?"	E.g., "If you can re-use an item you already have, there's no sense in	buying something new."		E.g., "Which of the following descriptions fits you better? 1 – Tightwad	(difficulty spending money); 6 – About the same or neither; 11 –	Spendthrift (difficulty controlling spending)."	E.g., "A bat and ball cost 1.10€ in total. The bat costs 1.00€ more than	the ball. How much does the ball cost $?''$ , and	"A farmer makes 4 piles of hay in one corner of a field and other 5 piles	in another corner. If he merges them how many piles will he have?"	A constant increase in the number of digits to reproduce. A simple	mathematical equation to solve between the memorization and the	reproduction phases.	E.g., "Considering a long time period (for example 10 or 20 years), which	asset normally gives the highest return: savings accounts, bonds or	stocks ?"	E.g., "In the last month, how often have you felt nervous and stressed ?"			E.g., "Indicate the extent you generally feel distressed."		
	Reference	Poor Behavioral	Regulation Scale			Preterence (Falk et al., 2016)	Frugality Scale	(Lastovicka et al.,	(666T	Tightwad-	Spendthrift Scale	(Rick et al., 2008)	3 items from	Frederick (2005)	and 3 items from	Oldrati et al. (2016)	Digit Span Test			6/8 items from	Lusardi (2008)		Perceived Stress	Scale (Cohen et al.,	1983)	PANAS (Watson et	al. 1988)	
	Higher value indicates	Poorer delay of	gratification	حماداتهم مادات محطحانا ا		behavior	Higher frugality			Tendency to	spendthrift		Lower intuitive	thinking			Better working	memory		Higher financial	literacy		Higher perceived	stress		More frequent	experience of	liegalive allect
asures	Potential range	8 - 40		,	7C – T		8 - 40			1 - 11			0 - 6				0 - 10	6 - 0	0 - 7	0 - 6	0 - 8		0 - 40			10 - 50		
the m€	Wtotal	.80	.81				<u> 60</u>	83.					.87	88.	.79		.81	.86	.81	.81	.78	69.	.85	.87	.83	.91	.91	
tics of	SD	5.17	5.38	07 7	04.7	7.26	6.15	7.48		1.37	1.44		1.66	1.79	1.40		1.57	2.07	1.83	1.60	1.88	1.70	5.39	5.81	6.47	6.57	6.77	
ve statis	Ν	19.71	20.31		00.62	23.50	30.38	29.45		6.00	6.17		2.25	2.55	2.10		8.75	5.70	3.36	3.75	4.29	4.03	18.33	17.79	24.65	27.11	25.90	
Table 2 Descriptiv	Variable	Poor delay of	gratification		Nisk prejerence		Frugality			Spendthrift			Cognitive reflection				Working memory			Financial literacy			Stress			Negative affect		

Table 2 continued

Table 2 continues

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Table 2 continued

Table 2 Descrip	tive stati.	stics of	the me	sasures			
Variable	Μ	SD	Wtotal	Potential	Higher value indicates	Reference	Notes
				range			
Financial hassles	2.40	2.43	89.	0 - 11	More financial hassles	The Daily Hassles	E.g., "Not enough money for basic necessities."
						Scale - Revised	
						(Holm & Holroyd,	
						1992)	
Cognitive load	23.10	6.45	.85	4 - 36	Higher perceived		Perceived burden on cognition caused by financial situation. E.g., "How
	5.53	2.05	,	1 - 9	burden		much time do you spend thinking about your financial situation?"
Reliability of	4.98	2.34	,	1 - 9	Higher perceived		"How much would you trust the scientist that your (delayed) reward will
environment	5.52	2.46	,		reliability of the		be rightly delivered?"
					environment		
Note. Values ok	tained fr	rom Da	taset 1	are writt	ten in normal font	; values obtaine	d from Dataset 2 are written in bold; values obtained
from Dataset 3	are writt	en in it	alics.				

reported as this approach is superior to the standard OLS procedure (outputs of the OLS regressions can be obtained from the supplementary materials). For simplicity, we decided to only report the standardized regression coefficients,  $R^2$  and its changes between the blocks. We set the smallest effect size of interest to r and  $\beta = |.1|$ , which means that effects (point estimates) smaller than .1 are not considered substantially meaningful. We intentionally do not report nor discuss the associated p-values. However, these as well as the confidence intervals (or SEs) of the estimates can be easily obtained from the supplementary materials. The data and analytic code are freely available at https://osf.io/yp85k/ and other researchers are invited to reproduce the results or use the data for their analyses. It is important to highlight the fact that the present research is of an exploratory nature and further (both close and conceptual) replications are very much needed.

#### Results

The binary correlations between time-discounting in monetary choices and its determinants indicated small effects, with the mean absolute value of r being .08 (*SD* = .07), ranging from .00 to .27. The estimates replicated fairly well across different time-discounting measures. For the exact correlation coefficients see Table 3.

The hierarchical regression analyses showed that all the studied predictors explained from 10% to 19% of the variance in time-discounting in monetary choices. The greatest increase in explained variance was observed after including the variables related to self-control and cognitive abilities. In particular, the biggest effect was observed for financial literacy with an average  $\beta = .26$ , followed by the general tendency to delay gratification ( $\beta = .18$ ) and financial hassles ( $\beta = .18$ ; note that the

Predictor	Data 1	Data	a 2	Da	ta 3
	Staircase	Staircase	IMCQ	Staircase	Monetary
	module	module		module	reward
Gender	.00	07	.08	05	15
Age	01	03	16	.00	.06
Education	.19	.12	.11	.12	.08
Economic status	02	.01	04	.03	.01
Health	01	-	-	-	-
Household income	.16	.08	.02	.23	.06
Subjective SES	.09	.03	.03	.03	.02
Self-control	07	.01	08	04	11
Delay of gratification	13	21	13	-	-
Risk preference	.01	.00	.05	-	-
Frugality	-	.10	.02	.03	.02
Spendthrift	-	09	07	11	03
CRT	.15	.17	.17	.10	.06
Working memory	.01	09	05	08	10
Financial literacy	.27	.16	.16	.10	.19
Stress	09	13	03	05	.02
Negative affect	02	08	.02	-	-
Financial hassles	26	-	-	-	-
Cognitive load	19	15	11	-	-
Trustfulness	-	.00	01	.07	.09

Table 3 Binary relationships between time-discounting and its determinants in all three datasets

financial hassles measure was only available in one dataset and thus the results should be interpreted with caution). The effects of all other variables were small, with an average  $\theta s \le .10$ . The summaries of the results can be found in Tables 4, 5, and 6.

#### Discussion

The present study aimed to explore how well a set of 1) sociodemographic variables, 2) financial situation, 3) self-control measures, 4) cognitive abilities, 5) negative experiencing, and 6) trustfulness predicts time-discounting in monetary choices. The results have revealed small correlations (average  $r = |.08| \pm .06$ ) between time-discounting in monetary choices and its potential determinants. The only substantively significant predictors ( $\beta > .10$ ) of time-discounting appear to be financial literacy (average  $\beta = .26$ ) followed by the general delay of gratification (average  $\beta = -.18$ ).

The present study expands on the paper by Bačová and Šrol (2021) on three levels. 1) Bačová and Šrol (2021) specifically focused on the cognitive predictors of time-discounting in monetary choices and highlighted the importance of susceptibility to bias in this context. In fact, several other studies (e.g., Aranovich et al., 2016; Białek & Sawicki, 2018; Hirsh et al., 2008) have outlined the importance of cognitive abilities in delay discounting. In the current study, cognitive predictors played a somewhat minor role in explaining the variance of time-discounting (mean  $\Delta R^2$  = .06). The difference is likely to be caused by using diverse cognitive abilities (which were

Table 4 Latent variables hierarchical regression analysis of predictors of time-discounting (N = 419; DV = Staircase module of time-discounting)

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Sociodemographic						
Gender (female)	03	03	02	.03	.03	.02
Age	.01	.01	.05	.02	.01	.00
Education	.20	.17	.14	.10	.10	.09
Economic status	04	06	06	06	05	05
Health	.01	.04	.02	.02	.03	.04
Income related						
Household income		.12	.11	.07	.07	.04
Subjective SES		.05	.06	.06	.06	.02
Control related						
Self-control			22	19	22	16
Delay of gratification			25	20	20	14
Risk preference			.03	.05	.05	.07
Cognitive						
CRT				18	18	20
Working memory				06	06	05
Financial literacy				.36	.35	.35
Negative experiencing						
Stress					11	06
Negative affect					.03	.03
Financial hassles						18
Cognitive load						.00
<i>R</i> <sup>2</sup>	.04	.06	.11	.16	.17	.19
R <sup>2</sup> change	-	.02	.05	.05	.01	.02

Note. Standardized regression coefficients are reported

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DV = Staircase module of <u>time-discounting</u>) Predictor Model 1 Model 2 Model 3 Model 4 Model 5 Model 6 Sociodemographic Gender (female) -.06 -.09 -.09 -.12 -.07 -.06 .03 .04 .03 .10 .11 .11 -.05 -.05 -.05 -.06 -.07 -.08 Age -.14 -.14 -.13 -.15 -.17 -.17 .06 Education .11 .03 .12 .03 .02 .10 .07 .02 .02 .02 .10 Economic status .00 .00 .01 .01 .01 .01 .02 -.01 -.01 .00 .02 .01 Income related .01 .01 Household income .04 .04 .01 -.05 -.01 -.01 -.05 -.06 Subjective SES -.02 -.04 -.03 -.03 -.04 .02 .03 .04 .04 .04 Control related Self-control -.12 -.06 -.06 -.06 -.20 -.15 -.13 -.13 Delay of gratification -.28 -.21 -.19 -.19 -.21 -.09 -.11 -.09 Risk preference .00 -.01 -.01 -.01 .06 .05 .06 .06 Frugality .02 .02 .03 .03 -.02 -.02 -.01 -.01 Spendthrift -.04 -.05 -.05 -.04 -.06 -.07 -.07 -.07 Cognitive CRT .08 .05 .05 .00 -.03 -.03 Working memory -.12 -.11 -.11 -.09 -.09 -.08 **Financial literacy** .12 .13 .13 .29 .29 .29 Negative experiencing Stress -.09 -.09 -.07 -.07 Negative affect .08 .08 .08 .08 Cognitive load -.09 -.09 -.11 -.11 Trustfulness .03 .02  $R^2$ .02 .02 .09 .12 .12 .12 .04 .08 .18 .04 .18 .18 R<sup>2</sup> change .00 .07 .03 .00 .00 .00 .04 .09 .00 .00

Table 5 Latent variables hierarchical regression analysis of predictors of time-discounting (N = 485;

Note. Standardized regression coefficients are reported

Predictor	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Sociodemoaraphic						
Gender (female)	06	05	04	03	03	03
· · · · /	15	15	14	12	13	12
Age	.00	.06	.07	.05	.05	.04
-	.05	.07	.10	.08	.08	.07
Education	.12	.09	.11	.08	.08	.08
	.08	.07	.06	02	02	02
Economic status	.01	07	06	06	07	06
	.01	01	01	.01	.02	.02
Income related						
Household income		.29	.29	.27	.26	.26
		.08	.07	.02	.03	.03
Subjective SES		09	07	07	07	07
		.01	.04	.05	.05	.05
Control related						
Self-control			.06	.03	.06	.05
			.11	.13	.12	.12
Frugality			.02	.01	.02	.02
			.02	01	01	01
Spendthrift			13	12	12	13
Cognitivo			04	.01	.01	.00
Cognitive				00	00	01
CRI				.00	.00	.01
Working momory				25	25	24
working memory				12	11	11
Financial literacy				00	00	06
i manetar interacy				.05	.05	.00
Negative experiencing				140	140	•77
Stress					06	05
					.03	.04
Trustfulness						.07
,						.05
R <sup>2</sup>	.02	.07	.09	.09	.09	.10
	.03	.04	.05	.18	.18	.18
R <sup>2</sup> change	-	.05	.02	.00	.00	.01
-	-	.01	.01	.13	.00	.00

Table 6 Latent variables hierarchical regression analysis of predictors of time-discounting (N = 240; DV = Staircase module of time-discounting)

Note. Standardized regression coefficients are reported

more general in this study) and especially by the fact that susceptibility to bias was not measured in the present study. On the other hand, financial literacy appears to be a promising factor in explaining time-discounting. Further research on the topic could be focused on its skill component rather than on financial knowledge (see, e.g., Topa et al., 2018). 2) By including a whole spectrum of different variables as predictors of time-discounting, a small step has been made towards a better understanding of its determinants in spite of the null results (except for financial literacy and the general delay of gratification tendency that showed themselves to be substantially significant predictors of time-discounting in monetary choices). Despite including multiple theoretically relevant variables, the study failed to explain a notable percentage of the variance in time-discounting in monetary choices. This corroborates the evidence that time-discounting is a stable trait which is only marginally determined by other stable factors (for a more extensive discussion, see, e.g., Meier & Sprenger, 2015; Odum, 2011a). Instead, the existing evidence suggests that time-discounting could be altered by shocks or crises (Bickel et al., 2016; Guiso et al., 2018). 3) Furthermore, we argue that a trade-off between immediate albeit smaller rewards and bigger but more distal rewards creates a paradox in decision-making. This is because maximization should be both economically rational and the intrinsically motivated desire of a person to make a profit (Frederick et al., 2002). However, this is not always the case - the effort to maximize profit may vary across cultures (Du et al., 2002; Chen et al., 2005). In some cultures, people's behavior tends to be driven by collectivist values. This means that an individual is often more focused on collective goals, even at the expense of personal benefit. This could significantly reduce the tendency to act impulsively. On the other hand, in some cultures, people may focus more on achieving personal goals which would lead to higher impulsivity in decision-making processes (see Kim et al., 2012).

Despite its benefits, the present study has several limitations. Firstly, we decided to take a broader view instead of an in-depth focus on a specific determinant of time-discounting. Thus, the study explored how well combinations of different characteristics related to a person predict the person's time-discounting in monetary choices. As such, we provide an overview of the results and some general explanations without delving deep into the psychological mechanics and discussion of specific relationships. Secondly, although we a real reward time-discounting scenario, it was not possible to match the size of the rewards involved in the hypothetical and real time-discounting tasks. To learn more about the difference in time-discounting between real and hypothetical choices, see Xu et al. (2016). Thirdly, the categorization of the variables into blocks should not be considered the only option and there are several alternatives on how to do it. Other researchers are welcome to use the data presented in this study and test their models.

In summary, the factors related to a person only account for a small proportion of the variance in time-discounting in monetary choices. As has been shown by Odum (2011a, 2011b), delay discounting could be considered a stable personality trait. If the theoretically relevant characteristics of a person only marginally explain time-discounting in monetary choices (across different measures and scenarios), a better understanding of time-discounting probably lies within factors that go beyond the person who is making the decision. Such factors include actual shocks and crises (e.g., Bickel et al., 2016; Guiso et al., 2018) or aspects of the reward (e.g., its size or time interval; Harman et al., 2020). Studying how these aspects determine time-discounting and what interventions (i.e., training programs) are the most effective for getting control over the decision from external factors to the person could be a way forward to global improvement in rational decision-making.

#### Acknowledgement

This work was funded by the Slovak Research and Development Agency [project nos. APVV-15-0404 and APVV-20-0319], the Research Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic and Slovak Academy of Science [VEGA under the contract no. 1/0559/21] and project PRIMUS/20/HUM/009.

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