


HOW IMPORTANT IS THE TIME VALUE OF MONEY IN DECISION MAKING? RESULTS OF AN EXPERIMENT*

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Abstract

This paper tests how important the time value of money (TVM) principle is in decision making in real-life conditions, when different selection criteria can be considered. A three-stage survey was administered to students from a Romanian university of economics. They were asked to choose between two cars. These cars have equal total cash outflows but different present values. The benefits from using them were not specified, thus inducing a model ambiguity: respondents may consider only cash flows, but they can consider other benefits, too. It was tested whether the answers remain stable when supplementary information is provided. The respondents explained their motivations. Probit regressions were used to explain the preferences for applying or not applying TVM, for switching from one answer to another, and for converging to a response compatible with a preference for TVM. TVM was not the main selection criterion. Financial education had no impact on the opinion.

Keywords: Time value of money, decision making, utility, model ambiguity

JEL Classification: G31

1. Introduction

The time value of money principle (hereafter, TVM) is generally accepted in finance. It is assumed in many studies and included as a proxy for financial literacy (van Rooij *et al.*, 2011; Chhillar and Arora, 2021). However, as a financial principle, it accounts only for cash flows. This study is focused on the decision-making process, when agents can consider multiple objectives.

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Surveys are often used in corporate finance to explain the decision-making process (Christelis *et al.*, 2021). Respondents' adherence to TVM has been checked in such surveys (e.g., Graham and Harvey, 2001; van Rooij *et al.*, 2011; Adam *et al.*, 2018). The general approach is to ask respondents about their preferences for some choices, implying the moment when different cash flows are earned or paid. When the question is formulated so as to cover the entire spectrum of solutions (clear formulations for cash flows, benefits, timelines, *etc.*), it can be stated whether the respondents are aware of TVM. However, such studies test whether respondents apply TVM or not when no other possible criteria are considered. Therefore, we first test the importance of TVM when more criteria are considered in decision making. This research gap is also suggested by Frederick *et al.* (2002) and, to some extent, by Baur and Lagoarde-Segot (2016) and Eyerici (2022). Then, unlike other studies, which test the preference for TVM in a one-stage experiment, thus assuming that respondents' preferences remain stable (as in van Rooij *et al.*, 2011), this study tests whether responses are affected by providing more clues. Afterwards, an experiment is constructed in the context of model ambiguity. As observed before, constructing a survey that tests directly whether one principle (such as TVM) is applied *ceteris paribus* (e.g., van Rooij *et al.*, 2011) cannot characterise agents' motivations when concurring criteria can be considered. Model ambiguity is often present in real-life decisions when different objectives and restrictions are considered. Analysis of decision making in the context of model ambiguity (epistemic uncertainty) is a fruitful domain for study in different fields (e.g., Hansen and Sargent, 2021). However, it is less used in survey construction, as in the case of this study.

In total, 293 respondents, students from a Romanian university of economics, were surveyed (using a self-designed questionnaire) about their decisions and motivations for choosing between two cars in a purchase decision. Cash flows were selected so that TVM led to a univocal response from a financial viewpoint. If TVM is the most important selection criterion, the respondents' preferences would be clear: the car with the lowest sum of current cash flows. However, nothing about non-financial benefits was specified in the survey. This lack of control may lead to the opportunity of providing different opinions, because respondents can consider (or not) TVM to be the principal criterion in making decisions. Thus, they may be indifferent to TVM, or may consider other attributes more relevant: product quality (signalled through prices), the utility determined by the possession or use of the product, personal image, sentiments, *etc.*

The respondents were students from a Romanian economics university, from faculties of finance and accounting. This type of sample has some benefits. Namely, compared to other statistical populations, the students are more familiar with financial terminology. This kind of knowledge is very important for an adequate flow of the experiment. Without

it, explaining the terminology can by itself influence the respondents, inducing a preference for the TVM principle. Furthermore, the students can be considered future professionals in the field, and from this perspective, understanding their motivations can be useful (Esfandiar *et al.*, 2019). However, such a sample comes with some limitations regarding the generalizability of the results. The students' behaviour can be different compared to other populations. Also, some demographic characteristics (*e.g.*, age, education) are particular for such a sample. Thus, some of the results may be valid only for students. Also, it can be argued that the results can be biased because the questionnaires were administered under conditions that remind respondents that TVM is the best option (they are students of finance and accounting).

This study finds that, at least among the respondents, even if they are students of accounting or finance, TVM was not the main selection criterion in decision making. Furthermore, providing more information (clues about the discounting process) did not cause a significant change in opinions. Additionally, when subjects face a practical decision, financial education does not have substantial effects. The subjects can be segmented into two main stable groups: those who consequently apply TVM and those who do not apply it. This segmentation is not influenced by gender, age or financial education (both actual and self-assessed).

The results can be interesting for academics because the preference for one fundamental theoretical background (TVM) is empirically tested for a distinct population (students) from Romania, a less studied country (regarding this issue). Furthermore, this study may be useful for better understanding the financial behaviour of individuals assessing utility. For practitioners, discussions between professionals and their clients about their priorities could be salutary.

The remainder of the paper is structured as follows. In Section 2, the background is briefly described and the hypotheses are proposed. Section 3 presents the methodological issues, including the experiment description. Section 4 describes the data. In Section 5, the results are interpreted. Section 6 concludes.

2. Background and Hypotheses

This section first presents a background of TVM. Then it lists some issues related to the link between financial education, financial literacy and accepting TVM. Finally, some issues related to the data collection method are introduced.

TVM may be related to some classical papers in economics, such as time preference theory (Böhm-Bawerk, 1930), impatience theory (Fisher, 1930) or discounted utility (Samuelson, 1937). It may be associated with different issues: the preference for actual

rather than future consumption, the higher risk associated with the future compared to the present, the possibility to invest and to benefit from a positive rate of return, the uncertainty associated with future benefits, *etc.* (for a review, see Frederick *et al.*, 2002). This theoretical framework is mainly normative, but is accepted by mainstream literature (*e.g.*, Rubinstein, 1976) and by practitioners (Graham and Harvey, 2001), even different tests performed in time do not prove its validity (Frederick *et al.*, 2002).

Corporate finance theory applies all these prerequisites, transforming all benefits and costs into discounted cash flows. The practice of discounting, using the opportunity costs of capital, thus assuming TVM, is accepted by practitioners and academics in finance and applied in the practice of valuation (Graham and Harvey, 2001). Also, TVM is considered a prerequisite in many studies (*e.g.*, Botha *et al.*, 2021). CAPM considers the discount rate a sum between a risk-free rate and a risk premium. Future consumption is taken into account in the decision-making process in consumption-based CAPM (Rubinstein, 1976; Lucas, 1978; Breeden, 1979).

However, TVM should not be considered axiomatic, especially when more selection criteria are taken into account (Frederick *et al.*, 2002). Eyerci (2022) presents a diversity of opinions regarding TVM in Islamic finance, from rejection to conditional acceptance to absolute acceptance. Baur and Lagoarde-Segot (2016) discuss the contradiction between TVM and sustainability.

For decision makers, other issues may be more important than TVM. For instance, they can try to maximize their utility functions, which can include other attributes more important than TVM (Kahneman and Thaler, 2006). Higher price levels can be considered proxies for better product quality (Shiv *et al.*, 2005). This approach is rational at a practical level: buyers prefer to pay a higher price, expecting lower future payments (and a lower level of stress, a higher utility) (Kahneman and Thaler, 2006). However, even if all persons prefer better quality to worse, they may differ in their willingness to pay for this better quality (Wolinski, 1983). Individuals can assess intrinsic values of different goods on the basis of prices. Thus, goods with higher prices may be regarded as having greater intrinsic values, even if this is not true (Shiv *et al.*, 2005).

Some studies have tested whether respondents use TVM in their decision making (van Rooij *et al.*, 2011; Chhillar and Arora, 2021). However, they are not concerned about the rank of this criterion when it is considered jointly with other objectives.

The first hypothesis tested is:

H_1 : Respondents consider TVM the main criterion in decision making.

Different studies confirm the positive impact of financial education on the quality of decisions (Hibbert *et al.*, 2012; Junger and Mietzner, 2020). In this context, even

if people initially do not assume financial principles (e.g., TVM), attending courses in finance may lead to acceptance of these principles. Thus, TVM may become a preferred rule in decision making.

In general, financial education leads to an increase in financial literacy (Paraboni and La Costa, 2021). Some studies use TVM to check the ability to make good financial decisions (van Rooij *et al.*, 2011; Chhillar and Arora, 2021). However, the link between financial education and financial literacy is not always confirmed. Some studies find more heterogeneous results (Urban *et al.*, 2020) or even find (almost) no relation (Fernandes *et al.*, 2014).

Thus, the second hypothesis tested is:

H_2 : A higher level of financial education positively influences the acceptance of TVM.

As in the case of H_1 , people (students, in our case) may include TVM in their judgements, but other issues may matter more to them. Thus, financial literacy may or may not be an explanation for preferring TVM as the principal criterion in selection.

Analysing the time preference, which is strongly related with TVM, Frederick *et al.* (2002) remark the difficulty of designing field or experimental studies able to account for the complexity of decision making in a real-world situation and for controlling all the relevant factors. People make decisions in an environment where the outputs are not always clear, in a context of model ambiguity.

To find out whether some principles are applied in different contexts, the use of surveys is a common approach (Junger and Mietzner, 2020). In some cases, questionnaires are administered to students (Esfandiar *et al.*, 2019, Janáček and Rybáček, 2020). In such studies, data are collected at one moment of time (one stage) (van Rooij *et al.*, 2011; Junger and Mietzner, 2020). This method of collecting answers implicitly assumes that respondents' choices remain stable over time. In the same vein, these studies do not account for the possibility that a decision is subject to change if new information is provided or if respondents are influenced by the manner in which some clues are formulated. Also the determinants of changing one's answers are not analysed.

Survey questions are formulated in a manner by which it is tested precisely whether TVM is adopted or not (e.g., van Rooij *et al.*, 2011). Even if model ambiguity is an interesting topic in economics (e.g., Pflug and Wozabal, 2007; Frydman *et al.*, 2020; Hansen and Sargent, 2021), a survey inducing a form of ambiguity is not usual. Inducing ambiguity can serve to better understand human behaviour, when the decision maker's multiple objectives - functions can be contradictory and/or have to be prioritized. For a better understanding of personal beliefs and motivations, some studies (e.g., Sahi *et al.*, 2013) conduct exploratory interviews.

Some articles have an experimental component (Paraboni and La Costa, 2021). In such studies, the characteristic variables are collected at different moments of time, before and after a treatment (for example, attending finance courses). In these cases, the change in answers can be the result of the treatment, but because of the length of time between the moments, it can also be the result of other issues (*e.g.*, moods, fluctuations in tastes, *etc.*) (Frederick *et al.*, 2002). They do not check the stability of responses when new information is provided.

3. Research Design

3.1 Experimental design

The questionnaire was presented to subjects, being students at two faculties of one Romanian university, in different courses, in February 2018. These two faculties include more financial courses in their curricula. As a result, all respondents were exposed to TVM. Each respondent had the opportunity to answer the questionnaire or not and to respond only once. Subjects gave their consent to participate in the study. During the experiment, the respondents were encouraged to express their opinions freely.

First, the characteristics of the respondents were collected (gender, age, faculty, bachelor/master, years in faculty, years since first finance course). Although they are not used in previous studies to find the determinants of preferring TVM, most of them are common demographic control variables used in various studies regarding other financial decisions. Thus, gender is used by van Rooij *et al.* (2011), McCannon and Peterson (2015), Skagerlund *et al.* (2018), *etc.* Age is also usually used as a control variable (Hibbert *et al.*, 2012; Skagerlund *et al.*, 2018, *etc.*). McCannon and Peterson (2015) used as an explanatory variable the number of years in faculty.

The variable “*number of years since the first finance course*”, proposed in this study, expresses better how many years the subject thinks lasted since their first finance course attended, reflecting a self-assessed level of financial education. For example, one respondent declared a period of 15 years, explained by the financial background provided by the family. In other cases, subjects from the same faculty year declared 0 or 1 year from their first course attended, possibly influenced by a more optimistic or pessimistic attitude.

The survey questions were then presented. First, the statement for one corporate finance application, in which a decision is required, was provided. The same application was presented in 3 successive stages, adding new information from stage to stage. For each of these stages, the questionnaire had two components: a decision (the respondents were asked to choose from three possible answers) and its motivations. Subjects were instructed to understand the requirements of the application. Set in the context of TVM, it is a basic corporate finance one (Dragotă *et al.*, 2012, p. 46) (see Box 1).

Box 1: Questionnaire Phase 1 questionnaire

You have to choose between two cars. A lifetime of exactly 5 years is anticipated for both of them. The acquisition price of the car UNO is 10,000 euros, but it will generate maintenance costs of 2,000 euros/year. The acquisition price of the car DUO is 15,000 euros, but it will generate maintenance costs of 1,000 euros/year.

Which one do you prefer:

A. UNO

B. DUO

C. Either one: the decision is irrelevant.

Justify your answer!

If only TVM is considered (as the discount rate is strictly positive), the answer will be A. UNO. The subjects had enough time to answer this question, and after a consultation, they proceeded to the second phase.

New information was provided in this phase in addition to the text provided in Box 1, namely: “*The interest rate on deposits (the effective interest rate on deposits) is 2% (per year)*”. This is not exactly a suitable discount rate because the risks of the alternatives are not equivalent. However, it can be mentally linked with the concept of TVM: instead of consuming a higher level of financial resources, you can invest your money in a bank (and earn the interest). The main purpose for adding this information was to remind the subjects about the existence of TVM.

The respondents had enough time to answer this question, and after a consultation, they proceeded to the third phase. In this phase, the new information provided was: “*The discount rate (used in the valuation of projects with similar risk) is 10% (per year)*”. This information can be used to apply the net present value (NPV) formula and to choose the best project based on this criterion. As noted above, this information is not necessary to decide on the best project in accordance with NPV, as long as the discount rate is positive. However, it was checked whether subjects can be suggested to apply NPV if they have the required information in numerical values.

By providing more clues, it was thus tested whether respondents change their decision if they receive more information related to the TVM concept.

3.2 Data processing

A probit regression analysis was performed to find the determinants of assuming TVM as the main selection criterion. The endogenous variable PH_{ij} (with j accounting for the phase when the answer is provided, $j = 1, 2, 3$) is equal to 1 if the respondent answers according

to TVM, and 0 otherwise. Because the dependent variable is not continuous, but takes only two values, OLS may not be the most appropriate model (McCannon and Peterson, 2015). In similar cases, probit regressions have been used by Hibbert *et al.* (2012) and McCannon and Peterson (2015).

First, a cross-sectional probit regression model was used to identify the determinants of PH_{it} :

$$PH_{it} = \alpha + \beta_1 GEN_i + \beta_2 AGE_i + \beta_3 FAY_i + \beta_4 YER_i + \beta_5 BMD_i + \beta_6 YFC_i + \varepsilon_i \quad (1)$$

In Equation 1, GEN is a binary variable reflecting the respondent's gender (1 = male, 0 = female), AGE is the subject's age, FAY is a binary variable for the faculty (1 if the respondent is from the finance faculty, and 0 if the student is from the accounting faculty), YER is the faculty year, BMD is a binary variable reflecting the degree (1 = master, 0 = bachelor), YFC is the number of years since the first finance course, as assumed by the subject.

Then, starting with the second phase, it was tested whether the answer provided in the previous phase (PH_j , with $j < i$) has an influence on the decision:

$$PH_{ij} = \alpha + \beta_1 GEN_i + \beta_2 AGE_i + \beta_3 FAY_i + \beta_4 YER_i + \beta_5 BMD_i + \beta_6 YFC_i + \beta_7 PH_{i,j-1} + \varepsilon_i, \text{ for } j = 2, 3 \quad (2)$$

Furthermore, we analysed the behaviour of the switchers from an answer in accordance with TVM to another (see Equation 3). The dependent variable *Switch* is a binary one, reflecting whether the respondent changed her or his decision. It is equal to 1 if the subject changed her or his decision, and 0 otherwise.

$$Switch_{ij} = \alpha + \beta_1 GEN_i + \beta_2 AGE_i + \beta_3 FAY_i + \beta_4 YER_i + \beta_5 BMD_i + \beta_6 YFC_i + \beta_7 PH_{i,j-1} + \varepsilon_i, \text{ with } j = 2, 3 \quad (3)$$

In the same way, it was analysed whether the answers provided by the respondents who changed their answers were in accordance with TVM. Thus, a binary variable, *Improvement*, was defined equal to 1 if the subject changed his or her decision to be in accordance with TVM, and 0 otherwise:

$$Improvement_{ij} = \alpha + \beta_1 GEN_i + \beta_2 AGE_i + \beta_3 FAY_i + \beta_4 YER_i + \beta_5 BMD_i + \beta_6 YFC_i + \beta_7 PH_{i,j-1} + \varepsilon_i, \text{ with } j = 2, 3 \quad (4)$$

Independent variables correlated with more than 0.3 in the module were not included in the same regression. For this reason, the regressions presented in Equations 1-4 were never applied including all variables.

4. Data

A total of 293 valid questionnaires were completed (4 were not usable). However, the number of responses was not identical for all three phases (291, 284 and 265 respectively). Fewer responses were collected for the explanations (289, 232 and 157 respectively). Due to the particular manner of collecting the responses, the response rate was higher compared to other studies (*e.g.*, Graham and Harvey, 2001; Hibbert *et al.*, 2012). Some descriptive statistics are provided in Table 1.

Table 1: Summary statistics for control variables

	<i>Gender</i>	<i>Age</i>	<i>Faculty</i>	<i>Year</i>	<i>Bachelor / master</i>	<i>Years since the first finance course</i>
Abbreviation	GEN	AGE	FAY	YER	BMD	YFC
Minimum	0	19	0	2	0	0
Maximum	1	34	1	4	1	15
Average	0.29	20.65	0.65	2.44	0.05	1.65
Median	0	20	1	2	0	1
Mode	0	20	1	2	0	1
Std. deviation	0.46	1.36	0.48	0.59	0.22	1.24
Variation coef.	1.55	0.07	0.74	0.24	4.31	0.75

Note: In this table, gender (*GEN*), faculty (*FAY*), and Bachelor/ master (*BMD*) are defined as dummy variables (*GEN*: 1 = male, 0 = female; *FAY*: 1 = faculty of finance, 0 = faculty of accounting; *BMD*: 1 = master, 0 = bachelor). The other variables are expressed in years.

Source: Author's calculation

Of the respondents, 207 (70.65%) were females and 86 (29.35%) were males. These proportions are usual for the faculties of finance and accounting in Romania, even if not for other countries (*e.g.*, McCannon and Peterson, 2015 report an inverse situation for the US). The subjects' age was between 19 and 34 years, with an average of 20.65 years (median = mode = 20 years).

A total of 144 respondents switched from one answer to another: 95 from an answer which was not in accordance with TVM to one preferring it and 55 for the opposite case.

5. Results and Findings

In all three phases, subjects (even if they are students in finance or in accounting) did not prefer the answer suggested by TVM (see Table 2). In the first phase, only 21.99% of the respondents preferred the alternative based on TVM; their number increased to 41.90% when information regarding the interest rate was provided, but decreased to 36.98% in the third phase.

Table 2: Preference for TVM principle (numbers of respondents)

		Phase 1		Phase 2		Phase 3	
Preference for TVM as principal selection criterion	Total	64	21.99%	119	41.90%	98	36.98%
	Women	43	20.98%	79	39.50%	67	36.61%
	Men	21	24.42%	40	47.62%	31	37.80%
Non-preference for TVM as principal selection criterion	Total	227	78.01%	165	58.10%	167	63.02%
	Women	162	79.02%	121	60.50%	116	63.39%
	Men	65	75.58%	44	52.38%	51	62.20%
Total		291	100.00%	284	100.00%	265	100.00%

Source: Author's calculation

Thus, H_1 is rejected.

The explanations provided were informative. Respondents who preferred TVM provided answers consistent with the principles of financial theory. The other ones emphasized the importance of lower maintenance costs (the interest for avoiding future financial problems). Other responses could be related to price signalling quality (Shiv *et al.*, 2005), a higher price being associated with a better performance.

The correlation coefficients between the answers according to TVM (for all 3 phases), and all considered explanatory variables – gender, age, faculty, year of faculty, bachelor/master level, and the number of years since the first course in finance – are very close to 0 (see Table 3).

Table 3: Correlations between variables used in study

	<i>GEN</i>	<i>AGE</i>	<i>FAY</i>	<i>YER</i>	<i>BMD</i>	<i>YFC</i>	<i>TVM as principal selection criterion</i>		
							Phase 1	Phase 2	Phase 3
							<i>PH₁</i>	<i>PH₂</i>	<i>PH₃</i>
<i>GEN</i>									
<i>AGE</i>	0.134**								
<i>FAY</i>	0.098	0.268***							
<i>YER</i>	0.005	0.537***	0.545***						
<i>BMD</i>	-0.014	0.448***	0.171***	0.615***					
<i>YFC</i>	0.023	0.156**	0.308***	0.404***	0.111*				
<i>PH₁</i>	0.038	0.044	-0.049	-0.086	-0.011	-0.027			
<i>PH₂</i>	0.075	-0.020	-0.068	-0.065	-0.062	-0.074	0.404***		
<i>PH₃</i>	0.011	0.045	0.032	0.008	-0.076	0.012	0.341***	0.429***	

Note: Phases 1-3 refer to the three phases of the experiment. The other variables are defined in Table 1. The symbols *, **, *** denote statistical significance at the levels of 10%, 5%, and 1%, respectively.

Source: Author's calculation

Most independent variables do not influence PH_2 or PH_3 . The exceptions are PH_1 , with a positive statistically significant influence on both PH_2 and PH_3 , and PH_2 , with a similar influence on PH_3 . These results show that the respondents were consistent in applying TVM. The main part of the subjects who preferred TVM maintained their opinion; alternatively, for the overall population, the others maintained theirs, too.

In Table 4, the results of the regressions are presented (to save space, not all possible regressions are included).

The results presented in Table 2 suggest the rejection of H_2 . For this sample, financial education does not have an effect on accepting TVM.

The learning hypothesis is confirmed by the higher coefficient of PH_2 compared to that of PH_1 (and an increase in McFadden R^2), when PH_3 is the dependent variable. For a more detailed analysis of this learning process, the determinants of the switch from one decision to another were considered (see Table 5).

Table 4: Determinants of preferring TVM as principal selection criterion in choosing investment project

<i>Dependent</i>	<i>GEN</i>	<i>AGE</i>	<i>FAY</i>	<i>YER</i>	<i>BMD</i>	<i>YFC</i>	<i>PH₁</i>	<i>PH₂</i>	<i>C</i>	<i>McFadden R²</i>	<i>Log likelihood</i>
<i>PH₁</i>	0.110	0.054	−0.192	–	–	–	–	–	−1.791	0.0065	−152.31
<i>PH₁</i>	0.113	–	–	−0.212	–	–	–	–	−0.295	0.0086	−151.99
<i>PH₁</i>	0.129	–	−0.151	–	−0.013	–	–	–		0.0039	−152.71
<i>PH₁</i>	0.101	0.043	–	–		−0.044	–	–	−1.622	0.0039	−152.70
<i>PH₁</i>	0.118	–	–	–	−0.050	−0.034	–	–	−0.750	0.0022	−152.96
<i>PH₂</i>	0.234	−0.046	−0.135	–	–	–	1.301***	–	0.489	0.1304	−167.45
<i>PH₂</i>	0.206	–	–	−0.087	–	–	1.296***	–	−0.333	0.1275	−168.02
<i>PH₃</i>	−0.020	0.014	0.138	–	–	–	1.048***	–	−0.956	0.0881	−158.80
<i>PH₃</i>	−0.108	0.046	0.132	–	–	–	–	1.173***	−1.886	0.1464	−147.79

Notes: In this table, C is the intercept. Estimates significant at the 10%, 5% and 1% levels are denoted by *, **, ***, respectively.

Source: Author's calculation

Table 5: Determinants of decision to change answer when new information is provided

<i>Dependent</i>	<i>GEN</i>	<i>AGE</i>	<i>FAY</i>	<i>PH₁</i>	<i>PH₂</i>	<i>PH₃</i>	<i>C</i>	<i>McFadden R²</i>	<i>Log likelihood</i>
Switch	0.175	−0.049	−0.131	–	–	–	1.036	0.0065	−201.75
Switch	0.188	−0.043	−0.155	−0.351*	–	–	0.994	0.0160	−198.45
Switch	0.074	−0.046	−0.117	–	0.759***	–	0.713	0.0678	−183.49
Switch	0.155	−0.058	−0.135	–	–	0.588***	0.992	0.0414	−176.04
Improvement	0.406*	0.003	0.265	–	–	–	0.060	0.0250	−90.03
Improvement	0.528*	0.158	0.046	−1.848***	–	–	−2.678	0.2138	−71.74
Improvement	0.335	0.001	0.347	–	0.914***	–	−0.406	0.1128	−81.55
Improvement	0.674**	−0.171	0.187	–	–	2.642***	2.842	0.4239	−47.53

Notes: In this table, the dependent variable *Switch* is defined as binary (1 if the decision is changed from phase to phase, 0 otherwise). The dependent variable *Improvement* is defined binary (1 if it is a switch in the decision such as to converge to the TVM principle, 0 otherwise). C is the intercept. Estimates significant at the 10%, 5% and 1% levels are denoted by *, **, ***, respectively.

Source: Author's calculation

The type of answer provided in the first and second stages is an explanatory variable for changing preferences. If the answer is consistent with TVM in the first stage of the experiment, the probability of changing the preference is negatively affected (the switch is less probable). Even if TVM was still not preferred per the overall population, some of the respondents used the clues provided for changing their opinion for a convergence to TVM.

Providing a more specific hint (the discount rate used in the valuation of investment projects with similar risk) did not improve the quality of responses from the TVM perspective, but rather the opposite was true. Indeed, the number of responses favouring TVM increased from Phase 1 to Phase 2 (41.90% > 21.99%) (when information on the interest rate was provided), but decreased to 36.98% (< 41.90%) in the third phase, when the exact discount rate was provided.

A total of 37 subjects changed their answer from one according to TVM to one in disagreement. In some cases, the error was due to some miscalculations, in a quest to apply TVM (but wrongly); these respondents still seemed to apply TVM. In other cases, the very specific financial information confused the respondents. It may be that some students did not fully understand TVM. Also, it can be explained by a depreciation in financial education over time (Fernandes *et al.*, 2014).

Another possibility is that higher quality (reflected in higher prices) is preferred to lower costs, and quality is more important in making decisions than TVM. In this case, a coincidence between prices and intrinsic values is assumed. Therefore, we focus on the number of respondents who preferred the car with the highest price. For the case of numerical values from this experiment, this choice reflects a preference for quality, but ignoring the postulate of TVM. Table 6 presents the results.

Table 6: Respondents and their preference for more expensive cars

	Phase 1		Phase 2		Phase 3	
	No.	%	No.	%	No.	%
Subjects prefer the most expensive car and do not apply TVM	144	49.48	108	38.03	99	37.36
Subjects are indifferent between the two cars	83	28.52	57	20.07	68	25.66
Total	–	100	–	100	–	100

Source: Author's calculation

When they explained their decisions, the subjects considered the costs less important than the quality of the car. This preference for quality may be more important than the financial result of applying TVM.

Another explanation is associated with the risk of reaching a lower income in the future (uncertainty about future income), which would not allow higher future payments. Future lower maintenance costs are also an explanation for some respondents' option.

We can be tempted to state that quality seems to have been the most important issue for the respondents (compared to the other possible choices). However, the number of these respondents was always below 50% (see Table 6). Moreover, if information about something related to discount rates was added, the number of respondents who prefer quality over TVM decreased from stage to stage. Some subjects, who seem to prefer quality, changed their point of view when the discount rate was provided, explaining this option through TVM. These students seem to have applied TVM only if one numerical value was provided for the discount rate.

6. Conclusions

This study tests the preference for applying the time value of money principle (TVM) when other criteria can be considered by respondents, in an experiment in the context of model ambiguity. This preference is tested in a three-stage experiment, thus checking whether the respondents (students of finance and accounting) maintain their preferences in time.

This study finds that, at least among the respondents, TVM was not considered the main criterion in decision making. Furthermore, providing more information about the discounting process did not lead to a significant change in opinions. Other attributes (such as preference for more expensive products as a proxy for better quality, maybe determining higher perceived utility) seem to have counted more. Financial education (measured by the number of years since the first finance course attended, and dividing the sample into bachelor and master students) had no significant effect on preferring TVM. However, when supplementary information (financial indicators) was provided, some subjects changed their opinion, converging to a preference for TVM. However, per the overall population, the respondents can be segmented into two main stable groups: the ones who consequently apply TVM and the ones who do not apply it.

The results may be useful for decision makers' better understanding in situations where multiple (contradictory) criteria can be considered. Even if TVM is accepted by some decision makers, it seems to count less for others. From a theoretical perspective, greater concern for modelling the utility function of deciders may be salutary. For practitioners, a discussion with clients to better understand their objectives can also be useful. A possible

application can be in appraising some investment projects that involve financial and non-financial dimensions (*e.g.*, a financial perspective, modelled through NPV, but also a socially responsible one).

We examined whether the subjects would change their opinions after receiving more clues (even of little or no importance). They changed their opinions, proving their dynamic character, an issue that can be considered in future analysis. The practical implication is that, at least in some cases, a decision maker can change her or his decision in different instances (*e.g.*, clues, manner in which information is provided, *etc.*). A good relationship between professionals and their clients should suppose a deeper concern for understanding the clients' real values and motivations in making decisions, which may mean checking their opinion more than only once.

One limitation of this study is the sample. A direction for future research can be to include, as respondents, individuals with a greater diversity in characteristics (ages, levels of education, levels of financial education, different cultures – *e.g.*, different countries, *etc.*). However, we expect results from a more diversified respondent structure to prove even less preference for TVM (similar to the concerns of Hibbert *et al.*, 2012, about exposure to finance). Another direction for study is to test whether agents' behaviour is different in cases where they make decisions regarding cash inflows versus cash outflows: in some studies, respondents have been proven to prefer to incur a loss immediately rather than delay it (Frederick *et al.*, 2002).

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