Is impulsivity a mediator of the relationship between financial literacy and debt decisions?

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ABSTRACT

After the 2008 crisis, EU regulatory authorities and policy makers started to devote resources to improve households financial literacy, considered as a key element of debt decisions. However, the role of another crucial determinant of debt burden has been neglected in such financial education programs. The present study examines the role of impulsivity and financial literacy as predictors of debt burden in a sample of 445 financially-literate participants. An ad-hoc built indicator of financial literacy and scores on the Barrat Impulsiveness Scale were used as regressors. The debt service to income ratio, a proxy of debt burden, served as the dependent variable. Both predictors resulted associated with debt burden; however, a mediation analysis showed that the relationship between financial literacy and debt was fully mediated by impulsivity. Findings suggest that financial education programs do not represent a conclusive solution to the problem and are discussed in terms of policy implications and means to formulate more effective intervention programs.

1. Introduction

A growing body of literature in the field of behavioral economic analyzed the impact of personal attitudes on debt decision-making, suggesting that several psychological factors and behavioral attitudes affect the individual's attitude to debt and indebtedness (Harrison et al., 2015; Karlsson, et al., 2004; Lea, Webley, & Walker, 1995). Among those factors, impulsivity appears to play a major role.

In the economic field, the notion of impulsivity is linked to that of hyperbolic discount (Franken et al., 2008; Zermatten, et al., 2005): individuals tend to systematically overvalue immediate costs and benefits and undervalue future ones. In other words, their preferences are not time-consistent as posited by traditional economic models but are present-biased. In general, high impulsive individuals discount the value of delayed rewards more than do self-controlled individuals (Wittmann & Paulus, 2008) and are less sensitive to the negative consequences of their choices (Martin & Potts, 2009; Potts et al., 2006).

When it comes to decision to demand for debt (in particular unsecured debt, such as consumer credit, credit cards), such present-biased preferences increase individuals' desire for immediate consumption and push individuals, at the time they have to decide whether to purchase on credit terms or not, to opt for immediate purchase, therefore increasing borrowing. This explains why individuals choose ''buy now, pay later'' solutions that bring immediate gratification at a future cost; in fact, individuals adopt impatient, short-sighted behavior patterns which make it difficult for them to be fully aware of the consequences of their spending decisions for the sustainability of personal debt (Meier & Sprenger, 2007; Siemens, 2007; Stango & Zinman, 2009). Point-of-purchase stimuli, logos, advertisements, discounts, product

design, marketing channel innovation, and sale promotions constitute examples of efforts to activate impulsive behavior (Jones et al., 2003; McCall et al., 2004).

Recent empirical evidences supported the view that impulsive individuals have a higher propensity to take on debt, in particular unsecured debt (e.g., Henegar et al., 2013; Verplanken & Sato, 2011; Watson, 2009). For example, Meier and Sprenger (2010) find that individuals, who exhibit a particular desire for immediate consumption, have higher credit card balances. Consistently, Limerick and Peltier (2014) highlight a positive relation between impulsivity and higher credit card balances on a sample of college students and Wang et al. (2011) find that compulsiveness is associated with higher frequency of revolving credit card use. In a previous study, impulsivity predicted unsecured debt, whereas it was not significantly associated with mortgages (Ottaviani & Vandone, 2011). Moreover, empirical analysis highlights a positive relation between impulsivity and over-indebtedness or financial fragility (Bacchiocchi et al., 2012; Gathergood, 2013).

The topic of debt and financial fragility has become more relevant in light of the aggravation of the economic and financial situation of households in Europe following the 2008 crisis. To face the problem, EU regulatory authorities and policy makers have started to devote efforts and resources to improve households financial literacy, considered as a key driver in softening households' financial vulnerability. In support to this view, the empirical studies in the field highlights that individuals participating in consumer credit market exhibit poorer levels of financial literacy compared to those who do not participate. In particular, the level of financial illiteracy is higher for individuals holding higher levels of debt-to-income and the same individuals also have higher shares of high-cost credit (Braunstein & Welch, 2002; Disney & Gathergood, 2013; Elliehausen et al., 2007; Lusardi & Tufano, 2015).

However, the fact that impulsivity may be responsible for suboptimal debt decisions may challenge the beneficial impact of financial literacy. For example, in examining how financial literacy and self-control relate to consumer over-indebtedness, Gathergood (2013) shows that both poor financial literacy and self-control problems are positively associated with over-indebtedness, but the second plays a more statistically significant role in the model. A plausible reason might be that consumers with self-control problems are more likely to use forms of credit that facilitate impulse-driven purchases (quick access to funds, close to a point of purchase), which usually bear higher cost of credit. Along the same line, Meier and Spreng (2013) analyze time preferences and financial information acquisitions, concluding that impatient individuals are a critical group since they heavily discount the benefits of being financially literate and, as a consequence, are less likely to participate in credit counseling programs even though those programs are provided for free.

To summarize, although financial education programs can still substantially improve households' financial decisions, it may well be that they do not have significant effects on the most vulnerable subjects. If this were the case, lack of self-control instead of lack of knowledge would be the key ingredient in credit decisions.

This issue needs to be carefully explored in order to contribute to the definition of effective financial education programs. If trait dispositions expose individuals to the risk of financial vulnerability and, at the same time, impair them to fully benefit from "ordinary" financial education programs, policy makers should think at designing financial programs that are attractive to this specific and vulnerable target population.

The present study aims to contribute to this relatively new field of research by analyzing the role –if any– that impulsivity plays in mitigating the impact of financial

literacy on household debt decisions and debt burden. Our first step was to build an indicator of financial literacy by appropriately combining different variables that summarize financial knowledge. Second, we measured the impact of impulsivity and financial literacy on households' debt burden, measured with the debt service to income ratio. Lastly, a mediation analysis was conducted to test the hypothesis that impulsivity would act as a mediator of the relationship between financial knowledge and debt decisions.

2. Methodology

2.1. Participants

Data for the present study were obtained from a larger data set collected during a 2-year study that had the major aim of investigating the role of emotions in financial decision-making. The sample was composed by 445 Caucasian subjects (348 men and 97 women) selected among investors and full time employees at international asset management societies. Household socio-demographic, economic, and psychological characteristics have been described elsewhere and will not be repeated here (xxx).

Informed consent was obtained from all participants. Each test was performed individually, and subjects were not compensated for their time. The research protocol has been approved by the local Ethic Committee.

2.2. Questionnaires

All subjects underwent a series of questions about demographic-socio economical information (e.g. household composition, demographic data, real and financial wealth, personal financial choices, etc.) and the Barratt Impulsiveness Scale (BIS-11; Patton, Stanford, & Barratt, 1995), as a measure of impulsivity. The BIS-11 provides a total

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score and separate scores for three subscales measuring different aspects of impulsiveness: motor, non-planning, and attentional impulsiveness. Cronbach's alpha coefficients > .78 for each subscale and the total score in the present study. In consideration of the highly significant correlation between the scores of each subscale and the total score (r_s > .80), the total score has been used in the statistical analyses of the present study.

2.3. Data analysis

To jointly analyze the different features of household financial knowledge, we first used a series of self-reported demographic-socio economical information to derive an indicator of financial literacy. As illustrated in Table 1, such indicator was created ad hoc for the purpose of the present study to take into account the following components: knowledge about different types of financial product (i.e., from simple to more sophisticated products), time dedicated to read and understand financial information, awareness about the payoff of financial investments, and the dynamics of the cost of indebtedness.

In Table 1, we identify the variables that specifically address household financial knowledge. Some of these variables are related to *knowledge or financial knowledge,* specifically the question "How many financial products do you know among the following?" (Q1). Others are related to *attention paid to financial information.* Specifically, we consider how much time is dedicated to read and understand financial information (Q2), how frequently the household read financial newspaper (Q3), the degree of awareness related to financial investments (Q4) and debts (Q5).

-Insert Table 1 about here-

To reduce and compact the dimensionality of our indicator, we have used a Principal Component Analysis (PCA). Qualitative replies were converted into quantitative data by assigning each one with a financial literacy score.

Second, a hierarchical regression analyses was conducted to test for the role of financial literacy (Model 1), and impulsivity (Model 2) in the prediction of debt burden, controlling for the traditional socio-economic predictors (age, family size, financial wealth; Model 3). The debt service to income ratio, that compares the households total monthly debt payment to the households' gross monthly income, served as the dependent variable. This ratio provides an indicator of the burden that debt holdings represent to current income and reflects more the significance of short-term commitments (Albacete & Lindner 2013; Ampudia et al., 2014).

Then, a bootstrapping tests of mediation using the Preacher and Hayes (2008) process macro with 5000 bootstrap samples was performed with debt burden as the dependent variable, financial literacy as the independent variable, and impulsivity as the mediator. Among the traditional predictors (age, family size, financial wealth), those that resulted significantly correlated with our dependent variables were included as covariate in the mediation model. A confidence interval for the size of the indirect path is generated and, if the values between the upper and lower confidence limits do not include zero, this indicates a statistically significant mediation effect. This approach provides standardized betas for the indirect effect estimates, and the corresponding 95% bias-corrected and accelerated confidence intervals.

3. Results

Table 2 illustrates the PCA. Results show that the first factor explains almost 50% of the phenomenon, whereas the other factors seem to play a less relevant role.

The eigenvectors associated to each eigenvalue are reported in the lower part of Table 2. The first vector, which is associated with the most relevant component, indicates that all the variables taken into account for the construction of the indicator of financial literacy have substantially the same statistical importance. Therefore, we interpret the first component derived from the PCA as our indicator of financial knowledge.

-Insert Table 2 about here-

Using the factors scores reported in Table 2 as weights, we construct a financial literacy index for each individual i as follow:

$$\text{Financial Literacy Index}= \sum_{p=1}^{n} a_p X_{pi}$$

where X_{pi} is the standardized value for the pth variable and a_p is its corresponding factor score. A variable with a higher score is associated with a higher level of financial knowledge and vice versa. From a descriptive point of view, the Financial Literacy indicator was characterized by a mean value of 7.42 (2.35) and ranged from 0 to 10.

Intercorrelations between the key variables of the present study are illustrated in Table 3.

-Insert Table 3 about here-

Model 1 in the hierarchical regression analysis indicates that financial literacy is a significant predictor of debt burden ($p = .05$). In Model 2, impulsivity resulted as a significant predictor ($p = .01$) but its inclusion made financial literacy no longer significant ($p = .16$). The model explained 4 % of the variance of debt burden. The inclusion of traditional socio-economic predictors did not change the role of impulsivity as a significant predictor ($p = .02$) and explained an additional 1% of the

variance of the dependent variable (R^2 = .051). None of the traditional socio-economic predictors appeared to be a significant predictor in Model 3 (*ps* > .1). The absence of excessive multicollinearity was suggested by variance inflating factors not substantially greater than 1 and tolerance well above 0.2.

-Insert Table 4 about here-

Given its association with debt burden, financial wealth was included in the mediation analysis as a covariate.

-Insert Figure 1 about here-

As depicted in Figure 1, mediation analysis showed that impulsivity was a significant mediator of the impact of financial literacy on debt (β = .06, 95% *CI* [.01; .10]; Sobel *z* = -1.73, p = .05). Moreover, after including impulsivity as a mediator, the direct effect of impulsivity on debt became nonsignificant (β = -.11, 95% *CI* [-.26; .04]) indicating full mediation. Approximately 4% of the variance in debt burden was accounted for by the predictors (R^2 = .04; *p* = 01). Financial wealth did not play a significant role as a covariate in this analysis.

5. Discussion

Since the 2008 crisis, a growing number of European families are facing difficulties in repaying secured or unsecured debt, have arrears to pay utility bills or rent, and are unable to make ends meet or to cope with unexpected expenses. Those households are "financially vulnerable", since they are particularly exposed to adverse shocks – such as job loss, reduction in working hours, death, illness – that can eliminate or reduce an income source and/or determine unexpected liabilities and negatively impact their financial situation.

Given the relevance of the issue, EU regulatory authorities have started devoting

efforts and resources to improve households' financial literacy, that is the ability to correctly interpret financial information, considered a key driver in softening households' financial vulnerability. However, whereas it seems plausible and intuitive that financial education programs or other public policy measures adopted to improve individuals' understanding of basic concepts in finance would be beneficial, existing studies offer mixed evidence on the effectiveness of such interventions (Fernandes et al., 2014; Willis, 2011). A crucial but often neglected point is that such educational programs may be effective or not depending on certain personality characteristics of the user. In the present study we find that poor financial literacy and impulsivity are both positively associated with debt. This means that if these two characteristics are taken into account individually, they both play a significant role in determining debt burden, as also suggested by previous studies (e.g., Gathergood, 2013). However, when both are simultaneously considered, impulsivity appears to be a full mediator of the relationship between financial literacy and debt burden. In other words, the effect of financial literacy on debt vanishes when impulsivity is taken into account. This result may first help to explain previous inconsistencies on the association between financial literacy and debt. In fact, while for example Disney and Gathergood (2013) and Lusardi and Tufano (2015) found a significant relationship between financial literacy and debt, other authors reported the absence of such association (see Lusardi & Mitchell, 2014 for a review). The second implication of our results is the need to either target financial education programs to non-impulsive individuals or to associate them with effective ways of reducing impulsive behaviors (e.g., cognitive-behavioral practices). Indeed, in light of results from our moderation analysis, it seems clear that "one-size-fits-all" programs are unlikely to be effective. Present findings may also have important policy implications for banks. Banks usually rely on demographic and

economic factors to analyze household creditworthiness and to determine credit limits and risk; data calls for the need to implement different systems that take into account personality characteristics.

Interestingly, impulsivity resulted negatively correlated with financial literacy: impulsive individuals have poorer levels of financial knowledge. Similarly, Meier and Sprengen (2013), provide compelling evidence for an association between time preferences and the decision to acquire of financial information. The authors show that acquiring financial information does not represent an attractive investment for impatient (impulsive) individuals, suggesting that these individuals do not participate in financial education programs. Here, we take those findings a step further, showing that impulsivity vanishes the positive effects of financial literacy on debt.

The first limitation that needs to be acknowledged is that almost two thirds of our sample is composed of experts in economics and finance. It is always difficult to estimate the effect of sampling bias; in our case, however, it may even have increased the robustness of the results, given that impulsivity is a mediator for levels of financial literacy that are likely higher than average. Second, our financial literacy index may not be the golden measure to assess this variable, as it does not include a direct measure of debt literacy (as designed by Lusardi & Tufano, 2015; van Rooij et al., 2011). However, the financial literacy index used in the present study exploits different variables as proxies for financial and economic skills providing statistically significant and robust results.

Limitations notwithstanding, present results support our hypothesis that financial literacy only acts as a limited predictor of debt burden, therefore does not represent a conclusive solution to the problem, especially for those who are more vulnerable as impulsive individuals. Understanding these relationships and their consequences on

debt decisions would provide policy makers with means to formulate more effective intervention and remediation programs. This is particularly important in terms of policy implications because financial debt has also been associated with higher perceived stress and depression, worse self-reported general health, and higher blood pressure (Sweet et al., 2013).

Acknowledgements

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Table 1. Items used to derive the financial literacy score.

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1. Which of the following financial products do you know? [multiple choice]

    a. Bank account [1]

    b. Bank deposit [1]

    c. CDs [1]

    d. REPOs [1]

    e. Postal deposit [1]

    f. T-bills and notes [1]

    g. Stock [1]

    h. Bond [1]

    i. Unit funds [1]

    j. Exchange Traded Fund [1]

    k. Hedge Funds [1]

    l. Asset backed securities [1]

    m. Derivatives [1]

    n. Index e unit linked insurance products [1]

2. How much time overall are you willing to devote to read and understand information that may be useful to make financial decisions?

    a. Less than 5 minutes [0]

    b. About 15 minutes [1]

    c. About 30 minutes [2]

    d. About 1 hour [3]

    e. Several hours [4]

f. I do not make such decisions [.]

3. In average how often do you read economic and financial newspapers or magazines?

    a. Several times a day, following the updates on the internet [4]

    b. Every day [3]

    c. Once a week [2]

    d. Once a month [1]

    e. Never [0]

4. Do you know the amount of gains/losses from your investments over the last twelve months?

    a. No [0]

    b. Yes [3]

    c. Yes but not precisely [2]

    d. I do not have investments [.]

5. Are you informed on how has the cost of your debt evolved over time?

    a. No [0]

    b. Yes [3]

    c. Yes but not precisely [2]

    d. I do not have debts [.]

Table 2. Principal Component Analysis performed on the financial literacy score.

Component	Eigenvalue	Explained Variability (%)				Cumulative (%)
C1	2.29	45.73				45.73
C2	1.04	20.77				66.49
C3	0.76	15.15				81.64
C4	0.50	9.98				91.62
C5	0.42	8.38				100
Variable		**C1**	**C2**	**C3**	**C4**	**C5**
Q1 (number of products)		0.44	-0.41	-0.56	0.33	0.46
Q2 (time dedicated)		0.38	-0.36	0.81	0.17	0.18
Q3 (financial newspaper)		0.52	-0.32	-0.15	-0.41	-0.67
Q4 (awareness investments)		0.46	0.51	0.03	-0.57	0.45
Q5 (awareness debts)		0.43	0.58	0.00	0.61	-0.32

Table 3. Correlation matrix between the key variables of the study.

	1	2	3	4	5	6
1. Debt burden	1	.07	-.11*	-.08§	.20**	-.12*
2. Family size		1	.16**	.25**	.03	-.02
3. Financial wealth			1	.10*	-.08	.22**
4. Age				1	-.02	-.12
5. Impulsivity					1	-.17**
6. Financial literacy						1

Table 4. Summary of hierarchical regression analysis for the prediction of debt burden.

	Model 1			Model 2			Model 3		
	B	*SE*	*β*	*B*	*SE*	*β*	*B*	*SE*	*β*
Financial literacy score	-.14	.08	-.12*	-.11	.08	-.09	-.09	.08	-.08
Impulsivity				.06	.02	.17**	.06	.02	.16**
Age							.03	.02	.11
Family size							-.03	.10	-.02
Financial wealth (log)							-.05	.21	-.02
R^2		.014			.041			.051	

Note: *$p < .05$; **$p < .01$.

Figure caption

Fig. 1. Path diagram for the mediation model.

Note. All coefficients are standardized.