

ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Master Thesis Behavioural Economics

Why Do We Fall for Persuasion? The Moderating Role of

Trait Self-Control in Nudging Interventions

Dita Vania Larasati

505885dl

Supervisor: G.D. Granic Second Reader: J.T.R. Stoop

Acknowledgement

I would like to firstly thank my thesis supervisor dr. G.D. Granic of the Erasmus School of Economics at Erasmus University Rotterdam. I am grateful for the insightful guidance, consistent patience, as well as constructive and straightforward feedback which he has provided from the very start of the construction of my master's thesis up to its completion. His knowledge within applied economics and structured way of working have facilitated me to provide my best effort for this thesis.

I would also like to acknowledge dr. J.T.R. Stoop of the Erasmus School of Economics at Erasmus University Rotterdam as the first reader of this thesis. I am thankful for his valuable thoughts and comments on this thesis. Furthermore, knowledge gained from his Experimental Economics class have proved to be beneficial for the completion of this master's thesis.

I would like to thank the experts and lecturers who have contributed to my learning experience at Erasmus University Rotterdam and in several ways have contributed to the construction of this master's thesis: prof.dr. K.I.M. Rohde, dr. MP Garcia Gomez, dr. T.M. Marreiros Bago d'Uva, dr. C.J. Riumallo Herl, prof.dr. A. Baillon, dr. J.P.M. Heufer, prof.dr.id. B.G.C. Dellaert.

Lastly, I would like to thank my parents for the continuous support and belief in me in completing my studies. I would also like to thank, for their moral support, ideas, and monitoring throughout the construction of this master's thesis, Devia Annisa and Cesilia Faustina. Furthermore, I would like to express my appreciation to fellow colleagues and friends from the Behavioural Economics program for continuous moral support, ideas, exchange of thoughts and knowledge, as well as positivity throughout the entire study experience in Erasmus University Rotterdam: Maria Paula, Daisy Ruijter, Maria Ester, Miriam Bastianello, Laicheng Xiang, George Strofyllas. Finally, I would like to appreciate my family and friends in the Netherlands who have provided me with moral support and warm welcome: the van Haasen family, the Hogeveen family, Paulus Sigalingging, as well as others who I am not able to mention one by one.

Table of Contents

1.	Introduction	3
2.	Theoretical Framework	7
	2.1 Research Questions	7
	2.2 Literature Review	7
	2.2.1 Mechanisms of Self-control Failure	7
	2.2.2 Strength Model of Self-control	8
	2.2.3 Trait Self-Control and Its Relevance	9
	2.2.4 Self-Control Failure and Decision Making	11
	2.3 Hypotheses	15
2	Methodology & Data	18
	3.1 Methodology	18
	3.1.1 Experimental Design & Procedure	18
	3.1.2 Specification of Variables	18
	3.1.3 Model Specification	20
	3.2 Data	23
	3.2.1 Participants and Sample Selection	23
	3.2.2 Descriptive Statistics	23
3	Results & Analysis	26
	4.1 Hypothesis Testing	26
	4.2 Model Evaluation & Robustness Check	34
	4.3 Explanatory Analysis	35
4	Conclusion & Discussions	37
	5.1 Implications	37
	5.2 Limitations and Future Research	38
A	ppendices	39
R	eferences	41

1. Introduction

Man's capacity to exert self-control and adapt to demands of group life marks a crucial component of civil society and life as we know today (Freud, 1930). Many studies summarize the definition of self-control as the capacity to consciously regulate one's behaviour in order to be in line with their environment, fostering social desirability and goal achievement, ultimately enabling individuals to live happy, successful, and healthy lives (Baumeister et al, 1998; Baumeister, Vohs, & Tice, 2007; Vohs & Faber, 2007; de Ridder et al, 2012). Another term for self-control is self-regulation, which contains a similar meaning. Both terms will be used interchangeably within this research.

Many social and personal problems encountered in society stem from lack of self-control (Baumeister, Heatherton, Tice; 1994). For example, aggressive behaviour towards others and acts of crime have been found to be significantly correlated with lacking self-control (Burton et al, 1998). Another example is within a professional setting. Ability to complete a cumbersome task requires self-control to not be diverted by distractions such as surroundings and temptation to do more hedonic activities. Within the economic context, impulsive spending has been widely discussed as a form of self-control failure, having been correlated to higher levels of real debt (Achtziger et al., 2014) and a higher tendency to purchase products which satisfice immediate gratification (Vohs & Faber, 2007; Honkanen et.al., 2012).

Failure to exert self-control can occur due to several factors, one of which is the lack of capacity to alter one's behaviour (Baumeister, 2002). The strength model of self-control states that this capacity for self-control draws from a common and limited pool of energy. Therefore, multiple acts of self-control depletes this resource, temporarily declining self-control capacity. Self-control capacity itself refers to an individual's capacity to exert strength for acts of selfcontrol, a part of someone's personality which can be referred to as a trait. Each individual has a different capacity to regulate self-control, where this capacity has been found to be correlated with a person's overall well-being in life (Mischel et al., 1988; Shoda et al., 1990; Gottfredson and Hirschi, 1990, Tremblay, Boulerice, Arseneault, and Niscale, 1995; Avakame, 1998; Cherek, Moeller, Dougherty, & Rhoades, 1997; Maszk, Eisenberg, and Guthrie, 1999; Kochanska, Murray, and Harlan, 2000; Tangney, Baumeister, and Boone, 2004). One notable study by Tangney, Baumeister, and Boone (2004) found that higher individual self-control level has been correlated with better task performance, impulse control, psychosocial adjustment, more moral emotions, more positive interpersonal relations, as well as higher levels of certain personality traits (i.e. conscientiousness and perfectionism). Differing levels of individual selfcontrol capacity, therefore, have implications on individual decision making.

Under conditions of low self-control, individuals tend to resort to low-effort and habitual courses of action, thus making more unplanned decisions which are not in line with their goals or with social desirability. Instead of putting cognitive effort into their actions, individuals rely on mental shortcuts or heuristics to make decisions. In other words, heuristic processing of a decision is a consequence of self-control failure (Wheeler, Briñoll, & Herman, 2007; Shah and Oppenheimer, 2008; Pocheptsova et al., 2009; Pohl et al., 2013). An example of such a selfcontrol failure is depicted in a study by Fennis, Janssen, and Vohs (2009) which provided a detailed account of increased charitable giving under conditions of low self-control due to reliance on heuristics which increase compliance to persuasion. These heuristics included consistency, reciprocity, and liking, all of which contain social elements (i.e. the desire to be perceived as having consistent behaviour across different situations, the feeling of obligation to return a favour, and having positive feelings towards another person). Salmon et al. (2015) conducted a similar study which showed that social proof heuristic, the tendency to opt for the most demanded choices by others, was able to effectively promote healthy food choices to individuals under conditions of low self-control. Meanwhile, Cheung et al. (2015) demonstrated in their study that a demand-scarcity heuristic (popular demand of goods by others) was able to more effectively promote a more optimal choice for well-being compared to a supplyscarcity heuristic (limited supply of goods) among individuals.

Key highlights of these previously mentioned studies are that they demonstrate how conditions of low self-control can be utilized to influence individuals to make decisions which are more beneficial for them in the long run; as well as how social components in heuristics play a key role in affecting individual choices. The concept of influencing a decision-maker to opt for the more optimal choice while still giving them freedom to choose the less optimal one has been widely discussed in economics within recent years and coined with the terms 'libertarian paternalism' or 'nudging' (Thaler & Sunstein, 2003; 2008). Several means can be implemented to nudge a decision-maker into selecting a particular choice, such as by altering the structure of choices, the description of choices (Thaler & Sunstein, 2008), or the environment of available choices (Wansink, 2010). Johnson et. al., (2012) elaborated tools of choice architecture which manipulate how choices are presented or described to decision makers, such as reducing the number of choice alternatives, using default choices, as well as limiting time windows. How a choice architect designs these choices affect how individuals will determine their decisions and address different problems encountered by decision makers. Examples of modification to the choice environment or situation include changing the social setting of the decision (Milch et al. 2009), the framing of outcomes (Tversky and Kahneman, 1981), as well as the label of a choice attribute (Hardisty et al. 2010).

Manipulation of choices design is one of the most commonly used methods within the field of behavioural economics to influence decision-makers without coercion, wherein this concept is frequently referred to as 'nudging' (Thaler & Sunstein, 2003) within the field of behavioural economics. Studying the underlying reasons behind 'irrational' decision-making and quantifying human behaviour, behavioural economics aims to facilitate optimal decisionmaking for long-term well-being. While it's been established that individuals make less optimal choices with lower self-control, few studies have shown how self-control level as a trait affects susceptibility to different types of 'nudges' or different ways to influence the decision-maker. By understanding how self-control as an individual characteristic affects this sensitivity to 'nudges', insights may be obtained which can prove beneficial to both choice architects and decision-makers. For example, by shedding light on how to better design nudging interventions which will leave people better-off. In this thesis, I study how self-control capacity impacts the effectiveness of different nudging interventions for a consumer choice. An online experiment was conducted where subjects were presented with a choice between two goods and received different nudging interventions, namely one containing a social element and another absent of this social element. Findings from this thesis, contrary to previous studies, did not find a conclusive result on which nudging intervention is the more effective. However, consistent with previous studies, it was found that trait self-control capacity plays a moderating role for the effect of nudging interventions on product choices made by subjects, weakening this relationship as self-control capacity increases. In other words, the effect that nudging interventions have on decision-making is affected by an individual's self-control capacity level.

This thesis research will contribute to existing literature on self-control and consumer behaviour in several ways. The first and most notable way is by investigating the moderating effect that individual trait self-control capacity has on how different types of nudging interventions influence consumer decision. While previous studies have observed how different levels of self-control capacity affect decision-making as well as how different types of nudging interventions are effective in influencing consumer behaviour, none have made a connection between these two aspects. Secondly, while most studies on self-control involve observing the effect of manipulated self-control depletion on decision-making, research on trait self-control and how it affects decision-making has opportunities for further development. In particular, this research aims to explore how dispositional self-control affects individual decision-making, both in the presence and absence of heuristics. Thirdly, not many studies have compared the effects of heuristics containing social elements on decision making with those of heuristics not containing any social elements, despite several studies emphasizing on the effectiveness of a social component in heuristics on influencing behaviour. Accordingly, this research seeks to reaffirm whether this social component is indeed crucial for an effective

nudging intervention to influence decision-making, notably while also controlling for individual trait self-control capacity. Lastly, substantial literature has emerged in self-control studies which present respondents with product choices in order to trigger resource depletion. Commonly used products include food and financial choices. This research will present respondents with a self-control dilemma involving a functional and a hedonic product choice trade-off, a less commonly used scenario in existing literature.

The remainder of this thesis will be structured as follows: Chapter 2 will elaborate on existing literature relevant to the scope of this study; Chapter 3 will describe the methodology used within this research and elaboration on the dataset used; Chapter 4 will depict this study's statistical results and findings; Chapter 5 will include discussions relevant to these findings, such as study limitations, implications, and overall conclusions.

2. Theoretical Framework

2.1 Research Questions

This thesis aims to answer the following research questions:

- 1. Does individual trait self-control capacity level have an effect on product consumption choice?
- 2. Are nudging interventions effective in influencing decision-making for a more optimal consumption choice?
- 3. Is a nudging intervention containing a social component more effective in influencing consumer choice compared to a nudging intervention without a social component?
- 4. Does individual trait self-control capacity have a moderating effect on how individuals are influenced by nudging interventions?
- 5. Does individual trait self-control capacity have a moderating effect on how individuals are influenced by different nudging interventions?

2.2 Literature Review

The review of existing literature within this part of the thesis provides knowledge on topics central to the formulation of these research questions. Moreover, this review aims to clarify basic concepts relevant to these questions and lay down the structure of thoughts behind this research. The following topics will be elaborated: Mechanisms of Self-control Failure, Strength Model of Self-control, Trait Self-control and Its Relevance, Self-control Failure and Decision-Making.

2.2.1 Mechanisms of Self-control Failure

Baumeister, Heatherton, and Tice (1994) define self-control or self-regulation as a person's ability to override their responses to certain situations; be it their actions or inner processes such as thoughts, emotions, and impulses. Carver and Scheier (1981; 2002) depict how self-control occurs when higher levels of input processes within a person take over the lower processes. This translates into behaviours that involve more complex networks of associations and more abstract goals. Self-control failure, on the other hand, refers to a person's lack of ability to carry out acts of self-control.

There are two forms of self-control failure (Baumeister, Heatherton, and Tice, 1994): underregulation, which refers to the inability to exert control over one's self, and mis-regulation, the exertion of self-control in a way that fails to bring the desired outcomes. In general terms, under-regulation occurs when a person is unable to alter their behaviours in order to meet desired standards due to insufficient individual capabilities or resources. This may also be affected by various factors such as psychological inertia and lacking attention. The concept of under-regulation will be the primary focus of this study. Meanwhile, mis-regulation occurs due to false beliefs or knowledge about the self and the environment, as well as due to attempts to control those things which are unable to be properly controlled (e.g. emotions, thoughts, impulses). This research focuses on self-control failure from the perspective of underregulation.

2.2.2 Strength Model of Self-control

One of the earliest theories of self-control failure (Baumeister, Heatherton, & Tice, 1994) stems from the concept of feedback-loops from systems theory (Miller, Galanter, & Pribram, 1960; Powers, 1973; Carver & Scheier, 1981, 1982 in Baumeister, Heatherton, & Tice, 1994). This concept proposes three crucial ingredients for effective self-regulation: standards, monitoring, and individual strength or capacity. Firstly, without clear standards, which can take various abstract forms such as goals and social norms, a person will not have the motivation to regulate their behaviours or effectively exert self-control. Secondly, in order to effectively follow through with standards or goals, an individual should monitor their actions and behaviours to be in line with these standards. When proper monitoring is in place, an individual is more aware of their behaviour and may correct for errors in their performance. Lastly, an individual should have the ability to operate themselves in such a way that responses high in relevance to achieving the set standards are strong enough to override lower impulses. The first two ingredients would serve no purpose without a person's individual ability to regulate themselves (Baumeister, 2002).

This last ingredient is the basis for the strength model of self-control, which is one of the most widely discussed theories of self-control and has been validated in numerous studies¹. The strength that an individual has for self-regulation is similar to that of willpower and requires self-stopping. Research has shown that this act of self-stopping requires both mental (Gilbert, Krull, & Pelham, 1988) and physical effort (Wegner, Shortt, Blake, & Page, 1990) which use up strength. A person unable to exert self-control could be lacking in strength to put forth these efforts or have limited resources to do so, oftentimes referred to as ego depletion. Lacking strength or resources can happen due to three possible causes: chronic, temporary, or external. The chronic cause is based on the idea of willpower as a trait personality. Each person has differing levels of strength to carry out self-regulation and self-discipline, which

¹ The strength model of self-control refers to the concept where acts of self-control draw energy from a single resource pool, therefore depleting it the more it is exerted (Baumeister, Heatherton, Tice, 1994; Baumeister, 2002; Inzlicht, Schmeichel, Macrae, 2014)

may cause some to more quickly drain their strength than others. The second cause occurs when a person temporarily loses their strength. This may happen when a person is depleted of their resources for strength after having to exert multiple acts of self-control or under conditions of physical fatigue and excessive cognitive load. Regardless of their chronic capabilities, a person's resources for strength is limited and may be exhausted. It should be noted that only effortful acts of self-control drain resources, while acts of self-control requiring no effort (such as regulating body temperature) operate independently of this limited resource pool (Baumeister et al, 2007). The last cause for lacking strength, the external cause, is the strength of the competing impulses or responses. Some impulses or responses are too strong to resist and may become stronger over time (i.e. visceral impulses such as the desire to go to the bathroom), regardless of an individual's strength for self-control.

2.2.3 Trait Self-Control and Its Relevance

The growing number of social problems stemming from self-control failure such as pathological gambling, violent crimes, and overspending has increased interest in studies on self-control over the years (Baumeister, Heatherton, & Tice, 1994). Rothbaum, Weisz, & Snyder (1982) have stated that people have higher levels of contentment as well as overall health when they fit better with their environment. This can be achieved by altering themselves to be more in line with their surroundings, such as by following various rules and social constructs put in place to guide them in their daily lives. It is our nature as human beings to live in groups. Consequently, this particular ability to 'fit in' and control antisocial impulses is desirable, particularly within modern-day civilized societies (Freud, 1930).

As previously mentioned, one of the main causes for self-control failure is limited individual trait self-control. Self-control as a personality trait refers to an individual's capacity to exert strength for acts of self-control, where this capacity is a part of someone's personality or disposition. Ample evidence has suggested that individual trait self-control is correlated to a person's overall well-being in life (Tangney, Baumeister, & Boone, 2004; Gailliot et al, 2007). The higher an individual's trait self-control capacity, the more they are able to comply with desired standards or goals, ultimately resulting in better physical and mental health as well as interpersonal and professional success. The lower an individual's self-control capacity, on the other hand, the higher the likelihood of exhibiting undesirable behaviours, thus decreasing their level of 'fit' to their surroundings.

The benefits of having higher levels of individual self-control capacity span across various life domains (Tangney, Baumeister, & Boone, 2004), the first and most prominent being impulsive behaviour. Romal and Kaplan (1995) have pointed to the fact that people with higher self-

control are more able to manage their finances than those with lower self-control, enabling them to save more money and spend less. Trait self-control has also been found to be negatively correlated to other impulsive behaviours such as alcohol and substance abuse as well as problem eating patterns (Wills, DuHamel, and Vaccaro, 1995; Cook, Young, Taylor, and Bedford, 1998; Storey, 1999; Peluso, Ricciardelli, and Williams, 1999). Other aspects and behaviours which exhibit a negative relationship with self-control are likelihood for psychological problems and disorders (Tangney, Baumeister, & Boone, 2004) as well as criminal behaviour, aggression, anger problems, and juvenile delinquency (Gottfredson and Hirschi, 1990; Tremblay; Pulkkinen and Haemaelaeinen, 1995; Latham and Perlow, 1996; Burton et al., 1998; Kochanska, Murray, and Harlan, 2000). Overall, trait self-control is positively correlated with many socially desirable behaviours and attributes, such as better task performance (Shoda, Mischel, and Peake, 1990; Mischel, Shoda, and Peake, 1988; Feldman, Martinez-Pons, and Shaham, 1995), better interpersonal relationships (Mischel, Shoda, and Peake, 1988; Eisenberg et al., 1997; Fabes et al., 1999), and display of moral emotions. For example, an individual who is more able to exert self-control will show tendencies to feel guilt for undesirable behaviour, as well as attempt to amend their future actions in a constructive manner (Tangney, 1991, 1995; Tangney, Miller, Flicker, & Barlow, 1996). Lastly, self-control capacity is positively correlated to the presence of certain personality traits such as conscientiousness and perfectionism (Fee & Tangney, 2000). However, the relationship between self-control and perfectionism has been found to be positively correlated up to a certain degree until it turns into a negative correlation. Certain levels of perfectionism which adhere to unrealistically high standards are negatively correlated with self-control and is connected to procrastination (Fee & Tangney, 2000).

When focusing on the impulsive behaviour domain and how it relates to consumption habits, several studies have affirmed the relationship of low self-control capacity with higher tendencies for impulsive purchases. Vohs & Faber (2007) found that those under low self-control make more unplanned spending, as confirmed by Honkanen et.al. (2012) who found that people under low self-control buy more unhealthy snacks impulsively. Achtziger et al. (2014) studied the effect of trait self-control on the amount of real debt. Unsurprisingly, lower levels of trait self-control was found to increase the amount of real debt accrued. This effect is fully mediated by compulsive buying. In a study on impulsive buying by Youn and Faber (2000) and how this relates to several personality traits, it was concluded that lack of control or impulsivity had the highest correlation to impulsive buying, with a negative relationship between the two variables. This thesis seeks to reaffirm these findings on the relationship

first research question: 'Does individual trait self-control capacity level have an effect on product consumption choice?'

2.2.4 Self-Control Failure and Decision Making

2.2.4.1 Decision Making Under Low Self-Control

When failing to exert self-control, we are not always deprived of our cognitive abilities. In the case of under-regulation, findings have shown that we display acquiescence towards the act of disinhibition. We are quite aware when our capacity for self-control has been depleted, thus consciously taking part in the decision to let go of control and giving in to impulses (Baumeister, Heatherton, & Tice, 1994). Baumeister (2002) also suggested that self-control would predict susceptibility to different marketing strategies, where consumers under low selfcontrol may be more impulsive and swayed to give in to immediate gratification compared to those with high self-control, who would focus more on long-term values and benefits. This is partly due to the dual-processes (Chaiken & Trope, 1999) of the human thought-processing system. The two processing systems, referred to as System 1 and System 2 (Stanovich & West, 2000; Kahneman & Frederick, 2002), are responsible for governing different types of decision-making. Decisions relying on System 1 are more intuitive, involve nonconscious processes, and require low energy expenditure. Meanwhile, decisions relying on System 2 are slow, controlled, and effortful, involving intellectual reasoning (Baumeister, 2007). Being under a state of low self-control has been found to be similar to being in System 1 processing (Hamilton, Hong, & Chernev, 2007). Schmeichel, Vohs, & Baumeister (2003) showed that depletion of self-control resources resulted in lower intellectual thinking performance, while not significantly affecting performance of automatic tasks. Accordingly, decisions made under the condition of depleted resources for self-control are more quick, spontaneous, and require lower processing skills.

Studies by Pocheptsova, Amir, Dhar, & Baumeister (2007) found that individuals depleted of self-control were more likely to make inaccurate decision strategies, taking shortcuts in their thought processes instead of reasoning. Under conditions of low self-control, people were less likely to be affected by the compromise effect (Simonson, 1989), i.e. the preference for the middle option in a set of choices; more likely to succumb to asymmetric dominance effect (opting to make simple decisions instead of difficult ones as well as letting simple decisions dictate difficult decisions); and avoided decision-making altogether. Wheeler et al. (2007) concluded in their studies that people depleted of resources for self-control were more likely to adhere to counter attitudinal messages, confirming that depletion of self-control capacity reduces systematic processing and enhances heuristic processing. Not only are people with temporarily depleted self-control more likely to comply to persuasion, but also those with weak

chronic self-control abilities (Fennis, Janssen, & Vohs, 2009; de Ridder et. al., 2012), as measured by the self-control scale (Tangney, Baumeister, & Boone, 2004). These findings are consistent with earlier studies (Langer, 1992; Cialdini, 1993; Cialdini & Goldstein, 2004) which posit that people tend to comply with influence principles such as consistency (i.e. the bias of desiring to behave consistently across different situations), reciprocity (i.e. feeling obligated to return a favor), and liking, when they are under 'mindless' states. Under these states, individuals were more likely to implement simple decision heuristics. Pocheptsova et al. (2009) proved across five different studies that people with depleted resources consistently relied on simple processing methods for decision-making, namely reference dependence, reliance on attraction, and lowered the compromise effect. Pohl et al. (2013) also had similar findings in their study, where manipulated conditions of depleted resources increased the likelihood of relying on recognition as a simple decision heuristic.

The previously mentioned studies point to the fact that being depleted of self-control promotes the use of mental shortcuts in decision-making, with the purpose of reducing mental effort. For simplicity, we will refer to these mental shortcuts as 'heuristics', consistent with the term used in existing literature (Pocheptsova et al., 2009; Shah & Oppenheimer, 2008; Pohl, 2013). The earliest research on heuristics defines the term as methods or strategies that simplify decision processing and reduce effort in order to produce certain solutions (Simon, 1990). Despite vagueness and redundancy surrounding heuristics research throughout the years, Shah & Oppenheimer (2008) defined a concrete framework to explain how heuristics reduce effort for decision-makers, following just a few others before (Gigerenzer et al., 1999; Payne et al., 1993; Todd, 2000). For a method to be effectively considered an 'effort-reducing' heuristic, they should operate on one or more of the following: "examining fewer cues, reducing the difficulty associated with retrieving and storing cue values, simplifying the weighting principles for cues, integrating less information, examining fewer alternatives". For example, the elimination by aspects heuristics (Tversky, 1983) allows decision-makers to examine fewer cues by focusing on the most important information (e.g. location, cleanliness, safety, etc) and setting selection criteria for these cues. Another example, the scarcity heuristics (Brannon & Brock, 2001), says that the rarer products are viewed to be, the higher its perceived value. This heuristic reduces difficulty associated with retrieving or storing cue values by providing ease of access to information for decision-makers. Effort reduction, in this case, is obtained when information is able to be processed efficiently or has been available through other channels (Shah & Oppenheimer, 2008). When heuristics are used and how frequently they are used are also important factors to take note of, as they provide clues as to what types of behaviours these heuristics govern. Gigerenzer et al. (1999) have suggested that heuristics

are used to fit the environment structure, meanwhile Gigerenzer et al (1999) and Payne et al (1993) have conducted studies which identified certain heuristics that result in better choices.

2.2.4.2 Nudges as Decision Making Aid

Within the fields of marketing and consumer behaviour, many strategies capitalize on persuasion tactics which incorporate heuristics in order to influence consumers to make purchases or spend their money (Boyle et al, 1992; Cialdini, 1993; Fennis, Janssen, & Vohs, 2009). However, it is crucial that decision-makers do not feel coerced or forced when they are being influenced. This could otherwise result in the opposite of the desired effect (Mortensen & Allen, 2013). Consequently, discussions on the role that heuristics play in marketing has been further amplified by the emergence of the concept of 'nudging' in behavioural economics. This can be defined as the act of influencing the decision of others, without coercion, in a way that leaves them better off, (Thaler & Sunstein, 2003). While its concept and implementation was intended for use within economic welfare and organizational policy, it has found its way into the marketing field. Influencing others' choices can be done by altering how the choices are presented to decision-makers, either through alterations in the structure of choices, or the description of choices (Thaler & Sunstein, 2008). Moreover, nudging interventions can also take the form of modifications to the environment of available choices (Wansink, 2010). For example, an avid smoker who is trying to guit smoking would control their smoking intake by rationing the amount of cigarette packages bought each day, purchasing one pack per day instead of in bulk (Wertenboch, 2001). This is in line with and complements self-control theories which established that people would seek to firstly control themselves in order to adjust to their environment, and if this fails, then they attempt to control their environment (Baumeister, Heatherton, and Tice, 1994).

There are many ways to alter the structure of a choice task in order to influence the decisionmaker. Depending on the problems faced by the decision-maker, different nudging interventions may be more effective in addressing these problems (Johnson et al., 2012). For example, when a decision-maker has alternative overload due to the overwhelming number of choices available, a choice architect, or the influencer, can reduce the number of available alternatives or use technology and decision aids to assist the decision-maker (Lynch & Ariely, 2000; Cronqvist & Thaler, 2004; Cook & Song, 2009; Kling et al., 2011). When the decisionmaker has myopic procrastination, the choice architect may opt to focus only on satisficing the decision-maker or providing a limited time window for them to make a decision (O'Donoghue & Rabin, 1999; Shu & Gneezy, 2010). Another form of nudging intervention is to manipulate the description of different choices in order to influence the decision-maker, some of which containing various heuristics. Similar to altering the choice task structure, different types of alteration to choice descriptions are designed to address different problems encountered by the decision-maker. Someone with naïve allocation may benefit from the partitioning of options (Langer & Fox, 2005; Fox, Bardolet, & Lieb, 2005; Martin & Norton, 2009). Someone with attribute overload may be able to simplify their thought processing through attribute parsimony and labelling, such as the use of good or bad labels for numeric information (Peters et al., 2009). To reaffirm findings on the effectiveness of nudging interventions in influencing consumer choice, as found in the previously mentioned studies, the second research questions is constructed: 'Are nudging interventions effective in influencing decision-making for a more optimal consumption choice?'.

Research on the usage of heuristics as nudging interventions have shown that different types of heuristics are proven to be effective in influencing decision-making. Pocheptsova et al. (2009) displayed how people relied on several heuristics for decision-making: reference dependency, compromise effect, and attraction effect. These heuristics had larger effects when self-control was depleted, with the exception of the compromise effect. Wansink (2010) found that heuristics that required little decision-making and had little ambiguity (e.g. instruction to use a specific-sized plate to eat) were most effective in achieving weight-loss for mindless eaters, while heuristics with more flexibility (i.e. instruction to eat a hot meal for breakfast) were easier to comply with and were more effective compared to heuristics that were more restrictive in nature (i.e. eat a specific dish for breakfast). Similar studies regarding healthy food consumption was conducted by Salmon et al. (2014; 2015), which showed that the social proof heuristic, or the tendency to view an option preferred by others as more desirable (Gierl et al., 2008), was able to successfully promote the consumption of healthier food products compared to when no heuristic was present. Cheung et al. (2015) reaffirmed these findings in a study comparing the effects of the limited supply scarcity heuristic and popular demand scarcity heuristic, i.e. a heuristic in definition akin to that of the social proof (Gierl et al., 2008), on individual choices for more 'optimal' products. In two studies, two sets of product choices were presented, namely food products and generic products. The more healthy food product was viewed as the more optimal choice and a utilitarian product was viewed as the more optimal choice over a hedonic product. In the first study, which only included the supply scarcity heuristic, this heuristic significantly increased the choice for a healthier food product under conditions of low self-control. In the second study, the demandscarcity heuristic proved to be more effective compared to the supply-scarcity heuristic in promoting choice for the utilitarian product over the hedonic product under conditions of manipulated low self-control. In light of these findings, this thesis puts forward the third research question: 'Is a nudging intervention containing a social component more effective in

influencing consumer choice compared to a nudging intervention without a social component?'.

Each heuristic is effective in its own right, some leaving more dominant impressions on decision-makers than others. Inzlicht (2012) and Schmeichel (2010) have found decision-making under low self-control to be associated with immediate gratification, while Jacobson (2011) have also emphasized on how decision-making under low self-control is oftentimes based on descriptive norm, or norms that are executed by others (Cialdini et.al., 1991). Therefore, heuristics which contain these two elements would prove to be strong influencers, as Cheung et. al. (2015) demonstrated through the previously mentioned study. The authors concluded that a demand scarcity heuristic is associated with descriptive norm and the supply scarcity with immediate reward. The study also implied that demand scarcity, or the heuristic which contains the social element, is more potent compared to the heuristic absent of any social component. The other heuristic used, the supply scarcity heuristic, is one that relies on exclusivity and product value to drive reward sensitivity for decision-makers (Cheung, 2015). However, an earlier study on heuristic (Lynn, 1991) found that the effect that the scarcity heuristic has on reward sensitivity is only moderate.

While previous studies have shown how trait self-control capacity affects receptiveness to influence (Fennis, Janssen, & Vohs, 2009; de Ridder et. al., 2012) and how nudging interventions containing social components and descriptive norms are more effective compared to those without these components (Salmon, 2014; 2015; Cheung, 2015), there is room for further studies on how trait self-control capacity affects receptiveness to influence, particularly that due to the presence of nudging interventions in general as well as specific types of nudging interventions. Therefore, the fourth and fifth research questions are formed: 'Does individual trait self-control capacity have a moderating effect on how individuals are influenced by nudging interventions?' and 'Does individual trait self-control capacity have a moderating effect on how individuals are influenced by different nudging interventions?'.

2.3 Hypotheses

To answer the research questions within this thesis, an online experiment was conducted. Participants of this study completed an online questionnaire consisting of three surveys: a hypothetical choice task between a product hedonic in nature and a functional product, the Brief Trait Self-control Scale survey, and a survey collecting demographic and lifestyle characteristics. Participants are randomly allocated into three groups where each group will receive a different treatment: one absent of any nudging interventions, one with a nudging intervention containing a social component, and another with a nudging intervention not containing a social component. Within the confines of this study, a choice made for the functional product over the hedonic product is considered the more optimal one. Five hypotheses are investigated, where each hypothesis corresponds to each of the research question and is derived from findings of existing literature.

Firstly, consistent with findings regarding the positive correlation that trait self-control level has on well-being in several life domains, including lower tendencies for impulsive behaviour, we hypothesize that a higher level of trait self-control will result in the more optimal product choice being chosen.

Hypothesis 1:

An increase in individual trait self-control capacity leads to an increase in the probability of choosing the more optimal product choice.

Secondly, findings from existing literature have consistently established the relationship between the use of heuristics in decision-making and conditions of low self-control. Under low self-control conditions, individuals are more likely to rely on heuristics for decision-making. Because the product choice task represents a self-control dilemma, we hypothesize that the presence of heuristics in the form of a nudging intervention for the more optimal product choice will lead to respondents choosing this option.

Hypothesis 2:

The presence of nudging interventions in the product choice task leads to an increase in the probability of choosing the more optimal product choice.

Thirdly, research on heuristics and nudging interventions have emphasized the effectiveness of heuristics which contain social components in influencing decision-makers compared to those heuristics which do not contain social components. Therefore, we seek to affirm these findings and hypothesize that the social proof heuristic would yield a larger effect on the probability of choosing the more optimal product choice compared to the scarcity heuristic. *Hypothesis 3:*

The presence of the social proof heuristic compared to no heuristic leads to a larger increase in the probability of choosing the more optimal product choice, than the presence of the scarcity heuristic compared to being exposed to no heuristic.

Fourth, previous studies have pointed to the fact that not only are individuals under conditions of low self-control more susceptible to influence principles, but also those with lower trait selfcontrol capacity. Therefore, we hypothesize a moderating effect of trait self-control capacity on compliance to the nudging interventions, where the lower trait self-control capacity, the higher an individual's susceptibility to nudging interventions. This hypothesis will be tested for two control groups which include two different nudging interventions.

Hypothesis 4:

The presence of nudging interventions increases the probability of choosing the more optimal product choice when self-control score decreases.

Lastly, in forming Hypothesis 5 we also refer to Hypothesis 3, which states that the social proof heuristic would be more effective compared to the scarcity heuristic in influencing decision-making. We hypothesize that this effect would also be salient in the moderating effect of self-control capacity towards both nudging interventions, where the increase in probability for choosing the functional product choice would be larger under the presence of the social proof heuristic for each decrease in self-control capacity score.

Hypothesis 5:

The presence of the social proof heuristic, rather than the presence of the scarcity heuristic, when compared to the presence of no heuristic, leads to a larger increase in the probability of choosing the more optimal product choice when self-control score decreases.

2 Methodology & Data

3.1 Methodology

3.1.1 Experimental Design & Procedure

This study adopts a between-subject experimental design with three different treatment groups: a base treatment group absent of any nudging interventions, the first treatment group with the presence of the scarcity heuristic, which is a nudging intervention not containing any social elements, and the second treatment group with the presence of the social proof heuristic, or a nudging intervention containing a social component. Respondents are asked to complete an online survey of 27 questions and are randomly allocated into each treatment group through the Qualtrics online randomizer. In the beginning of the survey, respondents are provided with an informed consent form and notified that they will have an opportunity to participate in a lottery as an incentive for participation. Upon providing consent to participate in this study, a product choice task between a hedonic and a functional product is firstly presented to respondents, followed by a set of questions measuring trait self-control, and lastly several questions on demographic and lifestyle characteristics.

3.1.2 Specification of Variables

There are a total of 13 variables which will be included within the regression model, as summarized in Table 3.1 below.

Variable Type	Variable	Measurement Tool
Dependent	Functional Product choice	1 item product choice task (Dummy for
		type of product chosen)
Independent	I ype of nudging intervention	Statement presented under functional product in product choice task
		(Dummy for 3 treatment groups)
Moderator	Self-control score	13 item Likert scale questions of Brief
	Interaction term between self-control	Self Control Scale
	score & treatment groups	
Control	Demographics	Age, gender, education, income,
		country of residence
	Lifestyle	Living situation, laundry frequency,
		washing machine ownership,
		technological interest

Table 3.1 Summary of Variables of Probit Regression Analysis

Dependent Variable: Optimal product choice chosen

Under all three treatment groups, respondents are asked to complete a product choice task which represented a self-control dilemma: a functional versus hedonic product trade-off. In the self-control context, the functional product is viewed as the more optimal product choice for long-term well-being. The task choice is framed as a hypothetical situation where respondents had a certain amount of budget to spend on their first home furniture. They are then presented with a choice between purchasing a washing machine (representing the functional product) and a high-definition smart television set (representing the hedonic product). The washing machine is viewed as a functional product choice as it serves the purpose of hygiene within a household and the smart television set is viewed as a hedonic product choice as its primary purpose is recreation. A dummy variable of 1 represents a choice for the optimal product and 0 represents the hedonic product choice.

Independent Variable: Type of nudging intervention

A dummy variable is generated for each treatment group: 1 for no heuristic present, 2 for the scarcity heuristic treatment, and 3 for the social proof heuristic treatment. In the base treatment group, no nudging intervention is presented to respondents. In the first treatment group, a statement containing the scarcity heuristic is inserted under the functional product, represented by the statement: "Limited edition: available only this month". In the second treatment group, the social proof heuristic is presented in place of the scarcity heuristic. It is represented by the statement: "Best-selling appliance of the month: available while stock lasts". The scarcity heuristic refers to viewing a product with scarce supply as more exclusive and therefore more valuable (Brannon & Brock, 2001). The social proof heuristic refers to viewing a product highly-demanded by others as more desirable (Gierl et al., 2008).

Moderating Variable: Trait self-control capacity score

Trait self-control refers to each individual's capacity for acts of self-control which remains as a part of their disposition or personality, thus an invariant variable. In order to measure individual trait self-control capacity, the 13-item Brief Self-Control Scale (Tangney, Baumeister, & Boone, 2004) is used. All questions take the form of self-assessed Likert-scale questions, with a final output of aggregate trait self-control score ranging from 13-65 points. Domains related to self-control included within the survey are task performance, impulsive behaviour, psychological adjustment, interpersonal relationships, moral emotions, as well as related personality traits (i.e. conscientiousness and perfectionism). This measurement scale was chosen taking into account its advantages such as validity, simplicity, and length (Hasford & Bradley, 2011; de Ridder, 2012; Lindner, Nagy, & Retelsdorf, 2015). To measure the moderating effect of trait self-control score on respondents' product choice for each treatment group, an interaction term between self-control score and treatment groups will be estimated.

Control Variables: Demographics & Lifestyle

Data on demographic and lifestyle characteristics of respondents are collected to control for factors which may determine the outcome of product choice in order to generate unbiased estimates. Furthermore, these control variables will enable us to conduct explanatory analysis. Demographic characteristics collected were of gender, age, country of residence (categorized based on continent of residence), education level, and monthly income. Lifestyle characteristics focused on respondents' living situation, habits related to washing of clothes within the household (frequency of washing and ownership of washing machine), as well as one question related to interest in technological trends and gadgets.

3.1.3 Model Specification

To test the previously stated hypotheses, 4 different Probit regression models will be estimated. A Probit model is selected because the dependent variable of interest, product choice, is a binary variable indicating a choice for the more optimal, functional product or the hedonic product. Meanwhile, our independent variables are both categorical and continuous variables. The predicted value of probabilities from the Probit model will not be outside of the (0,1) interval and the notation ϕ expresses the cumulative distribution function of the standard normal distribution.

Probit
$$(y = 1 | x_{i,\dots,n}) = \Phi (\beta_0 + \beta_i + \dots + \beta_n)$$

• Model 1:

This model will include self-control score and type of nudging intervention as independent variables, and demographic characteristics as control variables.

 $\begin{aligned} &Pr(product\ choice\ =\ 1|self\ control\ score, nudge, demographics) = \\ &\Phi\ (\beta_0 + \beta_1 self\ control\ score\ +\ \beta_2 nudge\ +\ \beta_3 age\ +\ \beta_4 gender\ +\ \beta_5 education\ +\ \beta_6 income\ +\ \beta_7 residence) \end{aligned}$

• Model 2:

This model will include self-control score and type of nudging intervention as independent variables as well as lifestyle characteristics in addition to demographic characteristics as control variables.

 $\begin{aligned} &Pr(product\ choice = 1|\ self\ control\ score, nudge, demographics, lifestyle) = \\ &\Phi\left(\beta_0 + \beta_1 self\ control\ score + \beta_2 nudge + \beta_3 age + \beta_4 gender + \beta_5 education + \beta_6 income + \\ &\beta_7 residence + \beta_8 living\ situation + \beta_9 laundry\ frequency + \beta_{10} own\ washing\ machine + \\ &\beta_{11} tech\ interest) \end{aligned}$

• Model 3:

This model will include self-control score and type of nudging intervention as independent variables as well as an interaction term for these two variables in order to measure the

moderating effect of interest. As control variables, we only include demographic characteristics.

 $\begin{aligned} &Pr(prod. choice = 1 | self \ control \ score, nudge, interaction, demographics) = \\ &\Phi \left(\beta_0 + \beta_1 self \ control \ score + \beta_2 nudge \ + \beta_3 interaction \ self \ control \ score, scarcity \ heuristic \ + \\ &\beta_4 interaction \ self \ control \ score, social \ proof \ heuristic \ + \\ &\beta_5 gender \ + \\ &\beta_6 age \ + \\ &\beta_7 education \ + \\ &\beta_8 income \ + \\ &\beta_9 residence) \end{aligned}$

• Model 4:

This model will include self-control score and type of nudging intervention as independent variables as well as an interaction term for these two variables in order to measure the moderating effect of interest. As control variables, we include both demographic and lifestyle characteristics.

$$\begin{split} &Pr(prod.\,choice = 1|self\ control\ score, nudge, interaction, demographics, lifestyle) = \\ &\Phi\left(\beta_0 + \beta_1 self\ control\ score + \beta_2 nudge\ + \beta_3 interaction\ self\ control\ score, scarcity\ heuristic\ + \\ &\beta_4 interaction\ self\ control\ score, social\ proof\ heuristic\ + \\ &\beta_5 gender\ + \\ &\beta_6 age\ + \\ &\beta_7 education\ + \\ &\beta_8 income\ + \\ &\beta_9 residence\ + \\ &\beta_{10} living\ situation\ + \\ &\beta_{11} laundry\ frequency\ + \\ &\beta_{12} own\ washing\ machine\ + \\ &\beta_{13} tech\ interest) \end{split}$$

To test for the effect of self-control score and nudging interventions on product choice, stated in Hypotheses 1, 2, and 3, we will estimate Model 1 and Model 2 which differ in the independent and control variables incorporated into each model.

Hypothesis 1: An increase in individual trait self-control capacity leads to an increase in the probability of choosing the more optimal product choice.

In Models 1 and 2, this would translate into a positive and significant beta 1 coefficient of selfcontrol score.

Hypothesis 2: The presence of nudging interventions in the choice task leads to an increase in the probability of choosing the more optimal product choice.

This would translate to a positive and significant beta 2 coefficient of nudging intervention in Models 1 and 2.

Hypothesis 3: The presence of the social proof heuristic compared to no heuristic leads to a larger increase in the probability of choosing the more optimal product choice, than the presence of the scarcity heuristic compared to being exposed to no heuristic.

This would translate to a positive and significant beta 2 coefficient of both nudging interventions, as well as a larger coefficient of the social proof heuristic compared to the scarcity heuristic in Models 1 and 2.

To test for the moderating effect of self-control score on the causal effect of nudging interventions towards product choice, stated in Hypotheses 4 and 5, we will estimate Models 3 and 4 which differ in the control variables incorporated into each model.

Hypothesis 4: The presence of nudging interventions, compared to having no nudging interventions present, increases the probability of choosing the more optimal product choice, when self-control score decreases.

This translates to negative and significant beta 3 coefficients of the interaction term between self-control score and nudging intervention, as well as negative differences in average marginal effects of self-control score for both the nudging interventions compared to having no nudging intervention present in Models 3 and 4.

Hypothesis 5: The presence of the social proof heuristic, rather than the presence of the scarcity heuristic, when compared to the presence of no heuristic, leads to a larger increase in the probability of choosing the more optimal product choice when self-control score decreases.

This translates to a negative difference in average marginal effect of self-control score for the social proof heuristic compared to the scarcity heuristic in Models 3 and 4.

Figure 3.1 below visualizes the hypothesized relationship of the moderating variable with the dependent and independent variables. The relationship between the presence of heuristics and probability of choosing the optimal product choice is positive, indicated by the arrow and positive sign. This means that with the presence of heuristics, the probability of choosing the more optimal product choice increases. However, self-control capacity weakens this relationship, as it has a negative effect on compliance to nudging interventions, as indicated by the arrow and negative sign.



Figure 3.1 The Moderating Effect of Self-control Score on the Relationship Between Presence of Heuristics and Probability of Choosing the More Optimal Product Choice

3.2 Data

3.2.1 Participants and Sample Selection

A total of 261 responses to the online survey was recorded, out of which 210 complete responses were able to be included in the analysis. Fifty one observations were dropped from the sample as respondents did not complete the entire length of the questionnaire. Respondents were recruited from various online channels such as social media and survey exchange forums. Sixty-five percent of respondents were female, 32% were male, and 3% did not identify as either gender or preferred not to disclose their gender. Respondents resided in 35 different countries, with 52% of countries in Asia, 40% in Europe, and 8% in continents other than Asia and Europe.

3.2.2 Descriptive Statistics

There are a total of 13 variables that will be used within the analysis, with 4 missing values for two variables, namely the technological interest variable and washing machine ownership variable.

Control Variables

The first set of control variables include demographic characteristics of respondents. Gender is a dummy variable indicating respondents' gender with a value of 1 for female and 0 for non-female (including males and others). Age is a categorical variable with 7 categories for age ranges, with 54% of respondents being in the 25-34 age range and 24% in the 18-24 age range. Education is also a categorical variable indicating respondents' level of education, with 5 categories in total. Sixty percent of respondents completed their bachelor's education and

22% of respondents completed a masters' education or higher. Income is a categorical variable for respondents' monthly income range in Euros, with 6 categories in total. Most respondents (33%) are within the >500-1500 Euros income group. Country of residence is further classified into continent of residence for a more flexible analysis. This variable is a categorical variable with 3 categories: Asia, Europe, and Other. Fifty-two percent of respondents reside in Asia, 40% of respondents in Europe, and 8% in continents other than Asia and Europe.

The next set of control variables are several items concerning lifestyle, habits, and interests. Living situation is a categorical variable indicating respondents' current living situation, with 5 categories. Twenty nine percent of respondents described their current living situation as "Living with partner (and/or children)", while 28% of respondents described their current living situation as "Living with housemates/flatmates". Two questions regarding respondents' clothes-washing habits are asked, the first being the frequency of doing laundry within the household. This variable is also a categorical variable, with six categories. Thirty five percent of respondents claimed to do their laundry once every week, and 28% once every few days. The second question to capture respondents' clothes-washing habits is regarding to washing machine ownership. This is a dummy variable that takes value 1 if respondents own a washing machine in their household and 0 if they do not. There are four missing values for this variable. Lastly, a question was asked to assess respondents' interest in technological trends and gadgets. This is a continuous variable which takes value from 1-5 on a Likert scale, the lowest numerical value indicating the lowest level of interest in technology. There are also 4 missing values for this variable.

Independent & Moderating Variables

Type of nudging intervention is the primary independent variable within the regression model, which is represented by the different treatment groups: 1 for no heuristic present, 2 for the scarcity heuristic treatment, and 3 for the social proof heuristic treatment. Respondents are randomly allocated into each treatment group, with the following allocation proportions: 36% in treatment 1, 31% in treatment 2, and 33% in treatment 3. The moderating variable within this model is the total trait self-control score, which is a continuous variable of aggregate self-control score for 13 questions. Each question has a value of 1-5 on a Likert scale, the lowest numerical value indicating the lowest level of individual trait self-control. The average value for the individual trait self-control score is 37 points, while its lowest value is 21 points and highest value 62 points. An overview of the independent variable trait self-control score is depicted in Figure 3.2 below.



Figure 3.2. Summary of Trait Self-Control Score Frequencies within Sample

Dependent Variable

The dependent variable product choice is a dummy variable which takes value of 1 if the respondent chooses the functional product choice (washing machine) and 0 if the respondent chooses the hedonic product choice (high-definition smart television). Within the base treatment group, 33% of respondents chose the hedonic product versus 29% in the Treatment 1 group and 35% in the Treatment 2 group. A summary of the allocation of product choice for each treatment group can be found in Table 3.2 below.

Product Choice	Control Group	Scarcity Heuristic	Social Proof Heuristic
Washing Machine	33%	29%	35%
Television	67%	71%	65%

Table 3.2 Allocation of Product Choice for Each Treatment Group

3 Results & Analysis

4.1 Hypothesis Testing

Firstly, we assess Hypothesis 1, which states that the probability of choosing the functional product choice would increase with an increase in trait self-control score. We estimate Model 1 which includes demographic characteristics as control variables and find, as implied by the Probit regression results found in Table 4.1 below, that an increase in self-control score decreases the probability of choosing the more optimal product choice, keeping all other factors fixed. However, this effect is not significant at the 10% significance level. We include additional control variables into the model, namely lifestyle characteristics, to estimate Model 2. After estimating this model, we were still unable to find any significant effect of self-control score on product choice. Therefore, we are not able to confirm Hypothesis 1 according to Models 1 and 2.

To assess Hypothesis 2, we refer to the same regression outputs from Models 1 and 2. This hypothesis aims to test whether the presence of nudging interventions will increase the probability of choosing the functional product choice. In Model 1, we observe that the presence of both the scarcity and social proof heuristics as nudging interventions, compared to not having any nudging interventions present, increases the probability of choosing the functional product choice, keeping all other factors constant. This effect is not significant at the 10% significance level. For Model 2, we include both lifestyle characteristics and demographic characteristics as control variables. Our findings showed that the presence of both the scarcity and social proof heuristics as nudging interventions, compared to not having any nudging interventions present, increases the probability of choosing the functional product choice, ceteris paribus. However, this effect is also not significant at the 10% significance level, thus we are unable to confirm Hypothesis 2 according to Models 1 and 2.

	Model 1	Model 2	Model 3	Model 4
Variables	Coefficients	Coefficients	Coefficients	Coefficients
Self-Control Score	-0.011	-0.004	0.059*	0.096**
	(0.017)	(0.018)	(0.035)	(0.040)
Treatment Group: Nudging Intervention				
Scarcity Heuristic	0.312	0.386	3.350*	6.281***
	(0.239)	(0.260)	(1.863)	(2.234)
Social Proof Heuristic	0.131	0.282	4.190**	5.154**
	(0.240)	(0.276)	(1.710)	(2.013)
Interaction self-control score-control			0.000	0.000

 Table 4.1 Probit Regression Results for the Relationship Between Self-Control Capacity, Nudging

 Interventions, and Product Choice

			(0.000)	(0.000)
Interaction self-control score-scarcity			-0.081*	-0.156***
			(0.049)	(0.059)
Interaction self-control score-social			0.400**	0.400**
proor			-0.109**	-0.129**
			(0.045)	(0.053)
Gender	o 4 4 -	0.404	0.007	
Female	0.117	0.161	0.207	0.308
_	(0.217)	(0.244)	(0.220)	(0.252)
Age				
25-34	0.107	0.467	0.096	0.507
	(0.265)	(0.317)	(0.267)	(0.319)
35-44	0.266	0.063	0.394	0.251
	(0.561)	(0.572)	(0.576)	(0.566)
45-54	-0.233	-0.188	-0.183	-0.264
	(0.420)	(0.575)	(0.418)	(0.548)
55-64	-0.974*	-0.971	-1.108**	-0.977
	(0.519)	(0.619)	(0.536)	(0.628)
65 and above	-0.239	-0.189	-0.313	-0.004
	(0.575)	(0.799)	(0.622)	(0.843)
Prefer not to disclose	4.910***		4.867***	-
	(0.521)		(0.543)	
Income				
>1500-2500	-0.332	-0.411	-0.330	-0.407
	(0.305)	(0.383)	(0.310)	(0.394)
>2500-3500	-0.495	-0.987*	-0.516	-1.236**
	(0.473)	(0.513)	(0.463)	(0.513)
>3500-4500	0.822	1.050	0.974	1.358*
	(0.630)	(0.706)	(0.707)	(0.787)
>4500	0.174	0.065	0.215	0.019
	(0.275)	(0.328)	(0.279)	(0.336)
Prefer not to disclose	0 291	0.308	0.354	0.392
	(0.318)	(0.372)	(0.328)	(0.375)
Education	(0.010)	(0.072)	(0.020)	(0.070)
Institute/Applied School/Applied Liniv	-0.046	0.047	-0 157	0 099
	(0.491)	(0.601)	(0.518)	(0.629)
I Iniversity (bachelors)	(0.491)	(0.001)	0.269	0.023)
	(0.450)	(0.610)	(0.477)	(0.400
University (masters and higher)	(0.439)	(0.010)	(0.477)	0.855
Oniversity (masters and higher)	0.373	0.572	0.039	(0.619)
	(0.463)	(0.596)	(0.494)	(0.618)
Other	-4.048***		-3.889***	
	(1.039)		(0.978)	
Continent				
Europe	0.997***	1.002***	1.009***	1.024***
	(0.231)	(0.297)	(0.233)	(0.294)
Other	-0.273	-0.347	-0.374	-0.458
	(0.426)	(0.498)	(0.420)	(0.493)
Living Situation				
Living with guardians/parents		-0.384		-0.373
		(0.405)		(0.413)
Living with housemates/flatmates		0.560		0.724*

		(0.381)		(0.395)
Living with partner (and/or children)		0.314		0.248
		(0.393)		(0.400)
Other		0.416		0.458
		(0.550)		(0.606)
Laundry Frequency				
Everyday		0.520		0.861*
		(0.401)		(0.453)
Once a month or less		-0.323		-0.136
		(0.531)		(0.539)
Once a week		0.702**		0.772**
		(0.326)		(0.328)
Once very few days		-0.428		-0.412
		(0.340)		(0.349)
Washing Machine Ownership				
Yes		1.008***		1.019***
		(0.334)		(0.343)
Interest in technology				
Tech interest score		-0.324***		-0.314***
		(0.097)		(0.101)
Constant	-0.010	-0.890	-2.687*	-4.994***
	(0.861)	(1.019)	(1.484)	(1.783)
Observations	210	203	210	203
Log-Likelihood	-113.92484	-92.867704	-111.37034	-89.084097

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

We assess Hypothesis 3 by interpreting the coefficients for both nudging interventions for Models 1 and 2, which can be found in Table 4.2 below. This hypothesis states that the social proof heuristic is more effective compared to the scarcity heuristic as a nudging intervention for product choice. Because we were unable to find any significant effect from Models 1 and 2, we also fail to confirm Hypothesis 3 with these models.

 Table 4.2 Average Marginal Effect of Probit Regression Results for the Relationship Between Self

 Control Capacity, Nudging Interventions, and Product Choice

Variables	Model 1 Marginal Effect	Model 2 Marginal Effect	Model 3 Marginal Effect	Model 4 Marginal Effect
Self-Control Score	-0.003	-0.001	0.018*	0.023**
	(0.005)	(0.005)	(0.010)	(0.010)
Treatment Group: Nudging Intervention				
Scarcity Heuristic	0.095	0.099	0.455***	0.633***
	(0.072)	(0.066)	(0.176)	(0.107)
Social Proof Heuristic	0.041	0.073	0.603***	0.464***
	(0.075)	(0.070)	(0.081)	(0.177)

Interaction: Self-control score-scarcity

Interaction: Self-control score-social proof

Gender				
Female	0.036	0.042	0.063	0.076
	(0.067)	(0.064)	(0.067)	(0.064)
Age				
25-34	0.032	0.115	0.028	0.118
	(0.079)	(0.080)	(0.078)	(0.075)
35-44	0.076	0.016	0.106	0.060
	(0.154)	(0.148)	(0.145)	(0.135)
45-54	-0.073	-0.050	-0.056	-0.067
	(0.133)	(0.153)	(0.128)	(0.139)
55-64	-0.316**	-0 258*	-0.348**	-0 248
	(0.158)	(0.156)	(0.154)	(0.153)
65 and above	-0.075	-0.050	-0.097	-0.001
	(0.184)	(0.212)	(0.196)	(0,209)
Prefer not to disclose	0.337***	(0.212)	0.334***	(0.200)
	(0.070)		(0.068)	-
Incomo	(0.070)		(0.008)	
111COME	0 100	0 107	0 106	0.000
>1500-2500	-0.109	-0.107	-0.106	-0.099
	(0.099)	(0.099)	(0.099)	(0.095)
>2500-3500	-0.164	-0.263**	-0.167	-0.309***
	(0.158)	(0.128)	(0.150)	(0.116)
>3500-4500	0.207	0.208*	0.232*	0.233**
	(0.126)	(0.110)	(0.125)	(0.096)
>4500	0.053	0.016	0.063	0.004
	(0.084)	(0.081)	(0.083)	(0.078)
Prefer not to disclose	0.086	0.073	0.101	0.085
	(0.093)	(0.087)	(0.092)	(0.081)
Education				
Institute/Applied	0.045	0.040	0.054	0.000
School/Applied Univ.	-0.015	0.013	-0.051	0.026
	(0.162)	(0.166)	(0.167)	(0.167)
University (bachelors)	0.091	0.105	0.083	0.119
Liniversity (mentant and	(0.149)	(0.167)	(0.151)	(0.163)
bigher)	0 174	0 150	0 184	0.210
night)	(0.147)	(0.162)	(0.154)	(0.160)
Other	-0.565***	(0.102)	-0.569***	(0.100)
Other	-0.303		-0.309	
Continent	(0.140)		(0.142)	
	0.005***	0.054***	0 000***	0.045***
Europe	0.295	0.251	0.290	0.245
	(0.062)	(0.068)	(0.061)	(0.064)
Other	-0.098	-0.103	-0.131	-0.129
	(0.153)	(0.149)	(0.146)	(0.139)
Living Situation				
Living with guardians/parents		-0.109		-0.102
Listin er stille		(0.111)		(0.109)
LIVING WITH		0 140		0 170*
nousemalesmalmales		(0.140		(0,000)
		(0.101)		(0.099)

Living with partner (and/or				
children)		0.082		0.064
		(0.105)		(0.104)
Other		0.107		0.114
		(0.136)		(0.144)
Laundry Frequency				
Everyday		0.132		0.202**
		(0.099)		(0.100)
Once a month or less		-0.090		-0.036
		(0.149)		(0.143)
Once a week		0.172**		0.184**
		(0.079)		(0.078)
Once very few days		-0.119		-0.109
		(0.094)		(0.092)
Washing Machine Ownership				
Yes		0.272***		0.263***
		(0.085)		(0.085)
Interest in technology				
Tech interest score		-0.083***		-0.076***
		(0.023)		(0.023)
Observations	210	203	210	203
Log-Likelihood Standard errors in parentheses	-113.92484	-92.867704	-111.37034	-89.084097
*** p<0.01, ** p<0.05, * p<0.1				

Table 4.3 Average Marginal Effect of Interaction Term Between Self-Control Score and Nudging Intervention For Model 3

Self-Control Score	Model 3				
Nudging Intervention	Contrast dy/dx	Delta- Method SE	95% Conf	.Interval	
Scarcity vs Control	-0.0238	0.0136	-0.0504	-0.0277	
Social Proof vs Control	-0.0323	0.0125	-0.0568	-0.0078	
Social Proof vs Scarcity	-0.0085	0.0120	-0.0321	0.0151	

Table 4.4 Average Marginal Effect of Interaction Term Between	Self-Control	Score and	Nudging
Intervention For Model 4			

Self-Control Score	Model 4			
Nudging Intervention	Contrast dy/dx	Delta- Method SE	95% Conf	Interval
Scarcity vs Control	-0.0365	0.0127	-0.0613	-0.0117
Social Proof vs Control	-0.0308	0.0117	-0.0538	-0.0080
Social Proof vs Scarcity	0.0056	0.0125	-0.0189	0.0302

We go on to test for Hypotheses 4 by estimating Models 3 and 4. This hypothesis states that the presence of nudging interventions increases the probability of choosing the more optimal product choice when self-control score decreases. We firstly estimate Model 3. We refer to the beta 3 coefficients of the interaction term between nudging interventions and self-control score in Table 4.1 and find that an increase in self-control score decreases the probability of choosing the functional product choice when both nudging interventions are present, ceteris paribus. This effect is significant at 10% significance level for the scarcity heuristic and at 5% significance level for the social proof heuristic, which enables us to confirm Hypothesis 4. From Table 4.3, we find that the average marginal effect of self-control score on the probability of choosing the more optimal product choice decreases by 2.38 percentage points when the scarcity heuristic is present, compared to when no heuristic is present, keeping all other factors constant. With the social proof heuristic, we find that the average marginal effect of self-control score on the probability of choosing the more optimal product choice decreases by 3.23 percentage points when the heuristic is present compared to when it is not present, ceteris paribus. This result is in line with Hypothesis 4 which translates to negative differences in the average marginal effects of self-control score when nudging interventions are present compared to having no nudging intervention present. We then estimate Model 4, where we include all available control variables into the model and interpret the sign and significance of the coefficient for the interaction term between self-control score and nudging intervention. Similar to findings from Model 3, we find negative and significant beta 3 coefficients for the interaction term between self-control score and nudging intervention, ceteris paribus. This effect is significant at 1% significance level for the scarcity heuristic and 5% significance level for the social proof heuristic. We also find that having the scarcity and social proof heuristic present, compared to having no heuristic present, decreases the average marginal effect of self-control score on the probability of choosing the more optimal product choice by 3.65 and 3.08 percentage points, respectively. To conclude, estimations from Model 4 also allows us to confirm Hypothesis 4 that self-control score plays a moderating role between the presence of nudging interventions and the probability of choosing choose the functional product choice.

Hypothesis 5 states that the moderating effect of self-control score for product choice would be larger for the social proof heuristic compared to the scarcity heuristic, in line with Hypothesis 3, which states that the social proof heuristic is a more effective nudging intervention compared to the scarcity heuristic. To test for this, we interpret the difference in average marginal effect of self-control score on the probability of choosing the functional product choice when the scarcity heuristic is present compared to when the social proof heuristic is present in Models 3 and 4. In Model 3, we find that the average marginal effect of self-control score on the functional product choice is 0.85

percentage points lower for the social proof heuristic compared to the scarcity heuristic. This implies that the presence of the social proof heuristic is more effective compared to the scarcity heuristic, which confirms Hypothesis 5 based on findings from Model 3. In Model 4, we find the average marginal effect of self-control score on the probability of choosing the functional product choice is 0.56 percentage points higher for the social proof heuristic compared to the scarcity heuristic. This indicates that the scarcity heuristic is a more effective nudging intervention, as the average marginal effect of self-control score is smaller when the scarcity heuristic is present. Therefore, we are unable to confirm Hypothesis 5 with estimates from Model 4.

To further clarify interpretation of our analysis, two graphs illustrating the predictive margins of the probability of choosing the functional product choice for each treatment group over different levels of self-control score are generated, each for Model 3 and Model 4, which are found in Figure 4.1 and Figure 4.2 below. The blue line within the figure represents the predictive margin for the scarcity heuristic and the red line shows the predictive margin for the social proof heuristic. We find that the predicted probability of choosing the more optimal product choice tends to be larger towards more extreme values of self-control score compared to moderate levels of self-control score, coming closer to the value 1 for both nudging interventions. Moreover, more extreme values of self-control score tend to exhibit larger confidence intervals of marginal effect. This could be caused by biased estimates of the self-control scale, which has previously been criticized for inaccurately capturing more extreme levels of trait self-control (Hasford & Bradley, 2011).

Interestingly, we find that for higher levels of trait self-control, the predicted probability of choosing the more optimal product choice for both of the nudging interventions decreases. The presence of nudging interventions appears to have the opposite effect for higher levels of self-control. A possible explanation for this could be that respondents with higher levels of self-control are more aware of the presence of nudging interventions during the choice task, leading them to make a choice according to their true preferences and not according to influence. Furthermore, respondents may associate subtle promotional messages as negative (e.g. due to feeling coerced), thus opting for the choice absent of nudging interventions instead.



Figure 4.1 Graph for Predictive Margins of Nudging Intervention Over Self-Control Score With 95% Cls for Model 3



Figure 4.2 Graph for Predictive Margins of Nudging Intervention Over Self-Control Score With 95% Cls for Model 4

Lastly, we find that for Model 3, the social proof heuristic more effectively increases the probability of choosing the more optimal product choice compared to the scarcity heuristic for moderate to high levels of trait self-control. Meanwhile, for Model 4, we find that the scarcity heuristic more effectively increases the probability of choosing the functional product choice for low to moderate levels of trait self-control. However, the differences between the average marginal effect of the interaction between self-control score and both nudging interventions are relatively small in magnitude and therefore may be negligible. This finding is unexpected and contradicts Hypothesis 5. A possible explanation for this could be that factors other than the social component of the heuristics affect respondents' receptiveness towards the different nudging interventions, such as fluency, which will be elaborated further within the discussions of this thesis.

4.2 Model Evaluation & Robustness Check

For each set of models, adding more control variables increases its explanatory power. As a measure of fit for the models, we refer to the log-likelihood value for each model. For Model 1, including lifestyle characteristics in addition to demographic characteristics as control variables increases its log-likelihood from -113.925 to -92.868. Meanwhile, adding the same set of variables into Model 3 to have Model 4 also increases its predictive power, with an increase from -111.370 log-likelihood to -89.084. Moreover, a joint significance test was conducted on all control variables and we can reject the null hypothesis that the variables are not jointly significant at 1% significance level, with a p-value of 0.000. We conduct the same test for both sets of demographic characteristics and lifestyle characteristics independently and find that each set of variables are jointly significant at 5% significance level. Detailed results on the model evaluation test can be found in Appendix A of this thesis.

To evaluate the robustness of our findings, we test for any differences in the frequencies of optimal product choice made between treatment groups with the chi-squared test with contingency tables. However, we were not able to reject the null hypothesis that the proportion of choosing the functional product choice is the same in all three treatment groups. We also attempt to test for any differences in frequencies of optimal product choice for different levels of self-control score. We generate self-control score as categorical variables with two different categories: low self-control and moderate to high self-control. Based on the chi-squared test with contingency tables, we are able to reject the null hypothesis that there are no differences in proportion of choosing the functional product choice across the different self-control levels at the 10% significance level, with a p-value of 0.077. Furthermore, we measure the correlation between the dependent variable product choice with our independent variables self-control score and type of nudging intervention. Based on the Pearson's correlation coefficients, we

were unable to establish any significant correlation between the variables. Lastly, we conduct a joint F-test for the interaction terms of the two nudging interventions with self-control score and find that both variables are jointly significant at 5% significance level, with a p-value of 0.013. These results are in line with findings which confirmed Hypotheses 4. An overview of robustness check results can be found within Appendix A of this thesis.

4.3 Explanatory Analysis

Demographic Characteristics

We further interpret our findings by analyzing the effect that the control variables have on product choice for Models 3 and 4. For Model 3, we find that being in the '55-64' age category compared to being in the '18-24' age category decreases the probability of choosing the functional product choice by 34.755 percentage points. Furthermore, we find that being in the 'prefer not to disclose' age category compared to being in the '18-24' age category increases the probability of choosing the functional product choice by 33.401 percentage points, ceteris paribus. These effects are significant at 5% and 1% significance levels, respectively. While in Model 4, we find no significant effect of age on product choice. We must note that due to the few number of observations within the '55-64' and 'prefer not to disclose' age categories, the estimates for these age groups from Model 3 could be biased.

Next, we take a look at the variable income. Model 3 found no significant effect of income on product choice, while Model 4 found that being in income category '>2500-3500' compared to being in category '500 or lower' increases the probability of choosing the more optimal product choice by 30.932 percentage points, keeping all other factors constant. This effect is significant at 5% significance level. When estimating the variable education with Model 3, we find that being in the education category 'Other' compared to being in education category 'High School' significantly increases the probability of choosing the functional product choice by 20.971 percentage points, at 1% significance level. Keeping in mind the few number of observations within this category, this estimate could also be biased. On the contrary, Model 4 found no significant effect of education on product choice. Lastly, we interpret the continent of residence variable and find that for both Models 3 and 4, living in Europe, compared to living in Asia, increases the probability of choosing the functional product choice by 29.036 and 24.470 percentage points, ceteris paribus. This effect is significant at 1% significance level.

Lifestyle Characteristics

To interpret the effects of lifestyle characteristics, we firstly interpret the living situation variable. We find that living with housemates/flatmates, compared to living alone, increases the probability of choosing the more optimal product choice by 17.046 percentage points,

ceteris paribus. This effect is significant at 10% significance level. No other significant effect for living situation was found. Next, we interpret the variable laundry frequency. We find that doing laundry every day, compared to 2-3 times a month, increases the probability of choosing the more optimal product choice by 20.165 percentage points, ceteris paribus. Doing laundry once a week compared to 2-3 times a month also increases probability to choose the functional product by 18.380 percentage points. Both these effects are significant at 5% significance level. Moreover, owning a washing machine compared to not owning a washing machine significantly increases the probability of choosing the more optimal product by 26.268 percentage points at 1% significance level, ceteris paribus. Lastly, interest in technological trends and gadgets significantly decreases the probability of choosing the functional product choice by 7.640 percentage points, ceteris paribus.

4 Conclusion & Discussions

The main questions for this research stem from findings of previous studies which established a negative relationship between individual self-control and the use of heuristics in decisionmaking. Various studies have also delved into the topic of heuristics and how different methods affect decision-making, but few have reached a consensus on the key success factors of an effective heuristic for nudging interventions. The current research aims to contribute to self-control and heuristics research by addressing two main questions: 'How does trait self-control moderate receptiveness towards different types of heuristics?' and 'Is a social component a key success factor for a heuristic to be an effective nudging intervention in decision-making?'.

Findings from our hypotheses testing suggest that trait self-control capacity indeed plays a moderating role between compliance towards nudging interventions and decision-making, where the lower individual self-control score, the higher the compliance towards the nudging interventions. However, we were not able to confirm that the nudging intervention containing the social component (the social proof heuristic) was a more effective nudging intervention compared to the nudging intervention without the social component (the scarcity heuristic). Findings on this hypothesis showed mixed results, where one of our models was able to confirm this hypothesis, but upon the inclusion of additional control variables, failed to do so.

5.1 Implications

Findings of the current study could have several implications. Firstly, from the consumer behaviour perspective, it is well-established that heuristics have been commonly used to influence consumers in making purchasing decisions (Wasnick et al., 2009; Salmon, 2014; Cheung, 2015). With the spread of digitization and increasing competition in business, (EY, 2011; Brilhuis-Meijer, 2016) providing consumers with the best-quality products and services through the most efficient means has become increasingly important. This includes enabling consumers to make purchasing decisions according to their needs as efficiently as possible, such as through the integration of nudges and technology.

Not only are use of heuristics in decision-making beneficial for consumer utility and business growth, but it may also aid decision-making for more virtuous purposes. From the policy perspective, findings from this study may also contribute insights on how to design better nudges in welfare policies. Existing studies have shown how low self-control can be utilized to influence people to make more optimal choices, such as healthier food choices or more utilitarian products (Salmon, 2015; Cheung, 2015), instead of relying on individual self-control to choose the more virtuous choice.

Information on demographic profiling which can be related to trait self-control may provide insights on how to best design specifically targeted nudging interventions, such as for specific market segmentations or demographic profiles. Moreover, information on what elements are key for effective nudging interventions is useful to constructing relevant content of nudging interventions.

5.2 Limitations and Future Research

Previous studies on heuristics have highlighted the potency of heuristics containing social components, suggesting its strength lies in the descriptive norm which it adopts (Cheung, 2015; Salmon, 2015). While we seek to explore and reaffirm this finding, it appears that our findings showed mixed results, which could be driven by factors other than the descriptive norm, such as fluency. For example, frequent exposure to advertising of one of the products or the terms and statements used for each nudging intervention could affect which of the product choices are more easily processed by respondents, driving them to choose that option (Labroo & Pocheptsova, 2016; Pocheptsova et. al., 2009). To minimize this, future studies could obtain a more homogenous sample of respondents to observe the desired effect.

This study uses a one-shot and binary hypothetical choice task, which limits the number of measures and variables that can be observed. For a more comprehensive analysis and to better reflect conditions of day-to-day reality which present decision-makers with multiple choices, it is recommended that future studies broaden the choice list used, including a mix of products and attributes for decision-makers to consider (e.g. price and specific product attributes). Moreover, an actual choice task instead of a hypothetical one would be able to better reflect respondents' true preferences, despite the current study providing incentives to one random respondent to achieve motivation and believability.

Lastly, this study uses the Brief Self-Control Scale (Tangney, Baumeister, Tice, 2004) as a measure of self-control capacity. While this scale has many advantages, it produces an aggregate output of total self-control scale. Using other robust measurement tools which can produce multi-dimensional scores of self-control across various domains may provide additional insight to existing literature. Moreover, the Brief Self-Control Scale may be a less accurate measure for more extreme values of self-control score (Hasford & Bradley, 2011). Future studies can opt to use other measures accurate for all levels of self-control.

Appendices

APPENDIX A.

Evaluation and Robustness Check of Probit Regression Model for the Relationship Between Self-Control Capacity, Nudging Interventions, and Product Choice

Table A.1. Chi-squared Contingency Table for Product Choice & Nudging Intervention

	Control	Scarcity	Social Proof
Television	25	19	24
Washing Machine	50	47	45
Pearson Chi-square P-value	0.6020 0.740		

Table A.2. Chi-squared Contingency Table for Product Choice & Self-Control Score

	Low Self-Control	Moderate to High Self-Control
Television	10	58
Washing Machine	10	132
Pearson Chi-square P-value	3.1340 0.077*	
*** p<0.01, ** p<0.05, * p<	:0.1	

Table A.3. Pearson's Correlation Coefficient for Product Choice & Nudging Intervention

Pearson's Correlation Coefficient	P-value
-0.0116	0.8674

Table A.4. Joint Significance Test Results for Demographic & Lifestyles Characteristics, AsWell As Interaction Terms for Self-Control Score & Nudging Interventions

Variables	P-value
Demographic Characteristics	0,0017**
Lifestyle Characteristics	0,0019**
Demographic & Lifestyle Characteristics	0,0000***
Interactions Self-Control Score-Scarcity & Self-Control Score-Social Proof	0,0133**
*** p<0.01, ** p<0.05, * p<0.1	

APPENDIX B.

Brief Self-Control Scale Questionnaire

Table B.1 The Brief Self-Control Scale Questionnaire (Tangney, Baumeister, Tice, 2004)

Below you will read several statements. Please indicate for each statement how well it describes you, from score 1 (not at all like me) to 5 (very much like me).

	Not at all (1)	(2)	(3)	(4)	Very much (5)
1. I am good at resisting temptation.					
2. I have a hard time breaking bad habits.					
3. I am lazy.				-	
4. I say inappropriate things.					
5. I do certain things that are bad for me, if they are fun.					
6. I refuse things that are bad for me.					
7. I wish I had more self-discipline.					
8. People would say that I have iron self-discipline.					
9. Pleasure and fun sometimes keep me from getting work done.					
10. I have trouble concentrating.					
11. I am able to work effectively toward long-term goals.					
12. Sometimes I can't stop myself from doing something, even if I know it is wrong.					
13. I often act without thinking through all the alternatives.					

References

- Achtziger, A., Hubert, M., Kenning, P., Raab, G., & Reisch, L. (2015). Debt out of control: The links between self-control, compulsive buying, and real debts. *Journal of Economic Psychology*, *49*, 141-149.
- Avakame, E. F. (1998). Intergenerational transmission of violence, self-control, and conjugal violence: A comparative analysis of physical violence and psychological aggression. *Violence and victims*, *13*(3), 301.
- Baumeister, R. F., Heatherton, T. F., & Tice, D. M. (1994). *Losing control: How and why people fail at self-regulation*. Academic press.
- Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource?. *Journal of personality and social psychology*, 74(5), 1252.
- Baumeister, R. F. (2002). Yielding to temptation: Self-control failure, impulsive purchasing, and consumer behaviour. *Journal of consumer Research*, *28*(4), 670-676.
- Baumeister, R. F., Vohs, K. D., & Tice, D. M. (2007). The strength model of selfcontrol. *Current directions in psychological science*, *16*(6), 351-355.
- Boyle, B., Dwyer, F. R., Robicheaux, R. A., & Simpson, J. T. (1992). Influence strategies in marketing channels: Measures and use in different relationship structures. *Journal of Marketing Research*, 29(4), 462-473.
- Brandon, J. E., Oescher, J., & Loftin, J. M. (1990). The self-control questionnaire: An assessment. *Health Values*, *14*(3), 3-9.
- Brannon, L. A., & Brock, T. C. (2001). Limiting time for responding enhances behaviour corresponding to the merits of compliance appeals: Refutations of heuristic-cue theory in service and consumer settings. *Journal of Consumer Psychology*, *10*(3), 135-146.
- Brilhuis-Meijer, E., Pigosso, D. C., & McAloone, T. C. (2016). Integrating product and technology development: A proposed reference model for dual innovation. *Procedia Cirp*, 50, 32-37.
- Burton Jr, V. S., Cullen, F. T., Evans, T. D., Alarid, L. F., & Dunaway, R. G. (1998). Gender, self-control, and crime. *Journal of Research in Crime and Delinquency*, *35*(2), 123-147.
- Carver, C. S., & Scheier, M. F. (1981). The self-attention-induced feedback loop and social facilitation. *Journal of Experimental Social Psychology*, *17*(6), 545-568.
- Carver, C. S., & Scheier, M. F. (2002). Control processes and self-organization as complementary principles underlying behaviour. *Personality and social psychology review*, 6(4), 304-315.

- Chaiken, S., & Trope, Y. (Eds.). (1999). *Dual-process theories in social psychology*. Guilford Press.
- Cheung, T. T., Kroese, F. M., Fennis, B. M., & De Ridder, D. T. (2015). Put a limit on it: The protective effects of scarcity heuristics when self-control is low. *Health psychology open*, *2*(2), 2055102915615046.
- Cialdini, R. B., Kallgren, C. A., & Reno, R. R. (1991). A focus theory of normative conduct: A theoretical refinement and reevaluation of the role of norms in human behavior.In Advances in experimental social psychology (Vol. 24, pp. 201-234). Academic Press.

Cialdini, R. B., & Cialdini, R. B. (1993). Influence: The psychology of persuasion.

- Cialdini, R. B., & Goldstein, N. J. (2004). Social influence: Compliance and conformity. *Annu. Rev. Psychol.*, *55*, 591-621.
- Cook, D. J., & Song, W. (2009). Ambient intelligence and wearable computing: sensors on the body, in the home, and beyond. *Journal of ambient intelligence and smart environments*, *1*(2), 83-86.
- Cook, M., Young, A., Taylor, D., & Bedford, A. P. (1998). Personality correlates of alcohol consumption. *Personality and Individual Differences*, *24*(5), 641-647.
- Cronqvist, H., & Thaler, R. H. (2004). Design choices in privatized social-security systems: Learning from the Swedish experience. *American Economic Review*, 94(2), 424-428.
- de Ridder, D. T., & Lensvelt-Mulders, G. (2012). Taking stock of self-control: A meta-analysis of how trait self-control relates to a wide range of behaviours. In *Self-Regulation and Self-Control* (pp. 221-274). Routledge.
- de Ridder, D. T., de Boer, B. J., Lugtig, P., Bakker, A. B., & van Hooft, E. A. (2011). Not doing bad things is not equivalent to doing the right thing: Distinguishing between inhibitory and initiatory self-control. *Personality and Individual Differences*, *50*(7), 1006-1011.
- Eisenberg, N., Fabes, R. A., Shepard, S. A., Murphy, B. C., Guthrie, I. K., Jones, S., ... & Maszk, P. (1997). Contemporaneous and longitudinal prediction of children's social functioning from regulation and emotionality. *Child development*, 68(4), 642-664.
- Fabes, R. A., Eisenberg, N., Jones, S., Smith, M., Guthrie, I., Poulin, R., ... & Friedman, J. (1999). Regulation, emotionality, and preschoolers' socially competent peer interactions. *Child development*, 70(2), 432-442.
- Fagen, S. A., Long, N. J., & Stevens, D. J. (1975). Teaching children self-control: Preventing emotional and learning problems in the elementary school. Merrill Publishing Company.
- Fee, R. L., & Tangney, J. P. (2000). Procrastination: A means of avoiding shame or guilt?. *Journal of Social Behaviour and Personality*, *15*(5), 167.

- Feldmann, S. C., Martinez-Pons, M., & Shaham, D. (1995). The relationship of self-efficacy, self-regulation, and collaborative verbal behaviour with grades: Preliminary findings. *Psychological Reports*, 77(3), 971-978.
- Fennis, B. M., Janssen, L., & Vohs, K. D. (2009). Acts of benevolence: A limited-resource account of compliance with charitable requests. *Journal of Consumer Research*, 35(6), 906-924.
- Ferrari, J. R., Stevens, E. B., & Jason, L. A. (2009). The relationship of self-control and abstinence maintenance: An exploratory analysis of self-regulation. *Journal of groups in addiction & recovery*, *4*(1/2), 32.
- Fox, C. R., Bardolet, D., & Lieb, D. (2005). Partition dependence in decision analysis, resource allocation, and consumer choice. In *Experimental business research* (pp. 229-251). Springer, Boston, MA.
- Freud, S. (1930). Civilization and its discontents (J. Riviere, Trans.).
- Gailliot, M. T., Baumeister, R. F., DeWall, C. N., Maner, J. K., Plant, E. A., Tice, D. M., ... & Schmeichel, B. J. (2007). Self-control relies on glucose as a limited energy source: willpower is more than a metaphor. Journal of personality and social psychology, 92(2), 325.
- Gierl, H., Plantsch, M., & Schweidler, J. (2008). Scarcity effects on sales volume in retail. *The International Review of Retail, Distribution and Consumer Research*, *18*(1), 45-61.
- Gigerenzer, G., & Todd, P. M. (1999). *Simple heuristics that make us smart*. Oxford University Press, USA.
- Gilbert, D. T., Krull, D. S., & Pelham, B. W. (1988). Of thoughts unspoken: Social inference and the self-regulation of behaviour. *Journal of Personality and Social Psychology*, *55*(5), 685.
- Gottfredson, M. R., & Hirschi, T. (1990). A general theory of crime. Stanford University Press.
- Gough, H. G. (1987). *California psychological inventory: Administrator's guide*. Consulting Psychologists Press.
- Hamilton, R., Hong, J., & Chernev, A. (2007). Perceptual focus effects in choice. *Journal of Consumer Research*, *34*(2), 187-199.
- Hardisty, D. J., Johnson, E. J., & Weber, E. U. (2010). A dirty word or a dirty world? Attribute framing, political affiliation, and query theory. *Psychological Science*, *21*(1), 86-92.
- Hasford, J., & Bradley, K. D. (2011). Validating measures of self-control via Rasch measurement. *Journal of Applied Business Research*, 27(6), 45.

- Honkanen, P., Olsen, S. O., Verplanken, B., & Tuu, H. H. (2012). Reflective and impulsive influences on unhealthy snacking. The moderating effects of food related self-control. *Appetite*, *58*(2), 616-622.
- Ingleton, R., Ozler, Y., & Thomas, P. (2016). The Digitization of Everything: How Organizations must Adapt to Changing Consumer Behavior, EY.
- Inzlicht, M., & Schmeichel, B. J. (2012). What is ego depletion? Toward a mechanistic revision of the resource model of self-control. *Perspectives on Psychological Science*, 7(5), 450-463.
- Inzlicht, M., Schmeichel, B. J., & Macrae, C. N. (2014). Why self-control seems (but may not be) limited. *Trends in cognitive sciences*, *18*(3), 127-133.
- Jacobson, R. P., Mortensen, C. R., & Cialdini, R. B. (2011). Bodies obliged and unbound: Differentiated response tendencies for injunctive and descriptive social norms. *Journal of personality and social psychology*, *100*(3), 433.
- Johnson, E. J., Shu, S. B., Dellaert, B. G., Fox, C., Goldstein, D. G., Häubl, G., ... & Wansink,
 B. (2012). Beyond nudges: Tools of a choice architecture. *Marketing Letters*, 23(2), 487-504.
- Kahneman, D., & Frederick, S. (2002). Representativeness revisited: Attribute substitution in intuitive judgment. *Heuristics and biases: The psychology of intuitive judgment*, 49, 81.
- Kling, J. R., Mullainathan, S., Shafir, E., Vermeulen, L., & Wrobel, M. V. (2008). Misperception in choosing Medicare drug plans. *Unpublished manuscript*.
- Kochanska, G., Murray, K. T., & Harlan, E. T. (2000). Effortful control in early childhood: continuity and change, antecedents, and implications for social development. *Developmental psychology*, 36(2), 220.
- Labroo, A. A., & Pocheptsova, A. (2016). Metacognition and consumer judgment: fluency is pleasant but disfluency ignites interest. *Current Opinion in Psychology*, *10*, 154-159.
- Langer, E. J. (1992). Matters of mind: Mindfulness/mindlessness in perspective. *Consciousness and cognition*, *1*(3), 289-305.
- Langer, T., & Fox, C. R. (2005). Naïve diversification and partition dependence in investment allocation decisions: An experimental investigation. *Unpublished manuscript, University of Meunster.*
- Latham, L. L., & Perlow, R. (1996). The Relationship of Client-Directed Aggressive and Nonclient-Directed Aggressive Work Behaviour With Self-Control 1. *Journal of Applied Social Psychology*, 26(12), 1027-1041.

- Lindner, C., Nagy, G., & Retelsdorf, J. (2015). The dimensionality of the Brief Self-Control Scale—An evaluation of unidimensional and multidimensional applications. *Personality and Individual Differences*, *86*, 465-473.
- Lynch Jr, J. G., & Ariely, D. (2000). Wine online: Search costs affect competition on price, quality, and distribution. *Marketing science*, *19*(1), 83-103.
- Lynn, M. (1991). Scarcity effects on value: A quantitative review of the commodity theory literature. *Psychology & Marketing*, 8(1), 43-57.
- Maloney, P. W., Grawitch, M. J., & Barber, L. K. (2012). The multi-factor structure of the Brief Self-Control Scale: Discriminant validity of restraint and impulsivity. *Journal of Research in Personality*, *46*(1), 111-115.
- Maszk, P., Eisenberg, N., & Guthrie, I. K. (1999). Relations of children's social status to their emotionality and regulation: A short-term longitudinal study. *Merrill-Palmer Quarterly* (1982-), 468-492.
- Milch, K. F., Weber, E. U., Appelt, K. C., Handgraaf, M. J., & Krantz, D. H. (2009). From individual preference construction to group decisions: Framing effects and group processes. Organizational Behaviour and Human Decision Processes, 108(2), 242-255.
- Miller, G. A., Galanter, E., & Pribram, K. H. (1960). Plans and the structure of behaviour.
- Mischel, W., Shoda, Y., & Peake, P. K. (1988). The nature of adolescent competencies predicted by preschool delay of gratification. *Journal of personality and social psychology*, *54*(4), 687.
- Mortensen, K. W. (2004). *Maximum influence: the 12 universal Laws of power persuasion*. AMACOM/American Management Association.
- O'Donoghue, T., & Rabin, M. (1998). Procrastination in preparing for retirement. *University of California-Berkeley Working Paper*.
- Payne, J. W., Payne, J. W., Bettman, J. R., & Johnson, E. J. (1993). *The adaptive decision maker*. Cambridge university press.
- Peluso, T., Ricciardelli, L. A., & Williams, R. J. (1999). Brief report self-control in relation to problem drinking and symptoms of disordered eating. *Addictive behaviours*, 24(3), 439-442.
- Peters, E., Dieckmann, N. F., Västfjäll, D., Mertz, C. K., Slovic, P., & Hibbard, J. H. (2009). Bringing meaning to numbers: The impact of evaluative categories on decisions. *Journal of experimental psychology: applied*, 15(3), 213.
- Pocheptsova, A., Amir, O., Dhar, R., & Baumeister, R. F. (2009). Deciding without resources: Resource depletion and choice in context. *Journal of Marketing Research*, *46*(3), 344-355.

- Pohl, R. F., Erdfelder, E., Hilbig, B. E., Liebke, L., & Stahlberg, D. (2013). Effort reduction after self-control depletion: The role of cognitive resources in use of simple heuristics. *Journal* of Cognitive Psychology, 25(3), 267-276.
- Powers, W. T., & Powers, W. T. (1973). *Behaviour: The control of perception* (p. ix). Chicago: Aldine.
- Romal, J. B., & Kaplan, B. J. (1995). Difference in self-control among spenders and savers. *Psychology: A journal of human behaviour*.
- Rosenbaum, M. (1980). A schedule for assessing self-control behaviours: Preliminary findings. *Behaviour therapy*, *11*(1), 109-121.
- Rothbaum, F., Weisz, J. R., & Snyder, S. S. (1982). Changing the world and changing the self: A two-process model of perceived control. *Journal of personality and social psychology*, *42*(1), 5.
- Salmon, S. J., De Vet, E., Adriaanse, M. A., Fennis, B. M., Veltkamp, M., & De Ridder, D. T. (2015). Social proof in the supermarket: Promoting healthy choices under low selfcontrol conditions. *Food Quality and Preference*, 45, 113-120.
- Salmon, S. J., Fennis, B. M., de Ridder, D. T., Adriaanse, M. A., & De Vet, E. (2014). Health on impulse: When low self-control promotes healthy food choices. *Health Psychology*, 33(2), 103.
- Schmeichel, B. J., Vohs, K. D., & Baumeister, R. F. (2003). Intellectual performance and ego depletion: role of the self in logical reasoning and other information processing. *Journal of personality and social psychology*, *85*(1), 33.
- Schmeichel, B. J., Harmon-Jones, C., & Harmon-Jones, E. (2010). Exercising self-control increases approach motivation. *Journal of personality and social psychology*, 99(1), 162.
- Shah, A. K., & Oppenheimer, D. M. (2008). Heuristics made easy: An effort-reduction framework. *Psychological bulletin*, *134*(2), 207.
- Shoda, Y., Mischel, W., & Peake, P. K. (1990). Predicting adolescent cognitive and selfregulatory competencies from preschool delay of gratification: Identifying diagnostic conditions. *Developmental psychology*, 26(6), 978.
- Shu, S. B., & Gneezy, A. (2010). Procrastination of enjoyable experiences. *Journal of Marketing Research*, 47(5), 933-944.
- Simon, H. A. (1990). Invariants of human behaviour. Annual Review of Psychology, 41, 1–19.
- Simonson, I. (1989). Choice based on reasons: The case of attraction and compromise effects. *Journal of consumer research*, *16*(2), 158-174.

- Stanovich, K. E., & West, R. F. (2000). Individual differences in reasoning: Implications for the rationality debate?. *Behavioural and brain sciences*, *23*(5), 645-665.
- Storey, F. S. (1999). Childhood abuse and self-regulation: Risk factors for heroin addiction.
- Tangney, J. P. (1991). Moral affect: the good, the bad, and the ugly. *Journal of personality and social psychology*, *61*(4), 598.
- Tangney, J. P. (1995). Recent advances in the empirical study of shame and guilt. *American Behavioural Scientist*, *38*(8), 1132-1145.
- Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of personality*, 72(2), 271-324.
- Tangney, J. P., Hill-Barlow, D., Wagner, P. E., Marschall, D. E., Borenstein, J. K., Sanftner, J., ... & Gramzow, R. (1996). Assessing individual differences in constructive versus destructive responses to anger across the lifespan. *Journal of Personality and Social Psychology*, 70(4), 780.
- Thaler, R. H., & Sunstein, C. R. (2003). Libertarian paternalism. *American economic review*, 93(2), 175-179.
- Thaler, R. H., & Sunstein, C. R. (2009). *Nudge: Improving decisions about health, wealth, and happiness*. Penguin.
- Todd, P. M. (2000). The ecological rationality of mechanisms evolved to make up minds. *American Behavioural Scientist*, *43*(6), 940-956.
- Tremblay, R. E., Boulerice, B., Arse-Neault, L., & Niscale, M. J. (1995). Does low self-control during childhood explain the association between delinquency and accidents in early adolescence?. *Criminal Behaviour and Mental Health*, 5(4), 439-451.
- Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science*, *211*(4481), 453-458.
- Tversky, A., & Kahneman, D. (1983). Extensional versus intuitive reasoning: The conjunction fallacy in probability judgment. *Psychological review*, *90*(4), 293.
- Vohs, K. D., & Faber, R. J. (2007). Spent resources: Self-regulatory resource availability affects impulse buying. *Journal of consumer research*, *33*(4), 537-547.
- Wang, J., Novemsky, N., Dhar, R., & Baumeister, R. F. (2010). Trade-offs and depletion in choice. *Journal of Marketing Research*, 47(5), 910-919.
- Wansink, B., Just, D. R., & Payne, C. R. (2009). Mindless eating and healthy heuristics for the irrational. *American Economic Review*, 99(2), 165-69.

- Wegner, D. M., Shortt, J. W., Blake, A. W., & Page, M. S. (1990). The suppression of exciting thoughts. *Journal of Personality and Social psychology*, *58*(3), 409.
- Wertenbroch, K. (2001). Self-rationing: Self-control in consumer choice. INSEAD Press.
- Wheeler, S. C., Briñol, P., & Hermann, A. D. (2007). Resistance to persuasion as selfregulation: Ego-depletion and its effects on attitude change processes. *Journal of Experimental Social Psychology*, 43(1), 150-156.
- Wills, T. A., DuHamel, K., & Vaccaro, D. (1995). Activity and mood temperament as predictors of adolescent substance use: test of a self-regulation mediational model. *Journal of Personality and Social Psychology*, 68(5), 901.
- Youn, S., & Faber, R. J. (2000). Impulse buying: its relation to personality traits and cues. *ACR North American Advances*.