Linking self-control to saving differences: An analysis across countries

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Abstract

In the debate that counterpoises cognitive and non-cognitive abilities, IQ is researched in differences across countries and associated to several factors, among which differences in savings. On the other side, non-cognitive factors such as self-control, while researched at the micro level, are not often analyzed cross-country. The main aim of this research is thus to identify the elements that form self-control at the national level and analyzing whether the overall index has predictive power in explaining savings. Alongside, it is explored which of the components is better at predicting savings. Lastly, a comparison between IQ and Self-Control is run to understand which one has more explanatory power. The method consisted in studying the theoretical literature, leading to the identification of the *capacity* of exercising self-control, and the *desire/interest* in exercising it. The former is measured through household survey data, and the latter with cultural indexes and institutional constraints. Results found strong relationship between national indexes of self-control and private savings, where the cultural component dominates the household one. IQ and Self-Control have similar power in explaining savings, and are highly correlated with each other. Overall, self-control seems an important factor in determining differences in private savings across countries.

Keywords: private savings, self-control, culture, time preference, patience, IQ.

Acknowledgement

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1. Introduction

"Existing theories generally agree that self-control can be defined as the capacity to alter or override dominant response tendencies and to regulate behavior" (de Ridder et al., 2012, p. 77).

There is a wide range of studies researching self-control's explanatory power in contexts of social behavior (such as criminality), health related behavior (such as obesity, smoking, drinking), and academic performance and work achievements (de Ridder et al., 2012). Thus, self-control seems to play an influential role in a wide spectrum of situations.

In the economic field, the development of behavioral economics, with the implementation of behavioral insights, has opened a broader and more accurate view on the reality of the processes that shape economic decision making. For instance, Moffitt et al. (2011) found that only 10% of children who scored highest on self-control are matched with low-income, while the percentage increased to 32% for the most impulsive kids. The authors found that kids with high self-control were more likely to be wealthy, compared to those who scored lower on self-control. The authors also suggest that traumas and violence aggravate the chance of out-of-control behavior, factors that tend to be more crucial for poor people.

The literature on the potential effects that self-control might have on economic decisions is mainly focused at the micro-level or on a more theoretical perspective. At a micro-level, behavioral economics has incorporated the concept in various economic experimental analyses. For instance, an experiment run in the Philippines shows that sophisticated agents demand for commitment tools in saving decisions (Ashraf et al., 2006), so that those who do not make use of the commitment saving product are those agents that lack self-control the most. Furthermore, in the context of savings, self-control has been researched also in relation to savings for retirement, showing empirical significance of its relevance (Mitchell & Utkus, 2003). Self-control seems therefore an important behavioral aspect influencing saving decision making and as a consequence economic outcomes. Indeed, under-savings have been suggested to have central welfare effects, resulting in weak resilience to shocks and missed investment opportunities (Karlan et al., 2014).

At the micro-level, the quantification of self-control highlights the individual differences in self-control. However, suggestions have been made that behavior related to savings differs also across countries and thus contributes to explaining divergence in saving rates (Carroll et al., 1994; Gersovitz, 1988).

Karlan et al. (2014) group into five categories the typologies of constraints to savings that are especially negative for the poorest: "transaction costs, lack of trust and regulatory barriers, information and knowledge gaps, social constraints, and behavioral biases" (p.38). Among the

behavioral biases, self-control plays a role, grouped under the set of preferences biases. Another preference bias is loss aversion, referring to the idea of a loss related to reference points set by individuals (Karlan et al., 2014). Other behavioral biases the authors outline are: bias in expectations, bias in the perceived prices, and bias in considering savings in relation to other factors. The first one is described by the author as over-optimism that leads to under-saving. The second bias consists in a different perception of the vector of prices; while the third one refers to inattention to savings in budget planning (Karlan et al., 2014). All this behavioral factors might thus influence the results, but studying them all at the same time would not be feasible.

Studies that incorporate such behavioral aspects at the macro-level tend to rest on abstract grounds, modeling the factors mathematically but without running empirical research (such as Thaler & Shefrin, 1981; Hoch & Loewenstein, 1991; Labison et al., 1998). Some other studies, instead, empirically research private saving differences across countries but they do no account for behavioral measures (such as Loayza et al., 2000). Few recent papers make an exception and go beyond the standard incorporation of institutional differences as drivers for the saving divergence by investigating the impact of cultural cross-country differences such as trust and religiosity (in de Castro Campos et al., 2013), or some Hofstede's cultural dimensions (in Wang et al., 2016). Wang et al. (2016) support the idea that the perception of time that shapes time preferences is part of countries' culture. This idea was already introduced by Jones et al. (2010) who further sustained that differences across countries in saving rates originate from intelligence disparity. These authors therefore use IQ scores to study cross-country differences in savings.

When controlling for institutional impediments and environmental barriers to savings, are there tangible differences in the saving behavior of different countries? Some authors found that there are, while others found that all countries are in general able to save in the same way (Karlan et al., 2014). Overall, it seems there is an unexplored question in the literature, which leads to the following research question:

Is the gap in savings across countries linked to
cross-country differences in self-control?

In cross-country studies, IQ has often been used as an explanatory variable for a wide range of economic differences (Jones, 2010; Lynn & Vanhanen, 2002; 2006; 2012). Nevertheless, the Intelligence Quotient, widely applied as an indicator for cognitive abilities, is both an incomplete and a biased measure to predict economic outcomes. Firstly, it is biased because endogenous to growth, as the Flynn effect suggests. The effect consists in finding an increase in IQ scores over the past century that researches have associated to environmental factors and a change in the way of thinking that makes new generations scoring higher (Flynn, 2013). In addition, IQ scores do not

offer a complete summary of the intelligence of a person, which is much more multi-dimensional than what the IQ score reflects. Gardner (2011) has identified 7 types of intelligence, where IQ gathers only 3 of them. Because of this, IQ tests might not be an appropriate benchmark to measure intelligence exhaustively. Nevertheless, the reason why IQ is an incomplete measure of intelligence is most likely due to the impossible challenge of fully converting it into a quantitative measurement.

Despite the large limitations of IQ scores, they have been extensively applied in research. On the other side, non-cognitive abilities (among which there is self-control), while theoretically acknowledged among influential aspects in shaping human behavior, have been mostly ignored in the empirical literature (Heckman & Rubinstein, 2001). The reason is mainly due to a lack of reliable measures (Heckman & Rubinstein, 2001). One of the few studies that run a comparison of the explanatory power between cognitive and non-cognitive abilities is the paper from Duckworth & Seligman (2005). The authors run an experiment from which they compare the predictive power of self-control and IQ on academic performance, finding that the former exceeds the latter. A sub-question in this research follows from this finding. In the case in which IQ has indeed explanatory power in relation to the saving variable implemented:

- *Does IQ outperform self-control in explaining the differences in savings across countries?*

Overall, past empirical researches suggest intelligence and time preferences differences are relevant in cross-country analysis on savings. Furthermore, papers on self-control suggest that this aspect has potential explanatory power. As discussed above, the macro-level literature related to cross-country differences in savings seems quite extensive when it comes to implementing standard economic variables, but scarce when accounting for behavioral factors. Considering the recent developments in behavioral economics and the recent findings at the micro-level, the literature on the macro differences that implement behavioral and cultural factors seems incomplete on the empirical aspect. This research attempts to quantify self-control as a proxy constructed by variables measuring concepts that the literature suggests as being determining factors of self-control. To answer the question on whether self-control and saving differences across countries are related, the first step is to identify those cultural factors that influence the formation of self-control at the national level. From here it follows the possibility of exploring which aspect of self-control has more explanatory power in the cross-country differences in savings. Following the literature, a further sub-question is asked:

- *Which aspect of self-control drives more strongly differences in savings across countries?*

The rest of the thesis is organized as follows: the next section consists of a theoretical overview, Section 3 explicates the methodology applied and the variables used, Section 4 reports the results, Section 5 discusses them, and finally Section 6 concludes together with an acknowledgement of the limitations and suggestions for further researches.

2. Theoretical Background

This Section presents an overview of the literature related to few theoretical points that are central for this research. Firstly, it looks upon the standard economic variables that are widely employed in the literature when it comes to researching savings. Secondly, it further specifies the characteristics of IQ, both in relation to savings and to self-control. Thirdly, it focuses on self-control and what aspects shape it. Fourthly, it gives a small note on the relationship and nuanced difference between the concept of self-control and that of time preference. Lastly, it brings together these notions into the conceptual model used in this current work.

2.1 – Standard variables

Standard macroeconomic variables have been widely studied in the literature of savings and its determinants. In this research such variables will be included as controls, since the main independent variable under attention is self-control.

Loayza et al. (2000) give a good overview of the variables that past studies have applied when studying savings across the world, dividing them into categories. Income is the category most widely applied and agreed upon as being a determinant of savings (see also Masson et al., 1995; Gersovitz, 1988; and IMF, 2005). Income is itself divided between its level, its growth through time, and the terms of trade derived by the ratio between the export prices and the import prices of a country. Overall, all these three variables have been widely found to have a statistical positive relationship with savings. Individuals with higher income levels tend to have a higher marginal propensity to save. This is due to the fact that lower income individuals need a greater percentage of their income to acquire the possession of the basic goods and services that most people need, so that higher income individuals have more leftover income to just store away into savings. In a similar line of thought, an increase in income will lead individuals to increase the portion of savings, because the need to increase consumption is less then proportional (Katona, 1949). Considering the terms of trade, they generally represent macroeconomic volatility in case they are subject to sudden changes. Shocks in commodity prices can either increase or decrease savings, depending on whether the adverse shock (i.e. decrease in prices) is on the import or export prices, respectively. Terms of trade growth, instead, might represent the expectations of people about the future, so that with an increase in terms of trade growth people might expect to be more prosperous in the future and thus save less / invest more. It is thus expected to be negatively related to savings.

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The second category concerns the demographic characteristics of the countries, with the shared idea that the aging of a population weights negatively on the overall savings (IMF, 2005). For this purpose, the age dependency ratio is commonly used, which usually compares the share of the working population with the share of the not working population, and is expected to have a negative coefficient when regressed against savings.

A third class is composed by financial variables. To consider the rates of return to savings, the real interest rates are commonly employed (Loayza et al., 2000; IMF, 2005). A decrease in interest rates should make saving less appealing and therefore lead to a decrease in the saving rates and an increase, instead, in the cash held and/or spending rates. However, this substitution effect can be dominated by the income effect, which leads individuals to compensate the decrease in interest rates by an increase in the amount saved. As a consequence, ambiguity in the sign of the real interest rate has led this variable to enter both positively and negatively, depending on the study. Some papers have even found it not significant at all (Corbo & Schmidt-Hebbel, 1991; IMF, 2005). This result could also be driven by the fact that the rates of interest do not matter much in developing countries, where many people live at subsistence level and therefore are not much reactive to oscillations in the rates of return (Ostry & Reinhart, 1995). For this reason, when an analysis includes both developed and developing countries it might result in statistical insignificance. Under the class of financial variables, in addition, it is often taken into account the extent of the financial depth of a country. The term financial depth refers to the size of the financial sector of a country: banks, other financial institutions, and financial markets. Although on this aspects authors have been heterogeneous in the measures used as indicators (see Loayza et al., 2000), the concept of financial depth involves the idea that a more rooted and developed financial sector of an economy encourages savings (Cook, 2003).

A fourth group is given by the influence that states' financial policies have on private savings. For this purpose, the share of public savings is usually employed (Loayza et al., 2000; IMF, 2005; Corbo & Schmidt-Hebbel, 1991). Generally, increasing the savings in the public sector crowds out private savings, therefore the two variables are negatively related. As a consequence, the public saving variable is expected to have a negative sign.

A variable showing strong ambiguities is inflation. Inflation is frequently used as a measure of macroeconomic instability and therefore uncertainty. Inflation is generally expected to stimulate savings because people act out of precautionary reasoning (Grigoli et al., 2014). However, although it is usually expected to have a positive sign, many studies have found a not statistically significant coefficient (see Loayza, 2000). This might be due to different reasons. For instance, expectations on future inflation can decrease the anticipated real interest rate, causing intertemporal

substitution and income effects that justify the resulting ambiguity over the sign the variable should take in the statistical regressions (Grigoli et al., 2014).

Finally, domestic borrowing constraints can represent a disincentive for households to save. To capture the different possibilities that households might have in accessing borrowing systems in different countries, the private sector credit is measured in relation to income, which coefficient takes up a negative sign because of the disincentive to save it represents (Loayza, 2000; IMF, 2005).

Overall, these are the main variables that the literature has been commonly employing. Nevertheless, in this work, a selection will be made in consideration of those variables which are considered to have main effects in a world-level analysis. This selection is presented in the methodology section 3.2, where the variables employed are operationalized.

2.2 – IQ

Moffit et al. (2010), report that self-control, IQ, and socio economic context tend to be positively related with each other. However, although IQ and parents' social economic status have strong explanatory power in predicting adult wealth, self-control has shown even higher significance as predictor of future wealth. For instance, more closely related to savings, financial skills in planning and (therefore) financial struggles are more strongly explained by self-control than IQ. Indeed, the coefficients for self-control found by Moffit et al. (2011) are significant at a p-level lower than 0.001, while the coefficients of IQ tend to be less strongly significant or even not significant (Table 1, p.2695).

Because of this, it seems reasonable trying to employ macroeconomic measures of self-control to verify its relationship with savings across countries. The reason why it has received less attention in the literature is maybe because of conceptual and quantitatively interpretative issues and ambiguities (Meisenberg & Lynn, 2011). However, also IQ measurements have their limitations and critics. The bias derived from the Flynn effect has already been expressed in the Introduction. In addition to it, also the computation of the IQ scores can be problematic, because sometimes different across countries. Critics have expressed doubts on the reliability of such scores, specifically referring to the common practice of employing the scores built by Lynn & Vanhanen (2002), considering that such scores have in part been only estimated (Jones et al., 2010; Hunt & Sternberg, 2006). Out of the 129 countries included in the list of IQ scores by the authors, for only 55 of them there were actual IQ data, while the rest of the values were computed through an estimation process (Hunt & Sternberg, 2006). Another main criticism, also already presented in the

Introduction, consists of the incompleteness of the IQ measure in representing the multidimensionality of intelligence. Hunt & Sternberg (2006) explain that intelligence tests are tests created by Western countries, so that the value of the knowledge and skills tested differ from the skills valued in other countries where, for instance, hunting and knowledge of herbal medicines is considered more necessary for survival.

Despite the limitations exposed, IQ scores have been found related to a wide range of phenomena. Lynn & Vanhanen (2012) report and summarize correlates of national IQs with several variables. Negative correlations are found with income inequality, crime, corruption and fertility. Positive correlations, instead, are found with per capita income, economic growth, economic freedom, education, democracy, and other sociological factors. Among these sociological factors, the authors report a quite high positive correlation (0.70) with national time preferences, otherwise called patience by the authors (see Jones, 2011; Jones et al., 2010).

In building the connection between IQ and self-control, Jones et al. (2010) get inspiration for their research from two empirical conclusions obtained in different areas of research. The first result is that IQ is found to be positively related to patience (especially being a topic of research in the psychological literature). The second result is that patience is found to be positively related to savings (conclusion usually documented by economic researches). Following these outcomes, Jones et al. (2010) logically hypothesize (and indeed find) that IQ is positively related to savings. For this reason IQ scores are included to account for this possible strong relationship and to explore whether the cognitive predictor outperforms the non-cognitive one in explaining saving differences. It also follows that correlation issues might emerge between IQ and patience/time preference measures; issues which will be checked for. The aspect of time preferences and its meaning, instead, will be discussed in section 2.4.

2.3 – Self-control

Baumeister et al. (2007) make an analogy between self-control and a muscle. According to their Strength model, self-control is a scarce resource and therefore subject to depletion. The authors say that when subjects engage in tasks that require effortful expression of self-control their performance tend to decrease in the subsequent tasks that require self-control, as analogous to a muscle.

The Strength model of self-control is amongst the most popular views to explain human failure in self-regulatory actions. However, there are various elements and perspectives that have been put forward to explain self-control differences. Self-control divergences could also be the

result of skills' differences, and therefore self-control can be learned, making important the environment where personality is developed (Hagger et al., 2010; Wills & Dishion, 2004; Baumeister et al., 2006; Baumeister et al., 2007). In this context, then, especially cultural aspects and social standards become relevant in shaping self-control at the national level. If self-control is a skill, then, it means that it can be trained and strengthen like a muscle (Baumeister et al., 2007).

Besides the environmental components that might influence self-control, there are also individual differences in the capacity of exercising it. Indeed, people are not endowed with self-control in the same way, although they are all subject to its depletion (Baumeister et al., 2006; Hagger et al., 2010). This characteristic brings (part of) self-control as being a result of personality traits.

The conceptual elaboration of self-control developed by Tittle et al. (2004) reflects an acknowledgement of both environmental and individual influences, providing at the same time sub-elements forming each category that therefore could be used to quantify self-control. In Baumeister et al. (2007) self-control is depicted as a muscle that can be trained and show improvements. Moreover, the authors add that "[t]argeted efforts to control behavior in one area, such as spending money or exercise, lead to improvements in unrelated areas […] [and] in self-control as measured by laboratory tasks." (p.352). This implies that self-control is a general resource that does not distinguish between which category the task requiring self-control belongs to. Moreover, Tittle et al. (2004), quoting the work of Gottfredson & Hirschi (1990), state that "those with low self-control lack '*ability* to calculate potential gain' (p.95) and are less '*capable* of delaying gratification' (p.97)" (p.147). For these reasons, although the elaboration by Tittle and colleagues is specifically related to crime and violent behavior, it could be extended to the relevance that self-control has on savings too, as it follows in the next paragraph.

Tittle et al. (2004) and Tittle (2011) divide self-control behavior between the *capacity* of exercising self-control, and the *desire/interest* in exercising it. While the former stems from personal traits, the latter is influenced and shaped by the social environment and situational contexts (Tittle et al., 2004; Tittle, 2011). The author suggests that this division is crucial because some individuals may be strongly capable of exercising self-control but their interest might be sometimes lacking, while on the other side some other individuals may have low self-control ability but strong interest in exercising it. Adapting this idea to the saving context, it could be said that some people have a strong personal tendency to control themselves and save but their interest might be low, and other people might be more subject to immediate temptations but the interest to save is stronger. The term 'interest' can be understood as representing the social environment and institutional contexts which interact and therefore influence the individual (Tittle et al., 2004). Thus, under this category, there are elements of social learning, internalization of values, social bonds' creation, peer

influences that push for conformity in behavior (Tittle et al., 2004; Tittle, 2011), together with institutional tools that help solving self-control issues by providing commitment devices (Mullainathan, 2005). Translating this into the context of saving behavior, it could be said that an individual might have low personal self-control, but because the saving infrastructures that are available incentivize saving behavior and because s/he lives in a social system in which everybody saves, s/he might have a strong 'interest' in saving. On the other side, there might be a person with a personality characterized by a strong self-control, but a social and infrastructural environment lacking saving incentives.

2.4 – Time preferences

Traditional economic approaches model time preferences exponentially, assuming a monotonic decrease as time increases. As opposed to traditional economic approaches, behavioral economics models time discounting of individuals as more closely resembling an hyperbolic function. The classic test to reveal this consists in making people choose between two options in two different scenarios. The first one involves choosing between a dollar today and three dollars tomorrow, while the second one consists of choosing between a dollar in one year and three dollars in one year and one day. The theory predicts that many subjects would choose to receive the one dollar in the short term scenario, but they would be willing to wait for the three dollars in the longer term. This inconsistency in preferences characterizes the hyperbolic time discounting, where people seem to make choices that their future selves will regret. Here is where self-control comes into play. Self-control entails exercising effort to resist time inconsistencies (Hoch & Loewenstein, 1991). Mullainthan (2005) sustains that self-control is about more than just overcoming time-inconsistent preferences, because in order to overcome time inconsistency it is necessary to be aware of it. People range somewhere in between the two extremes of sophisticated and naïve individuals, recognizing their time inconsistency to different degrees (Mullainthan, 2005). Some sophisticated agents that realize their own time inconsistency might decide to act against it and control themselves in different ways. Naïve and sophisticated individuals could also be thought of and divided between myopic and foresighted, where the latter are aware of "the possibility of a future adverse condition" (Warneyard, 1999, p.284). People with self-control can be thought of as sophisticated agents that impose on themselves commitment devices. In other words, beyond the mere recognition of the chance of future unfavorable situations, "with self-control you decide to do something about it" (Warneyard, 1999, p.284). However, following the description by Tittle et al.

(2004) and Tittle (2011), it does not seem to be necessary to recognize the adverse condition, in order for exercising self-control. In other words, people might behave as if being personally endowed with self-control, but they are instead just 'following' the social trend and common behavior of the community they are part of. Therefore, while one part of self-control comes from within the individual, as being foresighted and actively acting against his/her own time inconsistency, the other part of exercising self-control comes from situational and environmental influences.

From this description it follows that while a person might present time inconsistency but manages to control him/herself thanks to tools (such as institutional commitments), another person with the same time inconsistency and the same control devices might not exert control because naïve. Similarly, two people with the same time inconsistency and the same awareness might not be able to both successfully control themselves because of different availability of, for instance, institutional commitment devices. It follows that once again, two aspects of self-control emerge. On the one side, there is the more personal characteristic of an individual that might be more or less naïve, and on the other side there are institutional and environmental factors enabling and/or incentivizing at different degrees the exertion of control.

Overall, time preferences play an important role in influencing saving behavior (Laibson et al, 1998; Karlan et al., 2014; Becker et al., 2015). In empirical researches, time preferences have been found to significantly differ across countries (Wang et al., 2016). Wang and colleagues (2016) sustain that time perception is not only a personality trait, but it is also influenced by cultural factors. This claim is in accordance with the literature already analyzed, in the sense that social and environmental influences (as expressed by Tittle et al., 2004; Tittle 2011) do cause adaptation in the individuals' behavior. To account for the cultural elements which contribute to the time preference variation, Wang et al. (2016) implement in their analysis the cultural dimensions captured by Hofstede, finding that they significantly influence time discounting at the national level, even after controlling for standard economic variables.

The study by Wang et al. (2016) is very recent, and the authors state that such researches, linking cross-country differences to time preference, are rare in the literature and usually include only few countries. It follows the relevance of deepening the subject, and the focus of this thesis in the further step of linking self-control to savings, which is also an under-studied topic (Karlan et al., 2014). While Wang et al. (2016) have focused on time discounting differences and cultural elements affecting them, this study implements cultural factors as characterizing the social and environmental part of self-control, defined by Tittle et al. (2004) as the 'interest' in exercising it. Both time preferences and cultural factors are therefore part of what finally determines the ability and interest in exercising self-control (see Section 2.3).

2.5 – Conceptual model of self-control

This last section aims at clarifying the use of terminology in this research that in the literature is found to be inconsistent or confusing. The summarizing scheme can be found in Figure 1. The analysis in the previous section helps telling time preferences apart from self-control, and furthermore it allows to identify time preferences as a component of self-control.

A further matter in classifying the elements is what concerns the division between the 'capacity' to exercise self-control and the 'desire/interest' in exercising it. While Jones et al. (2010) identify time preferences with patience, here the term patience is used to represent the more individual characteristics formed at the household level, and the term time preferences is used to refer to the national cultural dimension that contributes in forming the individual characteristics. Therefore, the term patience refers to those qualities that help building a foresighted view and awareness for the need of acting upon their time inconsistency; these qualities are reflected by educational influences in the household context. Time preferences, instead, is more about conforming to what society in general does. Furthermore, a second element under the 'desire/interest' component of self-control is given by the institutional incentives that are in place in a country, and therefore the differences arising from the divergence in such institutional incentives.

In the context of time preference, while Wang et al. (2016) regress Hofstede's cultural factors against the variation in time discounting across countries, here, following the conceptualization of Tittle (2011) on the components of self-control, these cultural elements are considered intrinsic to time preferences and therefore components of self-control. Therefore, instead of conceptualizing them as influencing factors, they are part of the elements shaping time preferences. Overall, this chapter has identified the factors of self-control. The next section, instead, focuses on how to operationalize them.

Figure 1 - Summary of identified elements of self-control
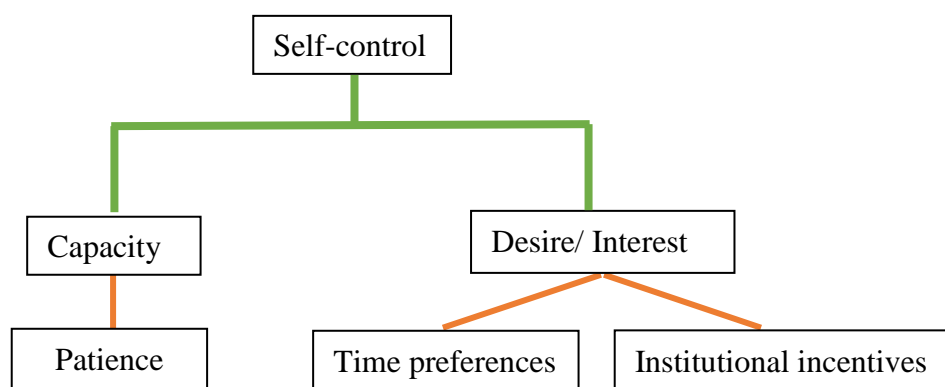
3. Methodology:

3.1 – Method

3.1.1 – Data

Data concerning standard macroeconomic variables were retrieved from the World Bank database of the World Development Indicators, following the consideration that the World Bank is one of the most reliable sources providing exhaustive and homogeneous data for a wide range of countries and therefore facilitating comparisons.

To capture the capacity to express self-control, it was made use of the European Values Surveys Longitudinal data File 1981-2014 and the World Values Surveys Longitudinal data File 1981-2014. To ease the time series analysis and the comparison across countries the two data file were merged together into the Integrated Values Surveys 1981-2014. The integrated data file covers 113 countries/regions, although the less developed ones where mostly integrated in the survey database from 1999. For this reason, in order to include some developing countries in the analysis it was made use of the dataset starting from 1999.

The variables measured with the surveys are taken at the household level, so that the influence they have on self-control is captured at the household level. On the other side, to measure the cultural influences that affect self-control at the national level, the Hofstede's dimensions scores were used. When studying cultural factors, the scores from Hofstede are amongst the most widely employed. Wang et al. (2016) use them as well in their analysis, mentioning the existence of other dimensions such as the Schwartz dimensions, which are found to be correlated with Hofstede's ones. For this reason, it could be concluded that both score sets reflect an analogous pattern in depicting culture, and thus both dimensions would draw similar results.

Finally, to measure intelligence, it was made use of the IQ scores published in Lynn & Meisenberg (2010), drawn with some corrections from the original work by Lynn & Vanhanen (2002; 2006). These scores were chosen to be employed in this research because they represent the most commonly cited source when it comes to compare IQs across nations, considering that they include 136 countries.

In Figure 2 can be found a summary of the main characteristics of the datasets, together with the adaptations necessary to run the statistical analysis. Considering the interest in understanding differences between countries, it follows that national scores and not individual scores are needed. The reason to take national averages is thus consequence of the spread

assumption in which individual differences are thought to cancel out in the overall population (Warneyard, 1999; Lambert, 2008). As can be seen in the table below, the data from IQs, Hofstede's dimensions, and World Bank datasets are already in the form of country scores. However, the variables retrieved from the World Bank have yearly data, so that only those data corresponding to the actual year(s) in which the surveys were taken are considered. The scores obtained from the surveys, instead, are household data clustered at the country level. To avoid multilevel problems, the answers were averaged to create a national score. Therefore, in practice, the answers in which households described the characteristics of interest as being either 'important' (1s) or 'not mentioned' as being important (0s) were summed and averaged. As a consequence, the higher the final score is, the more important the variable is considered to be in that country. A similar averaging of survey data was also implemented by de Castro Campos et al. (2013) who created country-level cultural indicators. Indeed, the averaging leads to the construction of a mean tendency at the national level. It follows that problems of correlation might emerge with the national cultural indicators of Hofstede, and therefore will need to be checked for. Furthermore, in the averaging to create the countries' scores, also answers corresponding to different survey years were averaged. As a consequence, for each country there is one estimated observational score for each of the survey questions considered.

It follows that for consistency reasons also the observations retrieved from the World Bank datasets were adapted. Specifically, there were considered only those year data that were available in the surveys and had corresponding year data in all World Bank datasets. Although for many survey years it was possible to have the same exact years for all the variables retrieved from the World Bank, this selection would have caused too many observations and countries to be dropped out of the sample. For this reason, missing World Bank year data were substituted with a maximum of -2/+2 year data. In some cases, though, year data were not available for this range either. At this point, that year was simply not considered, and as a consequence also the corresponding year in the survey observations was dropped. It might be argued that the answers from the surveys reflect quite stable values that do not easily vary throughout the years. However, since in this study savings are analyzed, it might be that some economic conditions affecting saving behavior that happed in certain years might have affected the answers given in the questionnaires run during that same time period. In this case, eventual shocks in the amount saved would correspond to influences in the survey answers. Thus, this possibility justifies the selection procedure just described.

Figure 2 - Overview of the datasets characteristics and eventual corrections.

Variable category	Type of data	Level of observations	Time of observations	Corrections needed
IQ	Numeric: discrete with 100 reference score for Great Britain	Country	Fixed	None
Hofstede scores	Numeric: discrete from 0 to 100	Country	Fixed	None
World Bank Datasets	Numeric: continuous	Country	By year	Data were used in correspondence to the actual year(s) in which the surveys in that country were taken.
Integrated Values Surveys	Categorical: - "important" = 1 - "not mentioned" = 0	Household	By wave / year	1. Averaging household data into country scores. 2. Averaging survey answers from different years into one observation.

3.1.2 – Sample

Countries were first selected on the basis of the list of countries available which were included in the collection of Hofstede's cultural dimensions scores. From that list were removed those countries that missed a score in at least one of the dimensions considered in this study (i.e.: Individualism/Collectivism, Uncertainty Avoidance, Short/Long Term Orientation). Following this selection, a couple of more countries were dropped because the IQ score was not available from the study of Lynn & Meisenberg (2010). Next to it, some more countries were eliminated because not part of the Values Survey questionnaires. Subsequently, several countries had to be left out because the data retrieved from the World Bank were not available for enough time periods (or any). A further selection was based on the availability of survey years in the World Bank datasets, as explained in the previous section. The final list of countries included in the empirical analysis amounts at 60 countries and can be found in Appendix A.

3.2 – Variables

In this section there will be described the variables implemented in the analysis to operationalize the theoretical concept exposed in the relevant literature overview. The relative summarizing scheme can be found at the end of this section in Figure 4.

3.2.1 – Dependent Variable

The dependent variable is the amount of savings of the private sector. The reason for choosing the private sector and not total domestic savings is because the interest of this study is on the behavior of individuals and the influence that ecological characteristics at the household and national level have on saving choices. Since the study is directed at understanding whether national characteristics have significantly distinct outcomes in saving behavior of private individuals across country, the analysis does not include state-level behavior. For this reason, if domestic savings were used, they would include also the public sector, while the interest is only on private savings.

3.2.2 – Independent Variables

The main independent variable is self-control. However, given the strong motivation found in the literature, IQ scores were also employed as an independent variable. However, following the conclusions from section 2.2, it seems that IQ might be interdependent and thus correlated to the independent variables that form self-control, and therefore, ultimately, with self-control itself. The expectations are not clear though, because other studies (such as Kocher, 2012) found that self-control is an important determinant of later life outcomes for children, but independently of intelligence (Kocher, 2012). In line with this result, no strong correlation should be found between IQ and self-control determinants.

To operationalize self-control, the Economics literature lacks concrete factors that could be used to quantify self-control. Because of this, the Sociology literature is used to create a proxy for self-control, following the indications given by Tittle et al. (2004) and Tittle (2011) and Cochran et al. (2006). Tittle et al. (2004) suggest that components of self-control can be found in diligent and persistent behavior, and Cochran et al. (2006) list impulsivity among the elements reflecting low self-control abilities. Because of this, to reflect the capacity of exercising self-control, two questions from the Integrated Values Surveys have been used. Both questions refer to important qualities that parents consider important to pass over to their children. The first one aims at measuring

determination and perseverance, which represent persistence in achieving something despite the difficulty of the task or its delayed reward. The second question refers to the quality of thrift, which consists of the careful use of money and other resources, instead of wasting them. It follows that both variables representing, respectively, Thrift and Determination/Perseverance are expected to show a positive coefficient when regressed against Private Savings. The specific questions reported in the questionnaire and the possible answers can be found in Appendix C (in the English version). The data drawn from the questionnaire are categorical, as the respondents could either mark the quality as being important or not important. Following the discussion in section 3.1.1, the survey data are averaged into country scores. However, before doing so, the variables were checked for within-between country variation. The reason for doing so consists of making a first step towards recognizing that individual differences do not average out in the country population. In Figure 3 below can be found the within and between country variation of the household survey data. As can be seen, there is between country variations; however, the variation within countries is much higher. This means that, while the observations on Thrift and Determination/Perseverance differ between countries, they differ much more within the same country. However, this does not rule out the possible statistical significance in finding cross-countries differences.

Figure 3 - Estimated Standard Deviation Within-Between countries.[1]

	Thrift	Determination/Perseverance
Within Country SD	0.4676891	0.4695513
Between Country SD	0.12381	0.1159248

Considering the 'interest' in expressing self-control, instead, to operationalize it, inspiration was taken from the work of Wang et al. (2016), Tittle et al. (2004), and Tittle (2011). Wang et al. (2016) make use of some of the Hofstede's cultural dimensions as contributors in shaping time preferences. The first one is Long-term Orientation, which entails a focus on the future and it represents societies where saving funds have central importance, as opposed to short-term oriented societies, where social spending and consumption hold a more important place (Hofstede, 2011). Therefore, the coefficient of this variable is expected to be positive. Moreover, this variable is also suspected to be highly correlated with Thrift, possibility that will be checked for.

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[1] *The estimation was run in Stata with the 'loneway' command.*

The second cultural factor considered by Wang et al. (2016) is the Uncertainty Avoidance Index, where the higher the score the less tolerant a society is towards uncertain and unstructured situations (Hofstede, 2011). Uncertainty has been found by Wang et al. (2016) to be an important predictor for national differences in time preferences. As a consequence, the Uncertainty Avoidance Index was included in this analysis. The expected effect of this variable on savings is positive, as the more intolerant a society is towards uncertainty, the more they would be pushed to save.

A third cultural factor forming self-control has been identified in the sociology literature as social bonds (Tittle et al., 2004; Tittle, 2011). On the economists side, Wang et al. (2016), in defining the cultural elements influencing time preferences, have identified the Hofstede's dimension of Individualism-Collectivism to have predicting power. Individualism consists of a society where individuals tend to provide for themselves and take care of themselves only, while Collectivism represents a society where individuals stand up for each other and are interdependent (Hofstede, 2011). Specifically, Wang et al. (2016) found that countries with a higher degree of Individualism have a higher preference towards long term payoffs. This finding is in line with the idea that individualistic people are more prone to planning and delaying gratification (Triandis, 1971). However, it could also be expected that people with a stronger social cohesiveness are more inclined to provide for their fellow citizens (Wang et al., 2016). The expected coefficient sign is therefore not clear; in the former case it would be positive, while in the latter case it should be negative, because the higher the score on the scale the more individualistic a country is.

Finally, the last important aspect emerging from the analysis of Tittle (2011) and Tittle et al. (2004) is represented by the existence of institutional structures which encourage the exertion of self-control. For this reason, three dummy variables are included, measuring the presence or not of compulsory saving schemes. The first one consists of the presence or not of Social Pensions, which refers to a minimum income that is guaranteed to elderly people as a safety net. The second dummy is about the existence of any mandatory publicly managed schemes; while the third dummy refers to the existence of any mandatory privately managed schemes. Other things being equal, mandatory pension systems lower the incentive to save (Whitehouse, 2005). For this reason, the presence of such schemes in the system might crowd out private savings, and therefore decrease the need of people to exercise self-control in privately organizing their savings. The variables implemented were retrieved from the World Bank website (World Bank, 2014).[2] However, a downside of these three dummies is that the data found in the World Bank are updated to the year 2012, and therefore refer to the schemes in place in that specific year. As a consequence, it might be that they are not

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[2] The three variables are turned into dummies, but in the original World Bank document the schemes are sub-divided depending on the type of scheme. Few of them, under the privately managed schemes, are mandatory but 'Optional', so that it appears to be an opt-out option. In those cases, the dummy was considered as 0, so not compulsory.

found significant, because the schemes have changed and keep on changing through time (Whitehouse, 2005). These three dummies are gathered into one dummy ranging from 0 to 3, depending on how many compulsory saving schemes are present in one country.

An assumption concerning self-control is made in relation to it as being a skill that can be learned (see Section 2.3). Specifically when it comes to the capacity of exercising self-control, such aspect is measured with surveys which are run through time. As a consequence, trend correlation in time could cause a problem. However, it could be assumed that the surveys are filled in by different households throughout the years. Because of this, a learning process would not be captured. Most importantly, it should be considered that the questions in the surveys are asked to parents, not to children or adolescents, so that it can be assumed parents are not in a (significant) learning phase anymore.

3.2.3 – Control Variables

The control variables implemented in this analysis are the standard variables used in macroeconomic analysis and already discussed under section 2.1. As already mentioned, a selection is made to include only those main variables considered in the literature as determining factors in influencing savings. For the selection it is followed the report from the International Monetary Fund (2005) for two main reasons. Firstly, the IMF is a reliable source which runs studies across countries with balanced samples of developed and developing countries, so that the variables included in their analysis of savings can be considered valid for the present study as well. Indeed, de Castro Campos et al. (2013), for instance, focus only on OECD countries, so that some macroeconomic variables not considered might still be important when countries outside the OECD list are included, and vice versa. Secondly, the study from IMF manages to restrict the list of standard variables incorporated in the analysis, hence the convenience to use those same variables, considering that they are included as control and not main independent variables.

The present study implements the following variables, as considered in the report of IMF (2005). To account for output it is considered the real per capita GDP growth, and the terms of trade growth. The real interest rate was included to check for rate of return on savings. To consider the constraints that households may encounter when borrowing it was included a variable measured by the private sector credit computed as a percentage of GDP. Moreover, public savings as a percentage of GDP were incorporated to account for fiscal policy influences. Finally, the elderly dependency ratio was implemented to account for the age of the population.

In appendix C can be found the exact variables retrieved from the World Development Indicators collected in the World Bank database and the eventual computation of some of the data in order to compose the necessary variables.

Figure 4 - Summary of the identified elements of self-control and their relative measurement
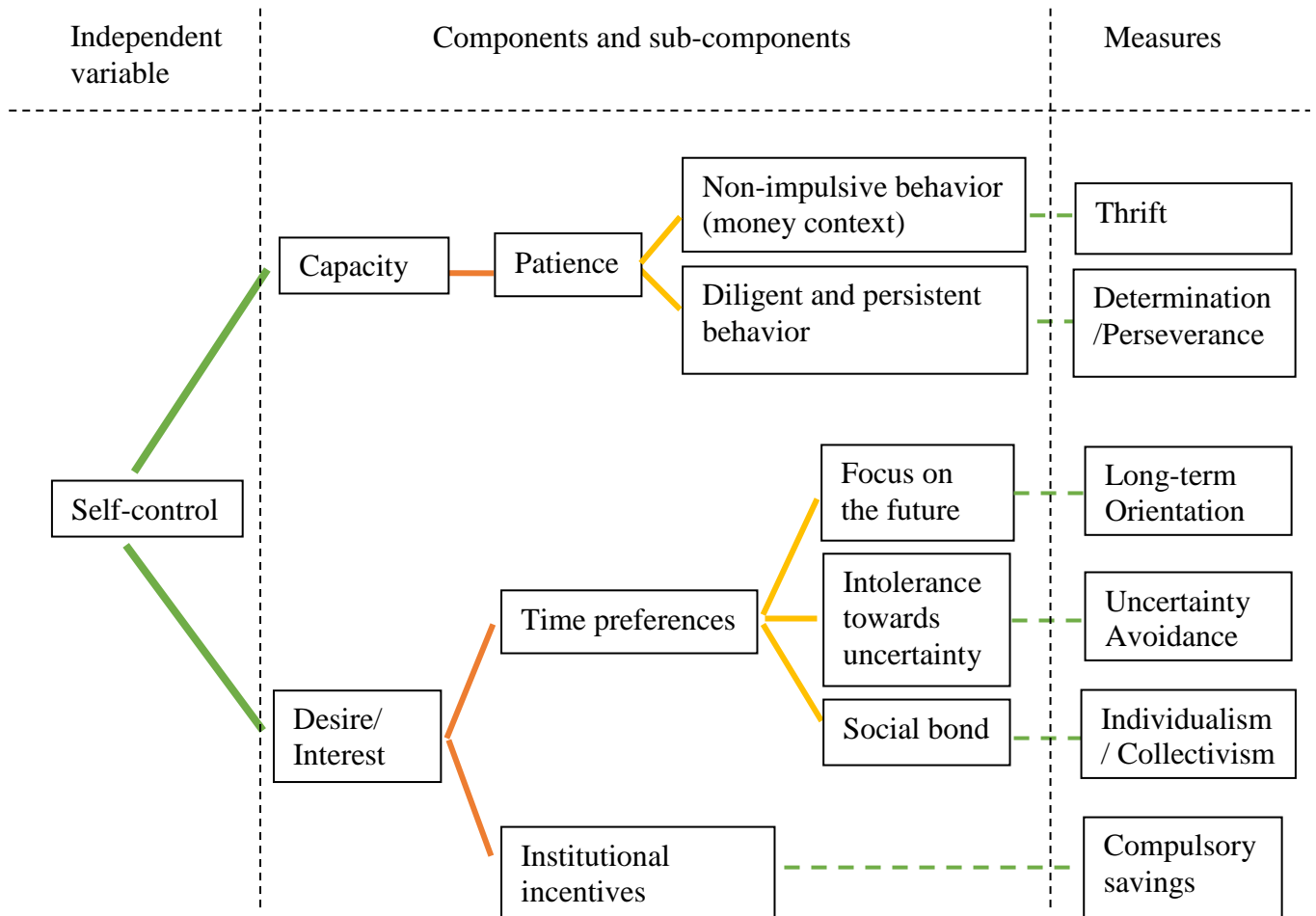
3.3 – Empirical Model

The empirical analysis was run with simple OLS regressions. This was possible because when multiple time observations were available for most of the countries, they were averaged into one. Moreover, also no multilevel issues were needed to be handled because the variables were all at the

country level, except the survey data. In that case, household observations were averaged before running the regressions, so that only one country score was obtained.

Considering the research question and sub-questions, the empirical analysis was divided in four steps. Firstly, the different components identified as determinants of self-control were checked for correlation between each others and with the dependent variable. Secondly, the component of Capacity and that of Desire/Interest were compared to answer the question on which aspect of self-control drives more strongly the differences in savings across countries. Thirdly, an index of self-control was created and analyzed together with the control variables. Fourthly, the explanatory powers of self-control and IQ were compared to answer the question about which of the two predicts savings better.

Following the first round of analysis, from which little (if any) significance was surprisingly found, data were 're-thought' and the empirical procedure was run again. Specifically, the unexpected results were thought to be consequence of the range of years included (1999-2014). Particularly, the economic crisis that hit from 2007 onwards might have caused some shocks in people's behavior that are not related to the answers given in the surveys and the cultural indicators. For this reason, all variables were re-calculated by including in the countries' averages only those observations up to 2006. Following this procedure, the sample of countries decreased to 51.

In Section 4 are reported the results emerging from the empirical analysis.

3.4 – Strength and weaknesses

First and foremost, the attempt in trying to create scores for self-control is probably flawed by many limitations and imperfection. The identified components might be incomplete or wrong, leading to misspecification in the model. However, the check run for model specification showed that the model was not flawed by omission of variables. Furthermore, the choices on how to measure the identified elements of self-control might be inaccurate, leading to measurement errors. Given these acknowledgements, further research should be directed towards the composition of a more precise measure.

Moreover, another problem that might be put forward concerns the merging of objective and subjective measures. Subjective measures are often criticized by economists, who label survey data as being not meaningful, especially when it comes to general measures of 'levels' or 'extent' of certain concepts that are difficult to observe (Bertrand & Mullainathan, 2011; Jahedi & Méndez, 2014). In this context, and relevant to this study, it emerges the issue of (unintentional)

manipulation, deriving from the inevitable ordering of questions in a survey. Indeed, whether a question precedes or follows another question could influence the answers in many ways, especially because people generally want to provide consistent answers (Bertrand & Mullainathan, 2011). Both Bertrand & Mullainathan (2011) and Jahedi & Méndez (2014) agree that the measurement error that emerges is heavier than just white noise. However, in both papers the authors agree that also objective measures contain biases. From the two studies it emerges that when a variable cannot be computed by objective measures free of errors, and the subjective measures do not present heavy problems of measurement error, then the subjective measures might even be a better tool to assess the variable of interest. The reason comes exactly from the same reason why subjective measures are criticized: their property of estimating unobservable characteristics in broad concepts (Jahedi & Méndez, 2014).

Considering the specific survey questions that it was made use of, Thrift has been criticized in the context of savings. Specifically, it is seen as an outcome variable that does not reflect personal values (de Jong & Schilpzand, forthcoming). Despite this consideration, from the way the variable is measured (for the exact question asked in the survey, see Appendix C) it seems that it reveals the propensity of the parents to (or at least their evaluation of) teaching such a quality to their children. To this extent, then, the Thrift question could be considered a measure of values at the household level.

Finally, endogeneity issues could dampen the validity of the empirical model used. Indeed, the findings of Moffit et al. (2011) already presented in the Introduction (p.4) suggest that traumas and violence aggravate the chance of out-of-control behavior, factors that tend to be more crucial for poor people. As a consequence, causality could be difficult to be determined. Are people with low self-control determining lower savings and therefore lower money endowment, or is the condition of poverty itself that causes people to develop lower self-control? To solve endogeneity problems, researchers often lag the suspected variable by several periods. However, in this context, considering the 'sticky' time variation in the cultural components of self-control, the lag needed might be of several decades or century. This justifies the choice in the thesis title of wording the relationship between self-control at the national level and savings as having a link; identification of a causal relationship goes beyond the scope of the current work.

4. Results

4.1 – Main results

As discussed in Section 3.3, the crisis that hit from 2007 onwards might have caused some inconsistencies in saving behavior. By including the observations of the years from 2007 onwards, only Long Term Orientation was found significantly correlated with Private Savings, even after trying to remove influential cases. After excluding the observations of the years after 2006, all variables were re-calculated by including in the countries' averages only those data up to 2006.

The descriptive statistics of the variables can be found in Appendix D. Few checks were carried out before running the regressions, to make sure that the data follow the Gauss-Markov prerequisites for Ordinary Least Squares to be a good estimate. Firstly, the dependent variable was logged, so that both the dependent variable and the residuals look much better, and are now normally distributed. However, in logging the dependent variable, one country needed to be dropped because the value of Private Savings was negative so that when logged it created a missing value. Secondly, after an analysis of outliers and influential cases, the country of Hong Kong was dropped because its Lever, Cook's Distance, and DFITS values were exceeding the critical values set by the literature as rule of thumbs. Thirdly, residuals are homoscedastic, meaning that they comply with the assumption of homogeneous variance of residuals. Finally, the linear relationship needed between independent and dependent variables is not violated.

The correlation matrix between variables is run again, and now they look much more as expected (see Appendix E). Only the Uncertainty Avoidance Index and the Compulsory Savings dummy are not significantly correlated to Private Savings. Considering Uncertainty Avoidance, its coefficient has also the wrong sign from what it was expected. This could be because it might reflect an aspect unrelated with time preference (and thus self-control). Despite the paper by Wang et al. (2016) connects it to time preference, the description of the index provided by Hofstede stresses the importance of not confusing uncertainty avoidance with risk avoidance. He explains (Hofstede, 2016, August 15) that the population of a country with low uncertainty avoidance might take risks, as long as they think to 'know them', and therefore are not uncertain about the situation. As a consequence, this explanation could illustrate the non-relatedness found between with Private Savings. Concerning the Compulsory Savings dummy, the reason for it to not be significantly correlated to Private Savings could derive from the fact that the measure was obtained by the World Bank website which provided the database updated to the year 2012. For this reason, considering that countries have greatly reformed their pension schemes in the past decades (Whitehouse, 2005),

the data obtained might not be in line with the saving behavior of previous years. Both Uncertainty Avoidance and Compulsory Savings are dropped from the list of explanatory variables, for the reasons explained above.

The following step in the analysis consists in the creation of the indexes of Patience, Time Preference, and the overall index of Self-Control. The choice of indexing is justified by both the theory outlined in the previous sections (see Figure 4) and the correlation between independent variables found in the correlation matrix (Appendix E). Firstly, Determination/Perseverance and Thrift are two sub-components of Patience, and they are also found correlated with each other. Secondly, Long Term Orientation is correlated with both Thrift and Determination/Perseverance. This outcome, as already expected (see section 3.2.2), could be consequence of the fact that these predictors might overlap and measure similar aspects in slightly different ways. To avoid having to drop predictors, and in line with the conceptual scheme of Self Control, the two indexes of Patience and Time Preference were created. Lastly, the final index of Self Control is created by putting together Patience and Time Preference. Before indexing, the variables are standardized to homogenize their scale; their descriptive statistics can be found in Appendix D.

Three regressions were run, to answer the respective research question and sub-questions. The first regression aims at answering the question related to which aspect of self-control influences more strongly savings. The regression outcomes can be found in Figure 5. As can be seen, all coefficients are positive, as expected. This means that an increase in the Patience or Time Preference index causes an increase in the amount saved. Time Preference and Patience are significantly correlated to each other, as already expected from the correlation that Long Term Orientation had with Thrift and Determination/Perseverance. For this reason, the two predictors were run in two separate specifications as simple OLS regressions, isolating the effect of the two independent variables. In order for the two models to have comparable regression coefficients, the variables need to be standardized. The standardized coefficients of different regressions can be compared because they are measured in units of standard deviations. This means that the interpretation of the coefficients is different. While in the usual regressions the relationship between dependent and independent variables is expressed in units of the variables, in the standardized models the relationship is expressed in units of standard deviations. So, comparing model (1) and (2), when the standard deviation of Patience changes by one, Private Savings change by 0.446 standard deviations. Similarly, when the standard deviation of Time Preference changes by one, the Private Savings change by 0.639 standard deviations. When looking at the R-squared, the one in the model with Time Preference amounts at 0.169, while that in the model with Patience amounts at 0.096. This means that the Time Preference index is able to explain 17% of the variation in Private Savings, while the Patience index can explain only 10%. Overall, this seems to mean that the

cultural component is a stronger predictor then the household component. This would mean that, in relation to explaining an increase in savings, the cultural elements that influence the development of individuals' self-control are stronger than the more 'personal' elements of self-control developed within the household.

Figure 5 - Comparison between Patience and Time Preference in explaining Private Savings

	(1) single OLS	(2) single OLS
Patience	0.446** (2.47)	
TimePreference		0.639** (3.28)
Constant	24.24*** (82.04)	24.24*** (85.53)
Observations	49	49
Adjusted R-squared	0.096	0.169

dependent variable: Private Savings
* p<0.10, ** p<0.05, *** p<0.001

The second step in the regression analysis aims at answering the main research question about the link between the overall measure of self-control and that of private savings. The regression outcomes can be found in Figure 6. In the table, the first column considers only the self-control index, columns from (2) to (7) implements one by one each singular control variable, and the last column includes all variables. As can be seen, the coefficient of self-control stays significant in all models. Considering the models where the control variables are considered one at a time, it can be seen that none of their coefficients is significant, except that of Private Sector Credit. Moreover, the coefficients of Old Dependency ratio and that of Private Sector Credit have also the wrong sign from what would be expected. Considering the ambiguity in the sign expected for the Real Interest

rate coefficient, it seems that the income effect dominates the relationship, so that individuals compensate a decrease in interest rates by increasing the amount saved. The coefficients of Real GDP growth and Public Savings are in accordance to the expected sign. However, the coefficients are not significant. It can be concluded that in this sample and with these variables, these control variables are simply not significant. The reason for these unexpected results concerning the control variables might be attributed to the delayed effect that they might have on savings. Taking previous years might thus be a solution to find them significant. However, there is no time series in the dataset, so that lagging in not possible.

Overall, all the models in Figure 6 are significant (the F-value is significant), even the last model with all the controls included. Although in column (8) some control variables change sign and stay not significant, Self-control maintains explanatory power. Specifically, an increase by one unit in the index of self-control causes an increase of 0.247 in the value of Private Savings. However, the Private Savings variable was logged, originating a Log-level regression, and therefore changing the numerical interpretation [3]. To interpret the coefficient, it needs to be taken its exponential value (i.e. exp 0.247 = 1.2802). Economically, it can then be said that private savings increase by 28% by each unit of increase in the self-control index.

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[3] Log- level regressions are of the type: $\ln(Y) = \beta_0 + \beta_1*X + e$. The interpretation is that if we increase X by one unit, Y would change by $100*e^{\wedge}\beta_1$ percent.

Figure 6 - Regressions with Self-control and control variables

	(1) OLS	(2) Control	(3) Control	(4) Control	(5) Control	(6) Control	(7) Control	(8) Control
SelfControl	0.386***	0.378**	0.401***	0.382**	0.222**	0.386**	0.369**	0.247*
	(3.55)	(3.40)	(3.69)	(3.38)	(2.08)	(3.50)	(2.85)	(1.94)
Real GDP growth		0.0130						-0.0513
		(0.39)						(-1.33)
Terms of Trade growth			-0.000483					-0.000252
			(-1.22)					(-0.67)
Real Interest rate				-0.00485				0.0356
				(-0.12)				(0.85)
Private Sector Credit					0.0228***			0.0272***
					(3.61)			(3.57)
Public Savings						-0.0000360		-0.000927
						(-0.01)		(-0.19)
Old Age Dependency Ratio							0.0109	0.00259
							(0.24)	(0.06)
Constant	24.24***	24.28***	24.32***	24.27***	22.84***	24.24***	24.05***	22.19***
	(86.92)	(81.71)	(85.37)	(63.94)	(49.67)	(85.96)	(28.74)	(21.38)
Observations	49	49	49	49	49	49	49	49
Adjusted R-squared	0.195	0.180	0.203	0.178	0.359	0.178	0.178	0.323

dependent variable: Private Savings
* $p<0.10$, ** $p<0.05$, *** $p<0.001$

The last step in the regression analysis aims at answering the sub-question that arose from the literature about whether self-control is a stronger predictor for savings than IQ or vice-versa. The regression outcomes can be found in Figure 7. After running a correlation between the two variables, they were found to be positively significantly correlated, with a quite high correlation of 0.7. For this reason, when regressed against Private Savings, it was made use of standardized variables in model (1) and (2), so that the two separate regression coefficients can be compared. So, comparing the two model specifications, when the standard deviation of Self-Control changes by one, Private Saving changes by 1.001 standard deviations. Similarly, when the standard deviation of IQ changes by one, Private Savings change by 1.042 standard deviations. Both coefficients are strongly significant with a p-value lower than 0.001. When looking at the R-squared, the one in the model with self-control amounts at 0.195, while that in the model with IQ amounts at 0.213. This means that the IQ scores are able to explain 21% of the variation in Private Savings, while the Self-Control index can explain 19.5%. Overall, while this appears like a tiny difference, it still means that in this sample IQ is slightly better as a predictor for the amount people save across countries. Another interesting aspect, connected to the discussion at the beginning of Section 3.2.2, is that self-control and IQ seem to be interdependent, because significantly correlated with each other. However, this outcome still leaves open the question on how / in what sense these two aspects are connected with each other.

Figure 7 - Comparison between Self-Control and IQ in explaining Private Savings

	(1) single OLS	(2) single OLS
Self Control	1.001*** (3.55)	
IQ		1.042*** (3.74)
Constant	24.24*** (86.92)	24.24*** (87.89)
Observations	49	49
Adjusted R-squared	0.195	0.213

dependent variable: Private Savings
* p<0.10, ** p<0.05, *** p<0.001

4.1 – Robustness checks

Three robustness checks were run to strengthen the results concerning the main research question. The first one considers the possibility of transforming the control variables to improve their distribution in terms of kurtosis and skewness with the aim of checking whether in that case the variables could become significant in the regression analysis. The second check runs the regression without those countries that were part of a macro group in the Hofstede's dimensional scores which shared one same cultural score for each dimension (i.e. West Africa, East Africa, Arab Countries). The third check substitutes the continuous dependent variable obtained from the World Bank datasets with a categorical dependent variable obtained from the Integrated Values Survey.

4.1.1 – Robustness check n.1

In trying to transform those control variables for which the distribution could be improved, logged transformation of the variables often substantially worked in making their distribution normal. However, for Real GDP growth, Term of Trade growth, and Public Savings it was not possible to keep the log because too many missings were created when transformed. Only Real Interest Rate and Private Sector Credit could be drastically improved by logging them without losing too many countries at the same time. Because of this, when the same regressions as the one in Figure 6 were run, the results do not change much. Self-Control stays significant in all the regression specifications. The outcome table can be found in Appendix F.

4.1.2 – Robustness check n.2

The countries part of the macro-groups that share the same score for each dimension are: Egypt, Jordan, Morocco, Nigeria, and Uganda. Therefore, the number of observations in the regressions decreases to 44. The same regressions as the one in Figure 6 were run, and the outcome table can be found in Appendix H. As can be seen, the Self-Control index stays significant across all regressions except when regressed together with Private Sector Credit. The coefficient of Self-Control is not significant and that of Private Sector Credit is strongly significant with a p-value lower than 0.001 and a positive coefficient. Another interesting aspect concerns the significance of the models overall. The F-statistic is not significant for models (4), (6), (7). This, compared to the significance of the simple regression run with only Self-Control, could mean that the addition of some control variables dilutes the significant effect that self-control has to the extent that the overall model loses significance. As a consequence, also model (8), which implements together all control variables,

results non-significant, despite the Self-control coefficient is. The outcome table can be found in Appendix G.

Overall, similarly to the conclusions drawn from the main regressions represented in Figure 6, the overall non-significant results concerning the control variables might be attributed to the delayed effect that some might have on savings. Moreover, once again, Private Sector Credit is the only control variable which holds significance across all regressions and robustness checks. This could be due to the fact that this variable does not have a delayed effect on individuals' saving behavior. However, this variable also consistently holds a positive coefficient sign, which is not what would be expected from the literature.

4.1.3 – Robustness check n.3

This last check has the aim of testing whether the index of self-control created yields the same results with a different dependent variable representing saving. By same results it is meant in terms of the sign of the relationship with savings and also in terms of significance of its explanatory value. The sample of countries that was possible to use (considering that the availability of answers for the dependent variables differ) amounts at 47, 36 of which are in common with the list of countries considered in the main regressions. The regression run was a Multilevel Ordered Logit, where the dependent variable is the one for which is necessary to cluster into countries. The dependent variable is categorical and it ranges from 1 to 4, where 1 means that the household has 'saved', 2 that it has 'just got by', 3 that it 'spent some savings and borrowed money', and 4 that it 'spent savings and borrowed money'. The independent variable of Self-Control is constructed in the same way as for the main regression.

The regression outcome table can be found in Appendix H. The model is overall significant, and the cuts are significantly different from each other. The coefficient of Self-Control is significant with a p-value lower than 0.001 and has a negative sign. This means that a unit increase in the index of Self-control decreases the odds of being in a higher category of the dependent variable. Practically, this means that an increase in the Self-Control of a country decreases the probability of saving less (or even borrowing money).

5. Discussion

This Section has the purpose of discussing few interesting side points arising from the main results presented in Section 4.1.

Firstly, it was interesting to see the profound difference in outcomes between the dataset including the years from 2007 onwards and the dataset excluding those years. From a comparison of correlation tables, in the first dataset only Long Term Orientation was significantly correlated to Private Savings. The fact that the variables were not significant before and they were after the crisis was excluded, might mean that the shock the crisis created made people change saving behavior in a way that was not consistent anymore with the answers obtained from the surveys. In addition, the Long Term Orientation dimension could still carry significance. This could simply mean that the cultural aspect representing the focus on the future that differ across countries is more resistant to shocks (such as the crisis), and therefore more rooted in societies.

The second point of discussion concerns the use of a dummy for compulsory saving schemes. While the non-significance of the variable used could be attributed to the year it was referring to, implementing a dummy to represent compulsory saving schemes might be insufficient in general, even if the proper years were available. There might be multiple reasons for this. First, mandatory pension schemes might treat workers in different sectors differently (Whitehouse, 2005), and therefore have different impacts on their saving behavior. Second, the age of the pension scheme (i.e. how long the scheme has existed for) might have an impact. For instance, it makes a difference if a person could start saving when s/he was 20 years old, than when s/he was 40 years old. Third, sometimes, pension scheme reforms do not work backwards, in the sense that only new entrants are affected by reformed schemes and workers already in the market are still subjected to previous systems (Whitehouse, 2005). Overall, this makes more difficult the task to have a valid proxy to represent the institutional incentives influencing the formation of self-control in the context of savings. Some more complex consideration of the sub-schemes characteristics could also be better to have a meaningful relationship with savings.

The third point of discussion concerns the control variables. Almost all of them were consistently insignificant. The more likely reason for this is that these variables very often have a delayed effect on economic behavior. However, there is no time series in this analysis, so there is no possibility of lagging them without having to change the dataset. Furthermore, the only variable that showed consistent significance in the analysis is that of Private Sector Credit. A speculative reason for this exception could be that this specific variable does not have a delayed effect on saving behavior. Another noteworthy aspect regards the sign that the coefficient of this variable has in the

regressions. The literature (see Section 2.1) expects the coefficient to be negative. This was indeed found in the work of Loayza (2000) and IMF (2005). Nevertheless, Edwards (1996) found a positive coefficient instead. This result does not support the view that borrowing constraints cause lower savings. Edwards (1996) explains that a possible reason for this unexpected result could be given by the fact that Private Sector Credit is not a good proxy for borrowing constraints. However, the author continues, more appropriate measures are not available for many countries.

Fourthly, it could be argued whether the index of Self-Control built in this work is appropriate to actually represent a national level of self-control. Considering the implementation of variables which are drawn from surveys, one could raise the doubt on the impact that measurement errors[4] (typically responsible to flaw survey data) had on the overall index of self-control. It follows another, more critical, possible limitation: the choice of variables as proxy for self-control might not be entirely appropriate to represent self-control. Following the literature that describes the elements and aspects of self-control, the variables implemented appeared to be the more accurate ones to measure the components of self-control. However, this is a call for further researcher to review and perfect the construction of the index.

Lastly, the comparison between IQ and Self-Control raises a couple of points. First, the two seem to be highly correlated with each other. Second, IQ seems to be slightly better at explaining savings than Self-Control. However, following the limitations expressed by the literature analyzed throughout this work, what does IQ actually measure? IQ tests can be divided between verbal and non-verbal questions, where the former inspects common knowledge, vocabulary, and math, and the latter examines puzzles and symbols. Murdoch (2010) historically analyzes how IQ tests were not based on scientific theories, but instead on needs of measuring achievements. The author also stressed how this measure's results started to be abused by attributing them the power of being able to explain individuals' capacity to think. It seems plausible that IQ, instead of measuring intelligence and thus mental ability, is actually a measure of the educational preparation of people. Overall, the doubts concerning what IQ scores mean are still standing. However, to whatever extent they are actually able to explain thinking ability, what emerges from the current analysis is that those scores are highly correlated with the Self-Control index generated, and the two have similar predicting power in explaining savings. It could be interesting if further research focuses on the way these two measures are interrelated; for instance, by analyzing whether all the components of Self-Control are correlated with IQ, or only few or one.

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[4] Main causes of measurement errors: questionnaire design, method of data-collection, interviewer influence in interpretation of answers or in misleading the respondent, interpretation of questions by the respondents (Kasprzyk, 2005).

6. Conclusion

The field of behavioral economics has extended the explanations of economic phenomena and behaviors by implementing insights from sociology and psychology. Consequently, also the literature on the causal aspects influencing savings has been enriched. Considering that one of the main tools of analysis for behavioral economists are experiments, many researches focus on micro-level analyses. Then, aggregating results obtained at the micro-level to form macro-level analysis often does not suffice because of the risk of incurring in ecological issues.

Some researchers have analyzed cultural components in relation to savings. However, cultural components are plausible to influence many 'personal' characteristics, among which self-control. At the micro-level, this characteristic has already been found to profoundly differentiate between individuals to the extent of influencing different outcomes in life. Moreover, authors that have analyzed differences between countries have often taken into account whether cognitive differences could have explanatory power (i.e. IQ scores). Nevertheless, at the macro-level, not many researches have considered non-cognitive abilities (i.e., for instance, self-control). Therefore, this research's main focus was about trying to fill the gap in the literature about understanding whether self-control differences exist in significant matter between countries to the extent that they can explain differences in savings.

The outcome of this research shows that the cultural components and the household elements that influence the individual formation of self-control have predictive power in explaining cross-country differences in savings. Moreover, the national cultural component seems to hold slightly more power, so that it seems that the cultural component of 'desire/interest' dominates the 'capacity' element of self-control. However, because of endogeneity issues, it is not possible to claim causality from this analysis. Nevertheless, I have argued that the results are relevant in underlying the importance that the elements forming self-control at the national level have in relation to savings.

The findings are relevant when placed in the larger context of the policy implications that they might hold. From the results it follows the usefulness that teaching self-control might have and the impact it might lay on the specific aspect of savings. This conclusion has already been put forward by some researchers referenced throughout this thesis, although their analysis was run at the micro-level taking into account individuals from the same society.

Beside the main contribution of this work, a few other interesting points have emerged. It was curious to see that more within country than between countries standard deviation was found. However, because of obvious reasons, this outcome concerns only the 'capacity' element of self-

control measured at the household level. This means that differences between households within the same countries are more profound than differences between countries. Some interesting points can also be drawn from the comparison between IQ and Self-Control. The two variables were found highly correlated. While this contributes little to the existing literature, it was curious to see that small difference was found in the explanatory power of the two variables in predicting savings.

Concerning these contributions some limitations arise. While the weaknesses have already been thoroughly discussed in the dedicated Section (3.4), the most important one concerns the main research question, consisting of the proxies used to measure the sub-elements of self-control. Further research is welcomed and recommended to work on a refinement in the construction of the index of self-control. Especially, it should focus on trying to improve the measures that represent the institutional incentives to save (i.e. Compulsory Savings). Another matter for further research, which also follows the introduction of a better measure of compulsory savings, concerns the explanatory power comparison between 'capacity' and 'desire/interest'. This comparison should then be reviewed, although the implementation of a valid measure for institutional constraints seems likely to lead to an even stronger conclusion on the power of desire/interest to be the aspect of self-control more strongly driving savings. A last suggestion for future research is related to IQ. Checking which sub-element of self-control is correlated to IQ might help in the understanding process of what IQ actually measures.

To conclude, many researchers that focus on improving the aspects and measuring the relevant elements that influence economic phenomena have made a big step forward when they acknowledged the relevance of behavioral factors. However, these factors are also more difficult to be observed (and thus accurately measured) then objective elements. Nevertheless, even if some elements are of difficult measurement, they might still be worth consideration and further study for improvement, because "not everything that counts can be counted, and not everything that can be counted counts" (Cameron, 1963, p.13).

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8. Appendix

Appendix A: List of countries in the sample (in parenthesis those excluded in the second round of analysis, after years from 2007 onwards were not included).

(Algeria)	Korea South
Argentina	(Kuwait)
Australia	(Lebanon)
Austria	Lithuania
(Bahrain)	(Malaysia)
Bangladesh	Malta
Belgium	Mexico
Brazil	Morocco
Bulgaria	Netherlands
Canada	New Zealand
Chile	Nigeria
China	(Norway)
Colombia	Peru
(Croatia)	Philippines
Czech Rep	Poland
Denmark	Portugal
Egypt	Romania
Estonia	Russia
Finland	Serbia
France	Singapore
Germany	Slovak Rep
Greece	Slovenia
Hong Kong	Spain
Hungary	Sweden
India	(Switzerland)
Indonesia	Uganda
(Ireland)	United Kingdom
Italy	USA
Japan	Uruguay
Jordan	Vietnam

Appendix B: World Development Indicators and eventual computation.

• *Private Savings*

Considering the (ex-post) national account identity of an open economy, we have that $Y = C + I + G + NX$, where Y is the national income, C is private consumption, I is investments, G is government purchase, and NX is the net result of the difference between exports and imports. Reorganizing the equation we have $Y - C - G = I + NX$, so that $S - I = NX$. Then, considering that S is the sum of private (S_p) and public (S_g) savings, we can split the identity in two. On one side, there is $S_g = T - G$, where T is the government revenue from taxes. On the other side, there is $S_p = Y - C - T$.

To construct the data the following indicators were used:
- GDP (current $)
- Tax revenue (% of GDP)
- Household final consumption expenditure (current $)

Computation in steps:
1. Disposable Income = GDP – (GDP * (Tax revenue GDP %))
2. Private Savings = Disposable Income – Household final consumption expenditure

• *Real GDP per capita growth*

To construct the data the following indicators were used:
- GDP per capita growth (annual %)
- Inflation, GDP deflator (annual %)

Computation in steps:
1. Real GDP per capita growth (annual %) = GDP per capita growth (annual %) – Inflation

• *Terms of trade growth*

The indicator used is: Net trade in goods and services (BoP, current US$).

Computation in steps:
1. Terms of trade growth = (Terms of trade$_t$ – Terms of trade$_{t-1}$)/Terms of trade$_{t-1}$*100

• *Private sector credit as a percentage of GDP*

The indicator used is: Domestic credit to private sector (% of GDP).

• *Public savings as a percentage of GDP*

To construct the data the following indicators were used:
- Gross domestic savings
- Private savings (as computed in the first point)
- GDP (current $)

Computation in steps:
1. Public savings = Gross domestic savings – Private savings
2. Public savings (% GDP) = (Public savings * 100) / GDP

• *Elderly age dependency ratio*

The indicator used is: Age dependency ratio, old (% of working-age population)

• *Real interest rate*

The indicator used is: Real interest rate (%)

Appendix C: Questions from the Integrated Values Survey questionnaire.

Question on Thrift and Determination/Perseverance:

_____
Q.49
Here is a list of qualities which children can be encouraged to learn at home. Which, if any, do you consider to be especially important? Please choose up to five.

CARD 49

A-   Good manners
B-   Independence
C-   Hard work
D-   Feeling of responsibility
E-   Imagination
F-   Tolerance and respect for other people
G-   Thrift, saving money and things
H-   Determination, perseverance
I-   Religious faith
J-   Unselfishness
K-   Obedience

_____

Response categories in file:
-5 Missing; Unknown
-4 Not asked in survey
-3 Not applicable
-2 No answer
-1 Don't know
0 Not mentioned
1 Important

Appendix D: Descriptive statistics of variables.

Variable	Obs	Mean	Std. Dev.	Min	Max
IdvCol	51	46.79412	23.26546	13	91
Uai	51	67.2451	23.09077	8	100
Lto	51	49.56137	22.97782	9	100
Thrift	51	.3579834	.149151	.0183706	.70125
DetPers	51	.3690649	.1334857	.0591054	.6724452
CompSvg	51	1.54902	.5025426	1	2
IQ	51	93.97059	8.130444	69	108.5
GDP	51	-2.548455	8.505485	-36.15951	8.163912
ToT	51	157.7773	699.8459	-122.898	4756.542
Interest	51	6.425574	7.293695	-11.53583	41.24017
Credit	51	63.8243	44.96989	7.105811	189.1945
PublSvg	51	2.070062	54.49805	-71.71344	345.6136
AgeDep	51	16.97162	7.109425	5.22032	29.91237

Variable	Obs	Mean	Std. Dev.	Min	Max
Patience	49	-5.47e-09	1.654455	-4.309683	3.494456
TimePrefer~e	49	4.41e-09	1.468758	-2.999371	2.582309
SelfControl	49	-1.54e-08	2.596847	-5.914918	5.099549

Appendix E: Correlation matrix between dependent and independent variables.

.

```
                    (1)

            PvtSvg      Thrift      DetPers      IdvCol        Uai        Lto      CompSvg
_____

PvtSvg          1
Thrift      0.300**         1
DetPers     0.262*      0.369**         1
IdvCol      0.344**     -0.230       0.118          1
Uai         -0.0822     0.0585      -0.00855     -0.215         1
Lto         0.290**     0.613***     0.424**      0.0786      0.0107        1
CompSvg     0.202       0.308**      0.186        0.0137      0.0992      0.170        1
_____
```

* p<0.10, ** p<0.05, *** p<0.001

Appendix F: Robustness check n.1.

.

	(1) single OLS	(2) single OLS	(3) single OLS	(4) single OLS	(5) single OLS	(6) single OLS	(7) overall OLS
SelfControl	0.378**	0.401***	0.375**	0.243**	0.386**	0.369**	0.266*
	(3.40)	(3.69)	(2.86)	(2.19)	(3.50)	(2.85)	(1.87)
Real GDP growth	0.0130						-0.00792
	(0.39)						(-0.13)
Terms of Trade growth		-0.000483					-0.000336
		(-1.22)					(-0.83)
log Real Interest rate			-0.282				0.310
			(-0.61)				(0.63)
log Private Sector Credit				1.134**			1.405**
				(3.01)			(2.58)
Public Savings					-0.0000360		-0.00134
					(-0.01)		(-0.26)
Old Age Dependency Ratio						0.0109	0.00817
						(0.24)	(0.17)
Constant	24.28***	24.32***	24.68***	19.87***	24.24***	24.05***	18.10***
	(81.71)	(85.37)	(28.66)	(13.46)	(85.96)	(28.74)	(6.68)
Observations	49	49	46	49	49	49	46
Adjusted R-squared	0.180	0.203	0.178	0.313	0.178	0.178	0.276

dependent variable: Private Savings
* p<0.10, ** p<0.05, *** p<0.001

Appendix G: Robustness check n.2

.

	(1) single OLS	(2) single OLS	(3) single OLS	(4) single OLS	(5) single OLS	(6) single OLS	(7) single OLS	(8) single OLS
SelfControl	0.270**	0.253*	0.292**	0.286**	0.0340	0.267**	0.290**	0.284**
	(2.13)	(2.00)	(2.31)	(2.10)	(0.31)	(2.05)	(2.12)	(2.04)
Real GDP growth		0.0471						0.0490
		(1.32)						(1.36)
Terms of Trade growth			-0.000509					-0.000498
			(-1.40)					(-1.33)
Real Interest rate				0.0144				
				(0.35)				
Private Sector Credit					0.0270***			
					(5.10)			
Public Savings						-0.000959		-0.000739
						(-0.20)		(-0.15)
Old Age Dependency Ratio							-0.0184	-0.0113
							(-0.42)	(-0.25)
Constant	24.43***	24.56***	24.51***	24.33***	22.82***	24.44***	24.76***	24.84***
	(87.77)	(84.04)	(87.32)	(61.27)	(59.32)	(86.58)	(30.05)	(29.64)
Observations	44	44	44	44	44	44	44	44
Adjusted R-squared	0.076	0.092	0.097	0.056	0.421	0.054	0.057	0.071

dependent variable: Private Savings
* $p<0.10$, ** $p<0.05$, *** $p<0.001$

Appendix H: Robustness check n.3

```
Mixed-effects ologit regression                Number of obs     =      82,515
Group variable:                 S003           Number of groups  =          47

                                               Obs per group:
                                                             min =         613
                                                             avg =     1,755.6
                                                             max =       3,923

Integration method: mvaghermite                Integration pts.  =           7

                                               Wald chi2(1)      =       12.46
Log likelihood = -99490.217                    Prob > chi2       =      0.0004
```

X044	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf. Interval]	
SelfControl	.9823435	.0049572	-3.53	0.000	.9726755	.9921076
/cut1	-1.289713	.0109295	-118.00	0.000	-1.311135	-1.268292
/cut2	.9530632	.0105352	90.46	0.000	.9324146	.9737118
/cut3	1.98524	.0126806	156.56	0.000	1.960386	2.010094
S003						
var(_cons)	8.08e+08	3.46e+07			7.43e+08	8.78e+08

```
LR test vs. ologit model: chibar2(01) = 4152.63      Prob >= chibar2 = 0.0000
```