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Institute of Economic Studies

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Czech Pension Reform through the Lens of Behavioral Economics

Master Thesis

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Abstract

The field of behavioral economics can provide original insights into many areas of economic decision-making. In my thesis I use the point of view of behavioral economics to assess the current Czech pension reform plan. I study time discounting as the main determinant of saving behavior and deal with its relationship to the Czech pension reform architecture. The three fundamental features of the Czech pension reform plan that are examined are entry into the private funded scheme that is to be introduced by the Czech pension reform plan, the contribution rate into the private funded scheme and access to deposits in the private funded scheme. In order to obtain data for my research I conducted own survey. The results of statistical analysis confirmed the hypotheses of behavioral economics that people exhibit heterogeneous time discounting which influences their saving behavior and these characteristics can also determine their preference for the pension reform features. It implies a possibility for policy-makers to take the behavioral impacts of the pension reform aspects into consideration when improving its final design.

Keywords: Czech pension reform, behavioral economics, time discounting, self-control, financial knowledge
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Abstrakt

Obor behaviorální ekonomie může přinášet originální způsoby chápání mnohých oblastí ekonomického rozhodování. V mé diplomové práci hodnotím z pohledu behaviorální ekonomie současný plán české důchodové reformy. Studuji diskontování jako hlavní determinant spoření a zabývám se jeho vztahem s podobou české penzijní reformy. Hlavní tři parametry plánu české penzijní reformy, které jsou v této souvislosti zkoumány, jsou vstup do systému penzijních fondů, který má být českou penzijní reformou zaveden, sazba příspěvků do systému penzijních fondů a přístup k depozitům v penzijních fondech. Data pro můj výzkum jsem získala vlastním dotazníkovým šetřením. Výsledky statistické analýzy potvrdily hypotézy behaviorální ekonomie, že lidé vykazují heterogenní diskontování, což ovlivňuje jejich chování spojené se spořením, a tyto charakteristiky mohou také determinovat preference vůči jednotlivým aspektům penzijní reformy. To implikuje možnost vzít v potaz behaviorální vlivy jednotlivých parametrů penzijní reformy při úpravě její koncepce.

Klíčová slova: česká důchodová reforma, behaviorální ekonomie, diskontování, sebekontrola, finanční gramotnost

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Declaration

The author hereby declares that she compiled this thesis independently, using only the listed resources and literature.

The author hereby declares that this thesis was not used to obtain another title.

The author grants permission to Charles University to reproduce and to distribute copies of this thesis document in whole or in part.

Prague, 14 May 2012 Jana Kahounová _____

(signature)

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Contents

Master Thesis Proposal

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Czech Pension Reform through the Lens of Behavioral Economics

Topic Characteristics:

My thesis will concern the very actual issue of pension reforming. The current concept of the Pay-As-You-Go pension system seems to be unsustainable under the expected demographic evolvement. In order to maintain the level of living after retirement people will be supposed to become more interested in financial planning and to be more responsible for their retirement saving. Therefore, one of the objectives of pension reform is to be designed in favor of higher saving behavior. In the words of behavioral economists, it should nudge towards higher savings.

The main aim of my thesis will be to study some aspects of the Czech retirement saving behavior which could help to suggest improvements in the recent proposals for pension reform. In my research I will use the concepts of behavioral economics.
Firstly, there is a role of financial literacy. Ignorance about basic financial concepts can be linked to lack of retirement planning. As shown by Lusardi (2008), financial literacy matters for financial decision-making. Those who are more financially knowledgeable are more likely to have planned for retirement.
Secondly, other aspect impacting pension saving behavior are time-inconsistent preferences leading people to a limited self-control (e.g., Ariely, Wertenbroch, 2002). People with those preferences still postpone their actions regarding retirement saving.
The last but not least important aspect consists in a tendency of some people with time-inconsistent preferences to voluntarily impose constraints (costly to cancel) on their future choices in order to resist future temptations and ensure the desirable actions (e.g., Ariely, Wertenbroch, 2002).
If we know how these aspects of people's behavior are related, we will be able to formulate recommendations for a financial education program or a design of the pension reform plans.

In order to obtain the microeconomic data for my thesis I'm going to conduct a questionnaire survey. However I'm aware of limitations of the survey method, it would be very costly and beyond my possibilities to conduct a field experiment which would reflect more realistic decision-making.
For my survey I will design a questionnaire consisting of two parts. The first part will ask about respondents' characteristics like age, sex, education and information on up-to-date retirement saving. It will also try to examine respondents' level of financial literacy and time consistency of their preferences. My measurement of financial literacy will be inspired by Lusardi, Mitchell (2007b) who devised a financial literacy survey supposing that a score in answering financial literacy questions is highly correlated with financial capability of respondents. I will also design a short financial literacy quiz approximating the level of financial knowledge. In order to reveal time consistency of individual preferences I will inspire by Ashraf et al (2006) who designed hypothetical time discounting questions for this purpose.
In the second part, three or four variations of the current pension saving plan will be offered to respondents. The respondents will be asked to range the pension programs from the best to the worst according to their personal preferences. The programs will differ in commitment conditions and determination of the contribution rate. These aspects reflecting behavioral characteristics were discussed by Ashraf et al (2006) and Thaler, Bernatzi (2004).

I will try to collect as large and diverse data sample as possible.

Hypotheses:

The principal hypotheses I would like to verify in my thesis:

1. Hypothesis #1: Financially less literate people are more likely to have time-inconsistent preferences.
2. Hypothesis #2: People with time inconsistent preferences are more likely to choose the pension program with contributions increasing in the future.
3. Hypothesis #3: Some subgroups of people with time-inconsistent preferences are more likely to choose the commitment retirement saving program.

Methodology:

I suppose to use statistic methods to summarize and describe the collected data.
In case of testing of the hypotheses, the explained variables will represent binary outcome. That is why I expect to employ the probit model. The probit model is appropriate when evaluating various marginal effects of explanatory variables. This model is most often estimated using standard maximum likelihood procedure, such an estimation being called a probit regression. There are also three assumptions that need to be tested and satisfied in order to use the probit estimation correctly:

(i) The explained variable is a binary variable.
(ii) The error term follows standard normal distribution.
(iii) None of any two explanatory variables are correlated with each other.

Outline:

The expected structure of my thesis:

(i) Introduction
(ii) Czech Pension Reform Plan
(iii) Literature Overview
(iv) Formulation of Hypotheses
(v) Survey Design
(vi) Data Description
(vii) Model Estimation
(viii) Conclusions

Core Bibliography:

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1. Introduction

Spend some effort in figuring out why each decision did or did not pan out. Doing that systematically is key: really try to question the way you make decisions, and improve it.
(Daniel Kahneman)

The reform of the Czech pension system has become one of the top discussed topics in recent years. The demographic evolvement and the reduction efforts in the public finance sector have emphasized the need to introduce another pillar of the Czech pension system, the private funded scheme which will raise personal responsibility for adequate savings for retirement. The architecture of the pension reform has been a subject of many discussions and analyses, however to my knowledge no analysis focused on the assessment of the Czech pension reform architecture from the point of view of behavioral economics. My study aims to fill this "gap".

In my thesis I discuss the concepts of behavioral economics that can be relevant for the retirement saving behavior. The behavioral hypothesis states that people do not always act as rational agents in their financial decision-making which has been supported by many empirical studies. Contrary to standard assumptions, there can be people who have difficulties with optimal saving for their retirement. Thaler and Sunstein (2008) claim that if people are not perfectly rational an appropriate choice architecture can help them in their decision-making. This could also have some implications for the Czech pension reform plan: if there are some people who have problems to make adequate saving decisions, the Czech pension reform plan can reflect these behavioral characteristics and include some features that will help to overcome their irrational behavior.

In order to examine how the behavioral characteristics of the Czech people are associated with the choices related to pension saving, I conducted a questionnaire survey investigating the said relationships. The inferences of the survey based on the statistical analysis methods mainly confirmed the behavioral hypotheses and provided a useful inspiration for the Czech pension reform architecture.

The thesis is organized as follows: the second chapter describes the context and the main features of the Czech pension reform plan. The third chapter summarizes the theoretical concepts relevant for pension saving behavior and reviews the relevant literature. In the fourth chapter, I formulate the main questions for my research. The fifth chapter presents the methodology of the survey and descriptive statistics of the collected data. In the sixth chapter, I deal with one of the main possible determinants of financial decision-making, the subjective discount rate, and I present empirical results of the analysis of its determinants. The seventh chapter studies the relationships between behavioral concepts and particular features of the private funded scheme and also presents the outcomes of the statistical analysis. The eighth chapter discusses the main implications of the results for the Czech pension reform plan.

2. The Czech Pension System and Its Reform Plan

2.1. The Czech Pension System and Population Ageing

So far, the Czech pension system consists of two pillars – a mandatory pillar, represented by a pay-as-you-go state system with defined benefits, and an optional pillar, represented by a fully funded private system with defined contributions. Contrary to many EU countries, an occupational pension scheme does not exist in the Czech pension system.

The mandatory pillar (also called the first pillar) is financed by pension insurance contributions from all economically active persons. The contributions are mandatory for both employees and self-employed persons. The current contribution rate is 28 % of the assessment base. For employees, the assessment base is derived from their gross income (6.5% is paid by the employee and 21.5 % is paid by the employer). For self-employed persons, the base is defined in a more complex way.

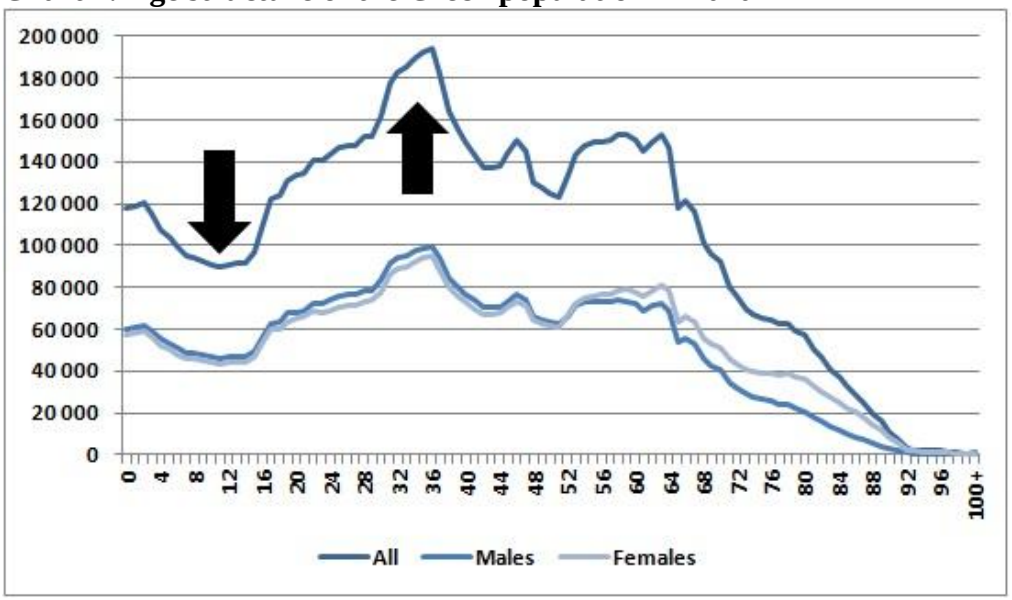
Although the scheme is financed only by economically active persons, the pension insurance covers the whole population regardless of their actual economic status. It provides three main benefits: old-age pension, disability pension and survivor's pensions. The mandatory state system is thus based on the solidarity of economically active persons with non-active ones who cannot contribute. Moreover, it is based on intergenerational solidarity which means that there is a higher replacement rate[1] for lower-income population groups relative to higher-income population groups. It should represent a tool of preventing low-income population groups from poverty in retirement.

The optional pillar (referred to as the third pillar) is based on a voluntary, supplementary and state-subsidized pension scheme ("penzijní připojištění se státním příspěvkem"). The optional pillar also includes products of commercial insurance companies, namely life insurance. Nevertheless, retirement income coming from the third pillar is marginal so far. The main financial resource of retirees is pensions from

[1] pensions relative to previous earnings

the public system. Ninety nine percent of persons aged over the retirement age threshold receive a state pension which covers approximately 95 % of their income[2].

Chart 1: Age structure of the Czech population in 2010



Source: Czech Statistical Office

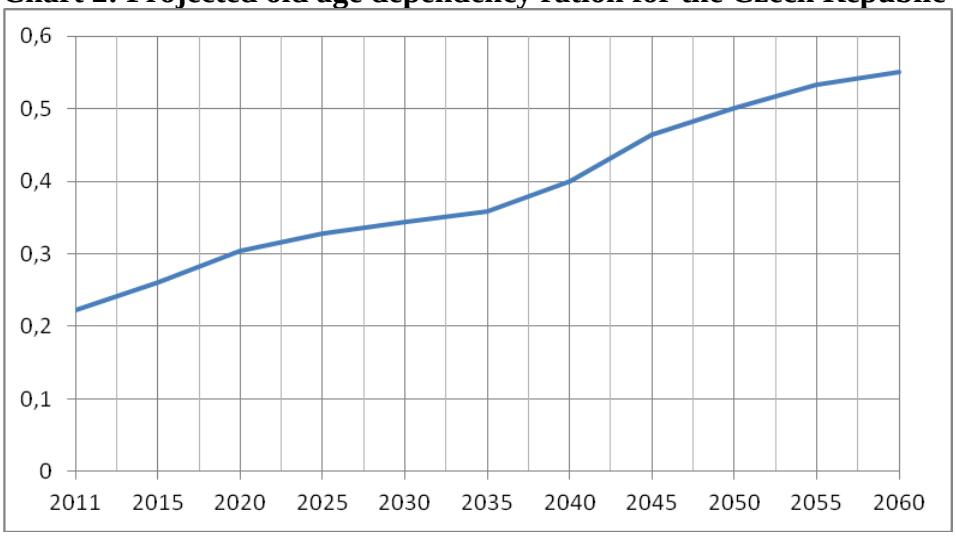
Generally, the aim of the pension system is to be financially sustainable so that the basic purpose, which is to namely deliver adequate retirement incomes and to allow older people to retain living standards and economic independence, can be achieved. In order to fulfill this goal the Czech pension system, like most of the EU pension systems, is undergoing a reform process due to the ageing of the population.

In the Czech Republic in the period from 1992 to 2010 life expectancy increased by 5 years to 72 years[3]. The fertility rate however, follows a decreasing trend. As shown in chart 1, the recent age structure of the Czech population is moving towards a high disproportion between economically active and non-active persons. It is expected that less persons will enter the labor market and more persons will retire in the future. Based on long-term demographic predictions, the imbalance is supposed to deepen. Chart 2 illustrates the old age dependency ratio[4] in 2011 and its projections until 2060 issued by the Eurostat. This process has grave consequences for the state budget deficit. With

[2] Český důchodový systém v kontextu EU, published by Ministry of Labor and Social Affairs, see: http://www.mpsv.cz/files/clanky/11969/Analyza.pdf
[3] Czech Statistical Office
[4] The ratio between the total number of elderly person sof an age when they are generally inactive (aged 65 years and over) and the number of persons of working age (from 15 to 64)

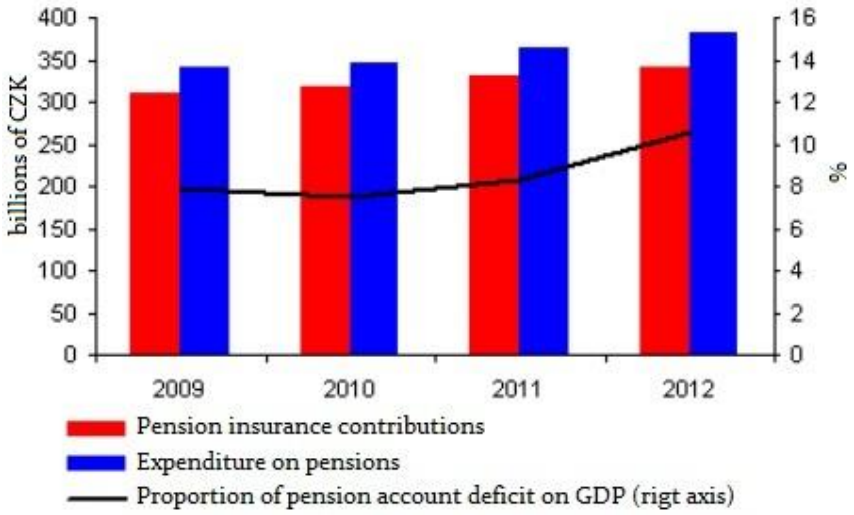
respect to the diminishing proportion of pension insurance contributors and the increasing number of retirees, expenditures of the pension account have already exceeded revenues from the pension insurance contributions, as documented by chart 3.

Chart 2: Projected old age dependency ration for the Czech Republic



Source: Eurostat

Chart 3: Revenues and expenditures of pension system in terms of proportion on GDP



Source: Czech National Bank

In the past decade, population ageing has become a problem for most of developed countries. As a response to the mentioned difficulties, there have been discussions on how to reform the existing Czech pension system for it to retain its financial sustainability. The problem of sustainability of pension systems has been reflected by many international institutions (e.g. IMF, OECD or European Commission)

which issued their recommendations for reforming the pension systems worldwide. There are several common international trends in reforming the state pension systems that reflect a link between increasing life expectancy and pensions:

- Increase in the retirement age
- Restricting access to early retirement
- Equalization of retirement ages for men and women
- Decrease in replacement rates
- Increase in contribution rates

Despite the efforts to reform the pay-as-you-go systems, a decrease in old-age pensions is expected and so the importance of complementary savings[5] is enhanced which can help secure adequate replacement rates in the future. Because complementary savings are introduced to complement public pay-as-you-go schemes with private funded schemes, there is an increasing emphasis on personal responsibility for individual saving. That is why, among other targets, one of the objectives of the pension reform plans is also to include features that would help people to save more.

2.2. The Czech Pension Reform Plan

In 2011 there were several legislative changes that have started the reform process of the Czech pension system. The main framework of the Czech pension reform was established by the adoption of Act 220/2011 Coll., on Pension Insurance (the so called "Minor" pension reform), and Act 426/2011 Coll., on Retirement Savings (the so called "Major" pension reform).

The force of fundamental changes associated with the "Minor" pension reform already took place as of 30 September 2011. It introduced an increase in the retirement age. As a result of the reform the retirement age will increase by each year and also retirement ages for men and women will be equalized, regardless of the number of children women have. The retirement age should be fully equalized for all people born

[5] Occupational and personal pensions, life insurance and other forms of asset accumulation that can be used to maintain living standards after retirement

in 1977. Then the retirement age will be 67 years. Thereafter, the retirement age of the policyholders born after 1977 will increase by 2 months every additional calendar year.

Another main measure related to the "Minor" pension reform is a change in the rules for determining the amount of the computation base of the percentage assessment of a pension benefit in favor of the principle of merit. As for the new rules, there was an increase in the computation base with respect to persons with higher incomes and a reduction in the computation base with respect to persons with medium incomes. The pension calculation of persons with low incomes shall not be affected by the change. Moreover, the computation base of early retirement pension benefits was also decreased. The "Minor" pension reform also introduced stricter rules for the regular adjustment (valorization) of pensions.

Another fundamental change is planned in relation to the "Major" pension reform that is supposed to take place as of 1 January 2013[6]. It should introduce a new private funded scheme (referred to as the missing second pillar) that will be closely linked to the state pay-as-you-go scheme. The main aim of the private funded scheme, a complement of the public pay-as-you-go scheme, will be to diversify risk and improve the stability of the Czech pension system. It will also increase the retirement income mainly for younger people and medium-income and high-income persons.

In the case of the private funded scheme, asset accumulation and investment management is to be based on pension funds (transformed existing pension funds or new subjects). License for this activity will be awarded by the Czech National Bank. Each participant of the pension reform program will choose a pension fund suiting her/him best and will counter-sign an agreement on pension savings with the selected pension fund. It will be possible to change pension funds during the period of pension saving. Each pension fund will offer four investment profiles that will differ in risk, portfolio structure and investment limits: a treasury bonds profile, a conservative profile, a balanced profile or a dynamic profile. Every person involved in the private funded scheme will be able to change her/his investment profile at any time.

[6] Introduction of "Major" pension reform depends on an evolvement on the Czech political stage that is currently strongly turbulent.

Once an agreement on pension saving is counter-signed, the participant will commit herself/himslef to save 3 % out of 28% of her/his assessment base for the pension insurance contribution to a selected pension fund account on condition that the contribution to the pension fund account will be increased by another 2% of the assessment base. The total contribution rate for pension insurance will thus be 30% of the assessment base, out of which 25% must be a contribution to the public pay-as-you-go scheme (the first pillar) and 5% must be contributed to the private funded scheme (the second pillar). As pension insurance is paid only by economically active persons, in case of economic inactivity, social insurance contributions will not be paid.

The option to enroll into the private funded scheme will be voluntary, however once a person enters the scheme, it will not be possible to cancel this decision. From 1 January 2013 every person aged over 18 years who pays pension insurance will be able to make a decision to enter the private funded scheme until she/he reaches 35 years of age. Persons aged 35 years and over will be free to make this decision during the first half-year of 2013. Economically non-active persons aged over 35 years will be able to make the decision to enter in 6 months from the date they become pension insurance contributors after 1 January 2013.

As mentioned above, the decision to enter the private funded scheme will be irreversible. It means that once enrolled into the pension funds saving, the participant will have to contribute until her/his retirement without the possibility to cancel the saving or to pre-maturely withdraw assets saved in the pension fund. This is to ensure the stability of the private funded scheme and resistance to financial market turbulences. Once a participant reaches the entitlement to retire (an entitlement for the pension from the first pillar), she/he has several options how to withdraw the savings in the private funded scheme:

- A lifelong old-age pension (with no inheritance)
- A lifelong old-age pension including the payment of a 3-year inheritance benefit in the same amount as the old-age pension
- An old-age pension paid out within 20 years (in case of a premature death the remaining savings is to be subject to inheritance proceedings)

2.2.1. The fundamental Features of the Czech Pension Reform Plan

Because the purpose of the "Major" pension reform is to help people to save more out of the mandatory pay-as-you-go scheme to prevent them from a decline of replacement rate and to diversify their retirement income, it should attract various groups of enrollees. If there are some specific groups of persons who are less able to make financial decisions, the pension reform plan should also implement measures to assist them. From the perspective of the pension reform architecture, there are several features that can affect saving decision-making of potential participants:

a) Entry into the private funded scheme

Entry represents first step in participation in the private funded scheme. When potential participants find the reform plan attractive, they will take actions to enter it. However, there can be difficulties associated with the enrollment into the private funded scheme. Potential enrollees need to collect and process relevant information because the decision to begin saving into a pension fund includes several other financial decisions that participants have to make, e.g. which pension fund to choose, what investment strategy would be the most appropriate or what form of withdrawal of savings to prefer. This could discourage certain group of people to enroll.

b) The contribution rate to the private funded scheme

The increase in the contribution rate for social insurance will – due to the private funded scheme – represent an additional amount of money that potential participants will have to give up for a reward in the distant future. The contribution rate for saving in the pension funds is set at a relatively low rate, compared to saving rates in other countries (e.g. Poland – 7.3 %, Slovakia – 9 %, Hungary – 8 %[7]).

On the one hand, the low contribution rate can reduce the risk that some participants may have to counter a significant decrease in their disposable income. On the other hand, it can also cause that some other participants may save at a lower

[7] Information by Ministry of Labor and Social Affairs: http://socialniporadce.mpsv.cz/cs/164

contribution rate than they would intend. An increase in the contribution rate would mean other additional savings for retirement.

c) Commitment to save into the private funded scheme

The entry into the private funded scheme with no possibility to cancel this decision represents a commitment to save until retirement age. This feature can discourage some potential participants who have an aversion to risk because it may expose their financial assets to many risks associated with changes of political or economical conditions. However, it may also represent a mechanism that can help people save and resist from spending their savings before retirement.

In order to assess how the architecture of the Czech pension reform could work with respect to the above mentioned features, it is necessary to understand which characteristics can determine people's decision-making associated with those features.

3. The Theoretical Basis: Aspects Determining Pension Saving Behavior

The prevailing approach to pension saving is represented by the life cycle model constituted mainly by Modigliani & Bloomberg (1954) and Friedman (1957). The model predicts that people prefer consumption smoothing over their life-time. In order to maintain a stable standard of living, people, who bear personal responsibility for their retirement saving, save when they are young and run saved assets down when they are old. It also means that in each time period they have to maximize their expected life time utility which is subject to budget constraints and conditional on the available information. Based on the assumption of rationality, people make optimal, inter-temporal, and consistent consumption-saving plans and follow them. The outcome of the life-cycle model is that people are sophisticated enough to determine their optimal saving rates and they are also able to reach an optimal level of savings until their retirement.

On the one hand, the life-cycle model proved to be a useful tool while explaining some patterns of saving behavior. It has also created a basis of research on consumption and saving as well as analyses of the effects of various social-insurance systems (e.g., Samuelson 1975; Feldstein 1974). On the other hand, many systematic anomalies and inconsistencies of human behavior with the model predictions have been revealed. The most fundamental role in challenging the standard assumptions belongs to behavioral economics.

Unlike neoclassical economics where people work towards maximizing their utility, behavioral economics studies the cases in which people do not or cannot do so. It comprises of situations when people would like to behave in the way that standard economics predicts, but they have difficulties in doing so. That is also the case of the life cycle model: to my knowledge, no one has contradicted the idea of maintaining the standard of living over the life time as well as the related consumption and saving principles. Nevertheless, with the increasing importance of personal responsibility for individual pension savings, the existing evidence suggests that retirement savings

adequacy is very heterogeneous and some people are hardly able to sufficiently save for their retirement (e.g., see More & Mitchell 2000; Haveman et al. 2006).

In my further research, two possible explanations of suboptimal pension savings will be discussed: a lack of financial knowledge supported by standard economics and cognitive biases formulated by behavioral economics. These two aspects can have possible implications for designing pension reform plans which nudge towards higher savings.

3.1. Financial Literacy

One of the discussed causes of the failure to save for retirement is a lack of financial knowledge needed to make optimal financial decisions. This explanation supports the traditional approach. From the neoclassical point of view, the decisions that seem to be irrational are made under conditions where the information is either very costly to process or the available information is not correct. Delivering relevant information thus can represent a remediable measure.

Numerous studies support the positive effect of financial education on pension planning and saving. One of the soundest proponents of positive impacts of financial knowledge is A. Lusardi. She deals with the issue in several contributions. Lusardi & Mitchell (2006) study the relationship between retirement savings adequacy and financial literacy based on U.S. household data. The analysis showed that financial illiteracy is widespread among the elderly U.S. population. The interrelation between financial knowledge and planning was found. The authors conclude that those who display higher financial literacy are more likely to plan and succeed in their planning.

Later, Lusardi & Mitchell (2007) provide an overview of the international evidence on financial literacy. They show that even in the most developed countries people possess a low financial knowledge which undermines their ability to efficiently save and invest. The authors also formulate requirements for financial education to have a positive effect on retirement saving: rather than simply delivering financial knowledge, it is important to provide people with better financial understanding and

skills. Financial lectures would be more efficient if they were targeted to particular population sub-groups.

Van Rooij, Lusardi and Alessie (2009) deal with financial knowledge and retirement planning in the Netherlands. An increasing complexity of financial decisions is being confronted with heterogeneity in financial knowledge. The evidence on the positive impact of financial literacy on planning for retirement is demonstrated even in the Dutch context. Nevertheless, the study leaves room for discussion on how to improve the effectiveness of financial education.

In the U.S. context, saving plans are linked to employers and employers' matching provisions that is why financial education in the workplace is emphasized. Bayer, Bernheim and Scholz (2008) explore employer-based financial education and activities associated with a retirement plan. The data coming from the KPMG Peat Marwick Retirement Benefits Survey are analyzed. The analysis showed that retirement seminars provided by employers are associated with higher rates of enrollment and contributions to a retirement plan. The effect is considered to be stronger for lowly compensated employees. The results appear to be robust with respect to estimation techniques.

Choi et al. (2006) concentrated on the impact of particular characteristics of retirement plans on saving behavior. In a section examining financial education, the authors consider effects of financial education to be dramatically overstated because of inappropriate measures of intended behavior and because of a correlation between financial knowledge and other factors determining savings behavior. Based on data collected in a large U.S. company, Choi et al. found a positive but modest impact of financial seminar attendance on changes in saving behavior. However, a more important role is assigned to psychological attributes.

Another field to be examined is the effects of school personal finance education on saving rates. The contributions are again concentrated on data from the U.S. Bernheim, Garret and Maki (1997) use a unique telephone survey to explore the long-term impact of high school financial education on personal saving rates and assets accumulation. This exploration was possible because between 1957 and 1985, some U.

S. states adopted legislation mandating some form of financial education and some states didn't. The results showed that, compared to the states that never enacted a mandate, high school financial curriculum mandates raised asset accumulation and saving when exposed students became adults. The difference was statistically significant. Bernheim et al. argue that early exposure to financial matters can make people more familiar with the world of finance.

Peng et al. (2009) exploited web survey data collected from alumni of a large mid-western university. They investigated the impacts of high school and university courses on personal finance. Although a positive association between participation in university financial courses and investment knowledge was demonstrated, no significant relationship between high school financial courses and investment knowledge was found. Assuming that university personal finance courses contributed to higher investment experiences of participants, financial experiences were further found to be positively associated with saving rates. The authors also admitted some limitations of their study. The web-based survey of university alumni represents a sample selection bias focusing only on population with university education and an e-mail account. Another shortcoming of the survey is the content of financial courses which was neither surveyed nor discussed.

Other contributions are more cautious about substantial effects of financial education. A very comprehensive contribution, originally prepared for Financial Services Authority in the UK, is provided by de Meza, Irlenbusch and Reyniers (2008). The authors present the behavioral economics view and approach more skeptically to the effects of financial education. They suggest that it is rather psychology that matters. The more fundamental determinants of decision-making are human intrinsic psychological attributes. They affect what people choose to know and what they do with the knowledge. The authors admit that financial education can be effective on the condition of improving financial knowledge and understanding, leading to a change of behavior. However the interconnection between financial understanding and behavior is not clear and it is difficult to derive a causality from it.

Another opponent of the significance of the impacts of financial education is L. E. Willis. In his contributions (2008a, 2008b) Willis argues that methodological

limitations of up-to-date studies, like unreliability and incompleteness of data, confounding variables, statistic insignificance and short time horizons, prevent us to derive the positive impact of financial education on financial decisions. An effective tool consists of so called debiasing training which means that improvement of financial decision-making should be addressed to behavioral difficulties.

The role of financial knowledge in retirement savings is ambiguous. The previous literature on the effects of financial knowledge on savings behavior found a positive impact and the existing evidence more or less suggests that financial education affects asset accumulation. Nevertheless, we should be cautious when relying on particular studies because of frequent limitations and inadequacy of the used data that can lead to an overstatement of the effects of financial education. One of the indispensable problems is the self-selection bias. People associated with data on financial education may have some common characteristics and those people generally could have a higher tendency to save for retirement.

Time discounting[8] can be an important factor for financial knowledge. Howlett, Kees and Kemp (2008) provided a psychological insight when examined the effects of a future orientation (a psychological proxy for time discounting) and financial knowledge on the enrollment into a retirement plan. The authors conducted an experiment mapping the participants' level of orientation towards the future and financial knowledge. The study suggests that people exhibiting a higher future orientation are more likely to enroll in the pension plan. The results also demonstrated the important interaction between financial knowledge and the orientation towards the future. Future oriented participants possessing a basic level of financial knowledge displayed significantly higher rates of participation in the retirement plan. Nevertheless, in the absence of financial knowledge, the impact of the future orientation on enrollment in the retirement program was neglectable.

We can assume that in order to improve retirement saving, it is crucial for financial knowledge to be able to affect the intrinsic behavioral attributes that are

responsible for the financial decision-making. Nevertheless, the causality can be adverse as well. An intuition suggests that if a financial training is offered, the decision to adopt financial knowledge can be also influenced by personal time preference. Meier & Sprenger (2008) provided a field study linking the decisions to acquire financial information with time discounting. The study showed a causality leading from time discounting to acquiring financial education. The higher the impatience, the lower the probability of participation in a financial education program. Financial education can thus be viewed as an investment into human capital. The authors conclude that individual time preference determines the decision to become financially literate.

Even though the direction of the causality between financial knowledge and the psychological attributes is not clear and we do not know which aspect plays the more important role, it is evident that psychology may be another barrier to adequate saving behavior as discussed in the following part.

3.2. Behavioral Economics: Cognitive Biases

This part will refer to the psychological attributes that can influence saving for retirement. Behavioral economics has formulated a collection of cognitive biases affecting financial as well as non-financial decision-making. According to Thaler and Benartzi (2004), the behavioral concepts relevant for pension saving are present-bias, procrastination, status quo bias and loss aversion.

3.2.1. Present-Biased Time Preferences

What prevents people from optimal saving can have something to do with self-control problems associated with time preference. Inter-temporal decision-making is often explained by the multi-period utility function which was introduced by Samuelson (1937). It is defined by the utility function with exponential discounting.

$$U_t(c_t,...,c_T)=\sum_{k=0}^{T-t}\delta^k u(c_{t+k}) \qquad (3.2.1.a)$$

[8] Time discounting comprises measurement of personal patience. It is defined in more detail in the

where $u(c_{t+k})$ is the person's utility function in period $t+k$, $(c_t,...,c_T)$ identifies consumption profiles, $D(k)=\delta^k=\left(\frac{1}{1+\rho}\right)^k$ is the person's discount function i.e. the relative weight the person attaches in period t to her/his well-being in period $t+k$. $D(k)$ is determined by the person's discount rate ρ.

In standard economics, the discount rate is determined exogenously and equals to the interest rate in the market since personal discounting doesn't matter because of the assumption of no arbitrage opportunities. It is dynamically consistent. In case of exponential discounting, choices of people are consistent over time and people have no problems with self-control. That is the idea behind the life-cycle model.

Despite the assumption of a dynamically consistent discount rate, it has been robustly demonstrated that people can have time-inconsistent preferences (e.g., Strotz 1955; Laibson 1997). Heterogeneity across individual personal characteristics was also demonstrated. Harrison et al. (2002) conducted a field experiment in Denmark and elicited discount rates from participants. They found that individual discount rates significantly vary with respect to several sociodemographic characteristics.

Another study deals in more detail with the unclear causality between education and the subjective discount rate. Based on data coming from Ugandan villagers, Bauer & Chytilová (2009) support the supposition that general education positively affects the subjective discount rate. The authors discuss several possible explanations, some of which can be relevant even in developed countries. They argue that education can improve cognitive skills and it can increase propensity to plan for the future.

Sunde et al. (2010) favor this notion by exploiting German evidence measured by choices made by individuals in paid experiments. The main robust finding is that people with higher cognitive abilities are significantly more patient.

The dynamic inconsistency of time preferences might cause self-control problems (e.g., Ainslie 1975; Loewenstein 1996). The reversal of time preferences is

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following section.

formally captured by quazi-hyperbolic discounting models (e.g., Ainslie 1975; Laibson 1997; O'Donoghue & Rabin 1999).

$$U_t(c_t,...,c_T) = u(c_0) + \beta\sum_{k=1}^{T-t}\delta^k u(c_{t+k}) \qquad (3.2.1.b)$$

where $\beta,\delta \le 1$.

The person's discount function's values are:
$$D(0)=1$$
$$D(1)=\beta\delta$$
$$D(3)=\beta\delta^3$$
$$D(4)=\beta\delta^4$$

For $\beta = 1$, these preferences correspond to the standard exponential discounting case. However, for $\beta < 1$ this representation captures the time-inconsistent preference for immediate gratification. It corresponds to situations when people have higher short-term discount rates (they are less patient in the short run) but lower long-term discount rates (they are more patient in the long run).

This type of preference is sometimes called present-biased preference. Under quazi-hyperbolic discounting, people perceive some actions in the short term as very costly, even if such actions can generate high benefits in the long term, and immediate, hedonic actions are perceived as more important. As a result, actions beneficial in the long-term are still postponed. That kind of behavior is called procrastination. It is also linked to the case of pension saving. Although retirement saving can bring a high utility in the future, present-biased people are not able to sacrifice a part of their present utility even if they intend to do so.

O'Donoghue & Rabin (1999) incorporated expectations about future behavior of people in the quazi-hyperbolic discounting model.

$$U_t(c_t,...,c_T) = u(c_0) + \hat{\beta}\sum_{k=1}^{T-t}\delta^k u(c_{t+k}) \qquad (3.2.1.c)$$

With respect to expectations of their future behavior, there are two model types of people with hyperbolic discounting: naïfs and sophisticates. The naïfs are not aware of their cognitive bias and they don't expect their future time-inconsistency ($\hat{\beta} = 1$). That is why their behavior directly reflects their bias to the present – naïfs will always under-save. Contrary to naïfs, sophisticates are fully aware of their cognitive bias

($\hat{\beta} = \beta$) and they can behave in a way seemingly opposite to the present bias as they can take measures to deal with the problem of preference reversal. Real people are considered to be imperfectly sophisticated with respect to their own estimates of the degree of dynamic inconsistency ($\beta < \hat{\beta} < 1$).

Present-biased individuals can value measures to deal with their dynamic inconsistency, however usage of these devices depends on the level of sophistication. Individuals with time inconsistent preferences may demand commitment devices if they are more sophisticated or under-estimate their usage if they are more naïve.

3.2.1.1. Commitment Devices

If people are aware of their time-inconsistent preferences and want to overcome the problems with their weakness for immediate gratification, they can use various tools. Those tools are known as commitment devices (e.g., see Bryan, Karlan & Nelson 2010). People attempt to impose restrictions, even costly, on themselves to reduce their future choices. Such commitment can help them to resist to future temptations.

One of the first studies dealing with commitment devices was provided by Ariely and Wertenbroch (2002). Based on experiments conducted in the school context, the authors analyzed basic evidence on people self-imposing costly deadlines to overcome procrastination. The effect of self-imposed deadlines on improving task performance was approved. Nevertheless, imperfect sophistication prevented people from setting their deadlines optimally.

Another research of commitment savings technologies supported these effects in developing countries (e.g., Gugerty 2007) as well as in developed countries (e.g., Thaler & Benartzi 2004). Ashraf et al. (2003) in their review of commitment savings products in developing countries, summarize commitment savings product features that can transform a normal savings product into a commitment savings product. They distinguish deposit-side features and withdrawal-side features. Deposit-side features, as automatic transfers, automatic reductions from paychecks, deadlines for bonuses or automatic increases of savings rate, attempt to motivate to making deposits into a

savings account. Withdrawal-side features, comprising of restrictions of savings or targeted savings, restricted timing of withdrawals, delayed withdrawals or withdrawal fees, try to prevent from withdrawals of deposits. Many of these features are used when designing pension saving programs, but they may be employed also for other reasons than only to stimulate commitments to save.

Sourdin (2005) concentrates on illiquid pension investments. The author uses data from the Australian Household Expenditure Survey. The study explored the relationship between probability of holding illiquid assets and impatience in the short term. Applying various econometric models, the results for all robustly found that current impatience, measured by a constructed proxy variable including expenditures on drinking, smoking, gambling or credit cards debts, is significantly and positively related to investment in illiquid assets.

These findings are supported by Ashraf et al. (2006) who conducted a field study in a Philippine bank. The commitment savings product restricting access to savings was offered to individuals without any reward that would compensate limited liquidity. The findings revealed that some Philippine population sub-groups exhibiting time inconsistent preferences were significantly more likely to accept the commitment savings product. It was true mainly for women who were considered to be responsible for household finance and thus more demanding on the mechanism of self-control. The study further approved long-lasting effects of the commitment device on savings balances.

The above findings can have possible implications in constructing pension savings programs. More understanding of peoples' behavior can assist in stimulating private savings for retirement. If present-biased people exhibit higher degrees of sophistication and are more likely to seek commitment savings products, pension programs should take this pattern into consideration.

3.2.2. Status Quo Bias

The status quo bias is related to procrastination and inertia. It stands for a general dislike of people for taking actions that involve immediate costs for benefits in the future. Neoclassical theory predicts that rational agents make decisions with respect to their well-defined preferences. Unlike standard theory, instead of optimization to make rational decisions, there are always tempting alternatives of doing nothing or maintaining one's previous decision. This pattern of human behavior was first documented by Samuelson and Zeckhauser (1988).

Samuelson & Zeckhauser analyzed data from decision-making experiments. The findings confirmed that people exhibit a significant status quo bias when they make important economic decisions. In one experiment, where participants were asked to make an investment decision, two alternatives of decision questions were used. In the neutral version, the first part of the participants was asked to invest a large sum of inherited money and four possibilities of investment were offered. In the status quo version, the second part of participants was asked to invest inherited portfolio of cash and securities and the same investment alternatives were offered. Tests revealed significant status quo bias of the respondents hypothetically investing the inherited portfolio because they were unlikely to change the original portfolio composition. When one option is presented as the status quo, it is more likely to be chosen.

Evidence on retirement plans emphasizes the role of defaults. Madrian and Shea (2001) examined the effects of automatic enrollment into 401(k), a type of retirement savings account in the United States. It was possible to analyze the impact of automatic enrollment because the authors could compare data coming from a U.S. corporation before and after it switched to automatic enrollment. Main findings suggested that under automatic enrollment, the rate of participation in retirement savings plans was significantly higher. Another finding showed that the default saving rate and the default investment strategy significantly influenced behavior of participants. A substantial part of automatic enrollees maintained the default saving rate and the default investment strategy.

The tendency to procrastinate can explain the above findings. In the absence of automatic enrollment, lower participation rates in retirement savings plan are evidenced. Under automatic enrollment, procrastination mirrors in the default saving behavior of enrollees. There are some possible explanations of why people procrastinate with their retirement saving plans:

First, if retirement savings decisions are too complex and costly, the rational choice is the status quo. Automatic enrollment and other defaults thus can be perceived as investment advice. Nevertheless, it can have further consequences. Defaults might become a general benchmark for savings decisions. This can have a negative impact on the overall saving behavior. Low default contribution rates and conservative default investment strategies may imply shifts with respect to the benchmark and this can lead to lower total savings. Therefore, the role of default setting in the retirement saving plan might be substantial.

Second, a type of status quo bias, the so called endowment effect (e.g., see Kahneman, Knetsch and Thaler 1991), can explain default effects in retirement savings plans. This refers to a tendency of people to value more an object they already possess than the same object they are only willing to acquire. Participation in a retirement plan is valued more highly when participants are already enrolled than when they are non-enrollees. That is why participation rates under automatic enrollment are significantly higher and the effect is long-term. The same argumentation can be applied to the default saving rate and investment strategy. In comparison with other alternatives, participants weigh losses associated with other alternatives more heavily. That is why they maintain defaults.

Another explanation is pure inertia associated with limited self-control. With respect to time inconsistent preferences, people can persist in their beliefs that they will start saving tomorrow but when tomorrow comes they lack self-control to do so that is why they postpone their saving decisions ad infinitum.

The status quo bias is an anomaly robustly evidenced in the retirement savings domain. Hence efficient default options can be a powerful feature of pension saving plans.

3.2.3. Loss Aversion

Loss aversion (a concept proposed by Kahneman and Tversky 1979 in the framework of prospect theory) is closely linked to the status quo bias and the endowment effect. People procrastinate to take actions because they are afraid that a new choice will generate a lower outcome than the original choice. Loss aversion stands for a tendency to asymmetrically value losses and gains. The disutility of losing an object is greater than the utility of acquiring the same object.

Shafir, Diamond and Tversky (1997) use the term money illusion to explain the tendency of people to think in nominal rather than real monetary values. People's perceptions of their own well-being can be produced by the participation of nominal as well as real representations. Even if saving can increase their real wealth, money illusion leads some people to consider saving contributions as a reduction of their actual nominal income. Interaction of money illusion and loss aversion can prevent people from saving more. When they are used to a certain level of take-home pay, people can perceive an increase in their contributions to saving plans as a loss because their take-home wage is reduced.

Thaler & Benartzi (2004) employed the concept of loss aversion when designing a pension saving program. They associated an increase in the contribution rate with wage rise to mitigate the perception of loss linked to a decrease in take-home pay. They presented loss aversion to be a substantial factor designing a pension saving plan.

4. Research Questions

My research will be inspired mainly by Thaler & Benartzi (2004) who designed a prescriptive savings plan incorporating behavioral concepts, the so called SMarT (Save More Tomorrow) plan. They documented the successful implementations of the program and suggest that behavioral economics can be employed to propose efficient features of pension saving programs.

My aim is to test Czech evidence on the above discussed behavioral concepts and explore their relation to the choice of particular saving plan features formulated in the context of the Czech pension reform proposal. Based on the results, I will assess the existing reform design through the optics of behavioral economics. Herewith I formulate the main questions for my research with respect to the previous research:

Research question no. 1: Do subjective discount rates significantly differ across individual people and across time periods?

As for standard theory, for all individuals I would expect homogeneous discount rates that are stable across time periods. According to the standard assumptions, discount rates are determined exogenously and no relationship between personal characteristics and discount rate would be expected.

The behavioral hypothesis suggests that different individuals can have heterogeneous discount rates and their discount rates might be dynamically inconsistent. Based on the previous research on determinants of time discounting, I expect that the subjective discount rate is determined by some observable personal characteristics.

Research question no. 2: Specifically, does the level of financial knowledge determine the subjective discount rate?

Standard assumptions would not predict that level of financial knowledge is a determinant of the subjective discount rate because time discounting is determined exogeneously.

Based on the previous empirical research on determinants of time discounting and factors of financial literacy, I would expect level of financial knowledge and the measure of patience to be correlated.

Research question no. 3: If there are some people exhibiting a present-biased discount rate, are they more likely to prefer the commitment features of the planned private funded scheme (i.e. automatic enrollment, deposit-side feature, withdrawal-side feature)?

Under assumptions of standard theory, as people are able to rationalize their choices and they have no difficulties with self-control, automatic enrollment will not be preferred. Standard theory also predicts no preference for the deposit-side feature of the planned private funded scheme, as people are rational and in every time period they are able to optimally determine their saving rate with respect to the expected life-time income. Similarly, the withdrawal-side feature will not be chosen because the restricted access to withdraw deposits prevents people from optimal savings management and a higher rate of return will be required as a compensation for the limited liquidity.

The behavioral hypothesis expects that, if they are sophisticated enough, people use commitment devices, even costly, to overcome their dynamic inconsistency. That is why individuals with a dynamically inconsistent discount rate are more likely to choose some form of a commitment device to save for retirement. As Ashraf et al. (2006) demonstrated people exhibiting present-bias are more likely to demand for the withdrawal-side feature of the saving scheme. According to Thaler and Benartzi (2004) the present-biased people are more likely to commit themselves to increase their contributions into pension funds with wage rise in the future (the so called deposit-side feature). Moreover, individuals characterized by the present-biased discount rate are more likely to prefer automatic enrollment into the private funded scheme to overcome their status quo bias and procrastination.

5. Research Methodology and Data

The aim of my research is to investigate whether particular design features of the Czech pension reform can play an important role in determining saving decision-making of people. The Czech pension reform is a very complex problem associated with financial, social, political and other issues. So far, many aspects of the Czech pension reform plan have been analyzed but to my knowledge no one has assessed the Czech pension reform plan from the perspective of behavioral economics. The main contribution of my research is thus an exploration of potential determinants of saving behavior and an examination of psychological attributes of the existing pension reform plan. I would like to understand how the attributes can work to help people to save for retirement.

5.1. Limitations of My Research

In order to collect data for testing behavioral hypotheses it is very common to employ an experimental approach. It tries to investigate relationships between economic variables in a controlled environment. It was first pioneered already in 1940s by R. Chamberlin. The established field of experimental economics is a relatively modern field providing replicable empirical data on decision making. Two basic types of experiments are used: laboratory experiments and field experiments.

Laboratory experiments enable to collect data on various research questions in a fully-controlled environment. Although the aim of laboratory experiments is to study relationships among variables of interest, the lab conditions might not generate results consistent with decision making in real economic situations because they cannot incorporate all the important socio-demographic variables needed to make decisions. That is why field experiments where experiments are conducted in a natural decision environment of the participants have become popular, e.g. Gächter argues that field experiments are the fastest growing area of experimental economics that gives us a richer picture of economic decision making. Nevertheless field experiments have a more limited scope of practicability and also the complexity of a field environment brings more limited control of experimenters.

Although conducting an experiment may be more relevant for my research and more realistic results may be obtained, I decided to conduct a questionnaire survey. With respect to the chosen topic, it would be very costly and difficult to perform a field experiment. Even though hypothetical answers may not exactly mirror real behavior of respondents, they can still infer some relationships among the observed variables. Questionnaire surveys can also encompass a wider and a more heterogeneous population sample than experiments because they are more accessible and less demanding for respondents. This was crucial for my study because its aim was to embrace a population sample as large as possible. Moreover, variables like subjective discount rate are very often estimated by hypothetical queries because there is no consensus on the method how to measure them in practice.

5.2. Survey Design

For the template of the questionnaire that has been used see Appendix 1 for reference. The questionnaire is divided into several sections. In the first section, questions on basic personal characteristics like age, sex, education and economic activity are posed.

Another set of questions focuses on measurement of financial knowledge. It is inspired by Lusardi and Mitchell (2006). To assess financial literacy from a limited number of questions, the authors proposed three basic queries relating to the most fundamental economic concepts: the interest rate compounding, the effects of inflation and the concept of risk diversification. Level of financial knowledge will be measured based on the number of correctly answered questions.

In the third section I decided to collect information on the respondents' attitudes toward pension saving in order to evaluate the sample's propensity and eligibility to save for retirement.

The aim of the next section of the questionnaire was to elicit the subjective discount rate in short and long term periods. In formulating questions mapping the subjective discount rate I drew inspiration from Frederick et al. (2002) who summarized

the most frequent methods of elicitation of the subjective discount rate. Among others, there are two commonly used procedures for the subjective discount rate elicitation: choice tasks and matching tasks. In choice tasks, the subjective discount rate is elicited by the respondent's choice of reward that she/he would be willing to obtain in the future instead of the alternative to obtain an immediate but smaller reward. In order to reveal the subjective discount rate more precisely, a set of choice questions varying by the amount of the future reward given the immediate reward constant is to be answered. A rational subject would switch from an immediate reward to the value of a future reward responding to her time discounting and any higher future reward would be preferred against the immediate alternative.

When we know the amount of money where a subject switches from an immediate reward (X) to a future reward (Y), the subjective discount rate can be calculated by (Y-X)/X. Matching tasks employ similar wording but without any pre-defined amounts of the delayed reward. In matching tasks, respondents are asked to fill in the amount of the delayed reward (Z) that they would perceive to be at least as attractive as a specified amount of an immediate reward (X). The subjective discount rate is thus given by (Z-X)/X.

Frederick et al. (2002) discuss the disadvantages of both methods. The authors argue that simple matching tasks bring very heterogeneous and inconsistent results as respondents frequently use a rule of thumb in their own estimates of a future reward instead of real values which causes that elicited discount rates are biased. On the other hand choice tasks can bring an anchoring effect which means that the firstly posed choice task can affect subsequent responses which would also represent a strong bias of results.

Despite the mentioned disadvantages, I have decided to combine both methods in my questionnaire. In my decision I was inspired by Wang et al. (2009) who combined these methods of the subjective discount rate estimation in their international survey on time discounting. The questions I used are the following:

You are about to obtain an amount of money. Which alternative would you choose?

a) to obtain CZK 1000 immediately

b) to obtain CZK 1020 a month later

In case you have chosen to obtain CZK 1000 immediately, what minimal amount of money would you require to obtain a month later to be willing to prefer the reward delayed by one month?

Moreover, the time horizon of the future reward represents the period of time discounting. To be able to assess the consistency of subjective discount rates among time periods, I also employed the same procedure for the one-month discounting period but in a yearly time frame:

You are about to obtain an amount of money. Which alternative would you choose?

c) to obtain CZK 1000 a year later

d) *to obtain CZK 1020 a year and a month later*

In case you have chosen to obtain CZK 1000 a year later, what minimal amount of money would you require to obtain a year and a month later to be willing to prefer the reward delayed by one month?

Based on the mentioned questions, we can elicit a monthly subjective discount rates in the present and in the horizon of a year. As the elicited discount rates may be affected by the above mentioned cognitive biases, I will group the obtained subjective discount rates into 6 intervals and assign them new average interval values. This method should help to reduce biases of discount rates elicitation.

The last section of the questionnaire deals with hypothetical tasks revealing the respondents' decisions and preferences towards the pension reform plan. Given some basic information about the pension reform, respondents are asked whether they would like to enroll to the proposed private funded scheme. All respondents are also asked to choose the form of enrollment into the private funded scheme that they would prefer.

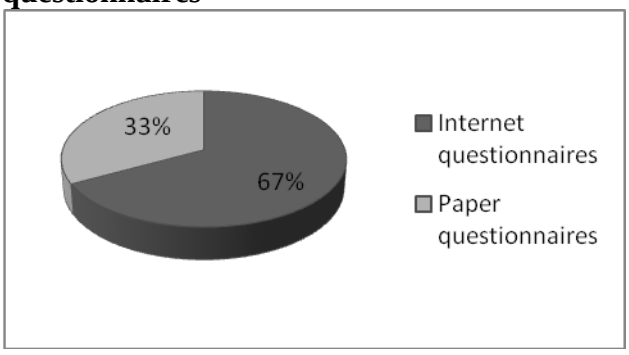
After respondents are stratified into groups of "enrollees" and "non-enrollees"; I ask the "enrollees" about advanced features of the pension reform plan. The first choice concerns the determination of the monthly amount of contribution into pension funds. A contribution increasing in the future with wage rise (designed by Thaler & Bernartzi, 2004, to suit people with present-biased time preferences and loss aversion) is offered against the alternative of a constant contribution amount.

The last query requires ordering alternatives of access to deposits in pension funds from the most preferred to the least preferred. Alternatives representing commitment devices (convenient for sophisticated people with present-biased time preferences) in forms of withdrawal side features are offered against the alternative of an unlimited withdrawal of savings.

5.3. Data

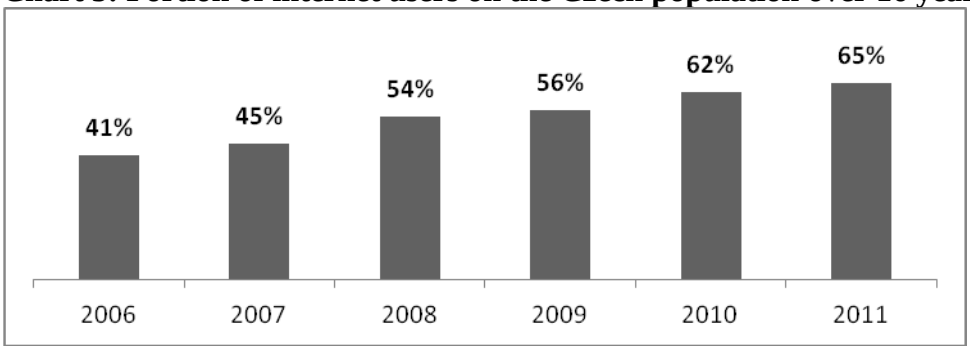
The survey was performed in the Czech Republic in the period from July 2011 to November 2011. To ensure the largest sample as possible I decided to use two ways of distribution of questionnaires: a paper form and an on-line (Internet) form. The Internet questionnaire was distributed to respondents via social networks and web pages that deal with questionnaire surveys. The paper form of questionnaire was offered haphazardly to respondents in companies, restaurants and other public places after those respondents had confirmed that they were not able to complete it via the Internet. The final sample consists of 540 completed questionnaires including 362 internet questionnaires and 178 paper questionnaires.

Chart 4: Structure of responses with respect to the method of distribution of questionnaires



Compared to the portion of the Czech population that was able to use the Internet in 2010, the structure of my sample with respect to my distribution methods nearly corresponds to it.

Chart 5: Portion of internet users on the Czech population over 16 years of age



Source: Czech Statistical Office, 2011

Nevertheless, we should be cautious in assessing the representativeness of the final sample. It is to be emphasized that there are differences between the above mentioned distribution methods. Internet users can be described by some specific characteristics. It is more likely that internet users are younger or more educated people[9]. Internet surveys are further subject to self-selection bias of respondents. It means that internet questionnaires are completed only by respondents who are interested in a given topic. The Internet environment does not provide efficient motivation for other sub-groups of respondents to complete the questionnaire. That is why a sample of internet responses is likely to have some specific characteristics that do not represent the general population sample. Surveys based on paper questionnaires provide better randomization of the sample of respondents. People who are willing to complete the survey can also show some common features but directly addressing respondents indisputably brings a reduction in the self-selection bias.

The goal of my research was to obtain the largest population sample as possible. That is why I decided to combine both methods of distribution of questionnaires. An indisputable advantage of the internet method of distribution of questionnaires is that there is a very high rate of returned responses. Unfortunately, as a result, the final sample's characteristics rather mirror characteristics of internet users particularly

interested in the Czech pension reform than the overall Czech population. On the other hand, the selection of respondents who were mostly interested in the surveyed topic and took the survey seriously might generate more realistic responses.

5.3.1. Basic Characteristics of Respondents

To assess the representativeness of the final sample with respect to the Czech population over 15 years of age refer to table 1.

Table 1: Overview of basic characteristics of respondents - comparison with the Czech population over 15 years of age (means)

	Overall sample			the Czech Republic[10]		
	Men	**Women**	**All**	**Men over 15 years of age**	**Women over 15 years of age**	**All over 15 years of age**
N	269	271	540	4 392 847	4 622 556	9 015 402
Sample	0,498	0,502	1,000	0,487	0,513	1,000
Age	38,914	34,860	36,880	45,715	48,874	47,335
Education:						
Basic education	0,048	0,070	0,059	0,119	0,209	0,165
Secondary education	0,219	0,129	0,174	0,425	0,286	0,354
Upper secondary education	0,361	0,417	0,389	0,307	0,376	0,342
Higher + high education	0,372	0,384	0,378	0,148	0,127	0,137
Economic status:						
Employed or self-employed	0,632	0,568	0,600	0,637	0,451	0,542
Student	0,204	0,262	0,233	0,100	0,101	0,100
Retired	0,134	0,100	0,117	0,203	0,312	0,259
Taking care of a child	0,004	0,037	0,020	0,001	0,074	0,038
Unemployed	0,026	0,033	0,030	0,043	0,042	0,043

	Internet questionnaires			Paper questionnaires		
	Men	**Women**	**All**	**Men**	**Women**	**All**
N	167	195	362	102	76	178
Sample	0,461	0,539	1,000	0,573	0,427	1,000
Age	32,898	30,385	31,544	48,765	46,342	47,730
Education:						
Basic education	0,018	0,046	0,033	0,098	0,132	0,112
Secondary education	0,132	0,046	0,086	0,363	0,342	0,354
Upper secondary education	0,341	0,410	0,378	0,392	0,434	0,410
Higher + high education	0,509	0,497	0,503	0,147	0,092	0,124
Economic status:						
Employed or self-employed	0,659	0,538	0,594	0,588	0,645	0,612
Student	0,281	0,318	0,301	0,078	0,118	0,096
Retired	0,036	0,051	0,044	0,294	0,224	0,264
Taking care of a child	0,006	0,046	0,028	0,000	0,013	0,006
Unemployed	0,018	0,046	0,033	0,039	0,000	0,022

[9] Refer to the Czech Statistical Office, Use of ICT by Households and Individuals 2011, available on-line: http://www.czso.cz/csu/2011edicniplan.nsf/publ/9701-11-r_2011

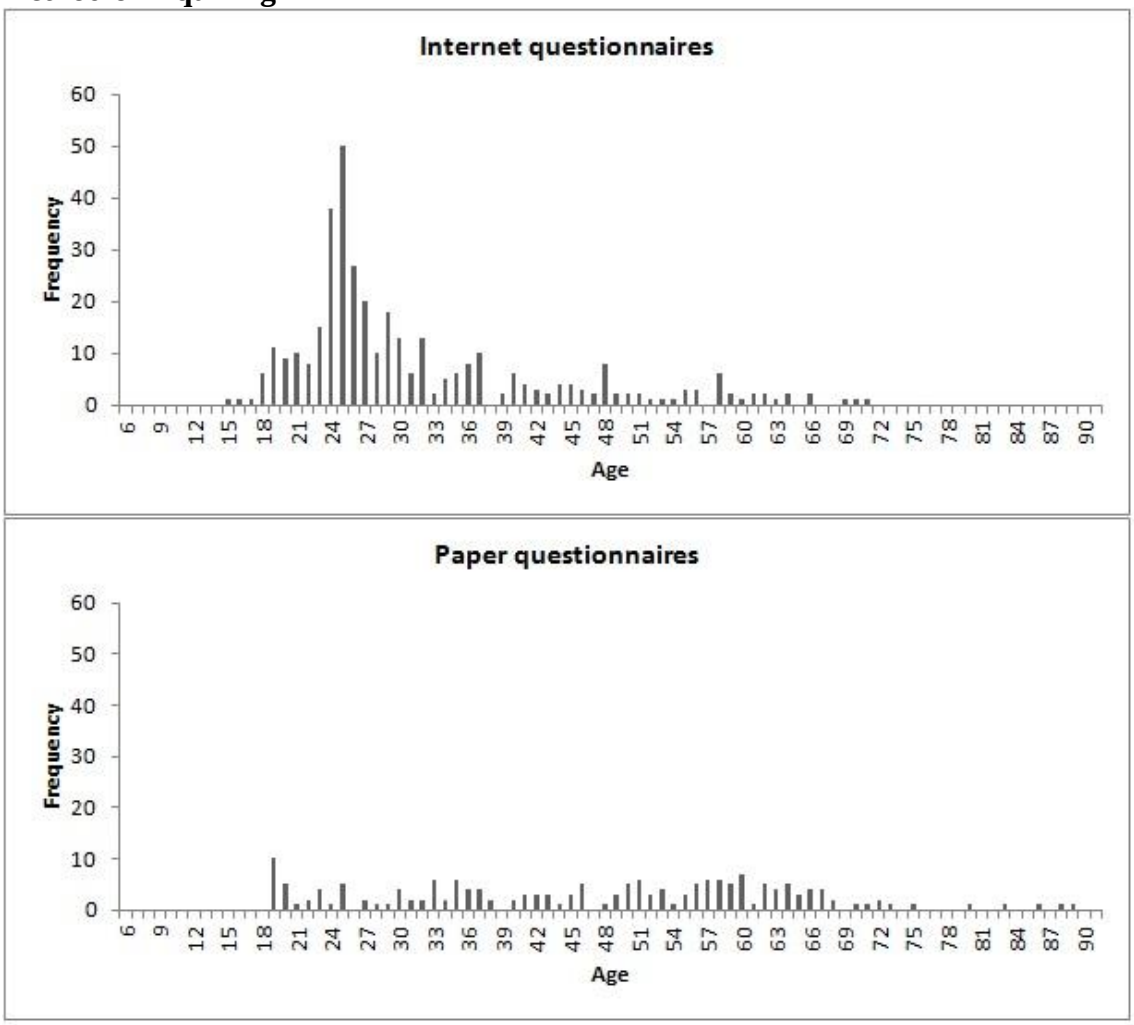
[10] Data for 2010

Data on the Czech Republic population: The Czech Statistical Office, Labour market and wages 1993 – 2010, available on-line: http://www.czso.cz/csu/2011edicniplan.nsf/p/3103-11

The final sample of 540 participants consists of 50 % of men and 50 % of women. The portions of men and women slightly differ for sub-samples obtained via internet and paper questionnaires. The subsample based on internet questionnaires consists of 54 % female and 46 % male participants. 43 % of paper questionnaires sub-sample are women and 57 % are men.

Another characteristic is the age structure of the sample. The participants selected to be convenient enough for the survey were people over 15 years of age. The sample thus includes respondents aged from 15 to 89 years. Chart 6 shows the age distribution of sub-samples in terms of the inquiring method.

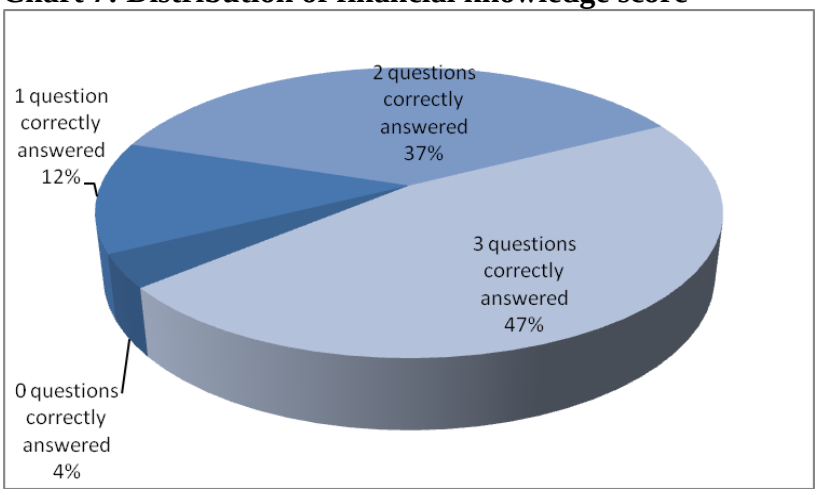
Chart 6: Histograms - breakdown of the age distribution with respect to the method of inquiring



The age distribution with respect to the particular inquiring methods supports the suggestion that the characteristics of the internet subsample are imbalanced. Due to this pattern the final sample is biased in favor of the younger population. Even though I addressed my survey to all age categories in order to achieve universal results, a higher proportion of younger people is included in the final sample compared to the Czech population over 15 years of age.

Another bias arises in classification of the final sample according to the level of completed education. As in the previous case, the internet subsample is imbalanced towards higher education and at the expense of secondary and basic education. This pattern is caused by the fact that a high portion of the involved internet respondents were master's degree students and recent graduates. The bias of the internet sub-sample thus affects the educational structure of the whole sample.

Chart 7: Distribution of financial knowledge score



To assess the level of financial knowledge of the final sample based on the number of correctly answered questions on financial literacy see chart 7 for reference. As shown, 84 % of respondents answered correctly at least two questions on financial literacy. This may suggest that most of the sample is well oriented in the financial concepts which does not represent well the Czech population since the nationwide survey performed by STEM/MARK, a.s. revealed that knowledge of the basic financial concepts among the Czech population is poor[11]. The outstanding level of financial

[11] The nationwide survey performed by STEM/MARK, a.s. for Ministry of Finance of the Czech Republic and Czech National Bank in 2010, for results refer to: http://www.mfcr.cz/cps/rde/xchg/mfcr/xsl/fintrh_fin_vzdelavani_59012.html

literacy of the final sample can be explained by exceptionally high proportions of high and upper secondary educated individuals since the level of general education co-determines financial knowledge (e.g. van Rooij et al., 2009).

Furthermore, I investigated the economic status of the participants. 60% of the final sample counts for employed or (and) self-employed, 23% is represented by students, 12% are retirees, unemployed represent 3% of the sample and 2% are people on parental leave. As already suggested by the above characteristics, compared to the paper questionnaires sub-sample, the internet sub-sample contains a significantly higher portion of students and a lower percentage of retirees. The high share of internet responses out of all the responses thus affects the whole sample.

To sum up, there is a trade-off between the response rate and the representativeness of the collected data. The Internet method was more successful in the number of completed and returned questionnaires. Even so, the internet method omitted some categories of respondents who are not familiar with information technologies. For that reason, the sub-sample based on the internet survey is unbalanced towards the characteristics of the internet user population, i.e. represents a more educated and younger population. The data sample obtained by the method of random personal inquiring includes all population categories and better represents the structure of the Czech population. Notwithstanding, the method is more demanding and did not enable to obtain the same sample size in the same time period as the internet survey.

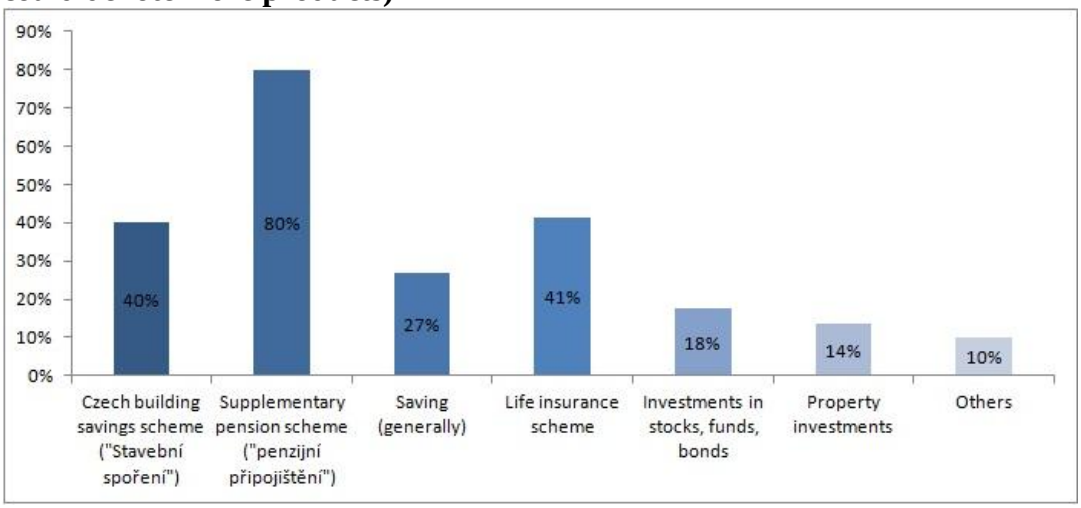
The final sample obtained by combining the two inquiring methods includes a relatively higher proportion of participants with high education. Furthermore, the mean age of the sample is lower compared to mean of the Czech population over 15 years of age. The said biases are caused by a higher share of students and a lower share of retirees among respondents compared to the Czech population older 15 years. These patterns mainly mirror the characteristics of internet respondents who represent two thirds of all responses. Even though the final sample does not represent the Czech population, it captures its variety at least.

5.3.2. Attitudes of Respondents towards Saving for Retirement

When asked about saving for retirement, 59% of respondents stated that they save for retirement, 40% do not create reserves for old age and 1% of participants do not know whether they save for retirement.

The following chart illustrates the types of saving products used by people who stated that they save for retirement.

Chart 8: Types of pension saving products used by participants (each respondent could denote more products)



Among the respondents, the most popular saving product is the supplementary pension scheme (the so called "penzijní připojištění"). 80% of those who save for retirement employ this product. This supports the need to use more saving products because the supplementary pension scheme provides only marginal income in retirement as I discussed above. The most frequent use of the supplementary pension scheme corresponds with the results of the nationwide survey performed by STEM/MARK, a.s. in 2010[12].

Those who stated that they do not save for retirement identified themselves with the following reasons of failure in their saving. The most common reason "Cannot

[12] The nationwide survey performed by STEM/MARK, a.s. for Ministry of Finance of the Czech Republic and Czech National Bank in 2010, for results refer to: http://www.mfcr.cz/cps/rde/xchg/mfcr/xsl/fintrh_fin_vzdelavani_59012.html

afford to save for retirement" is also in concurrence with the national results by STEM/MARK.

Another question attempted to investigate whether the respondents consider their current and planned reserves for retirement sufficient. It is to be emphasized that only 19% of all respondents considered their current and planned savings for retirement appropriate.

Chart 9: Reasons why respondents do not save for retirement (each respondent could denote more reasons)

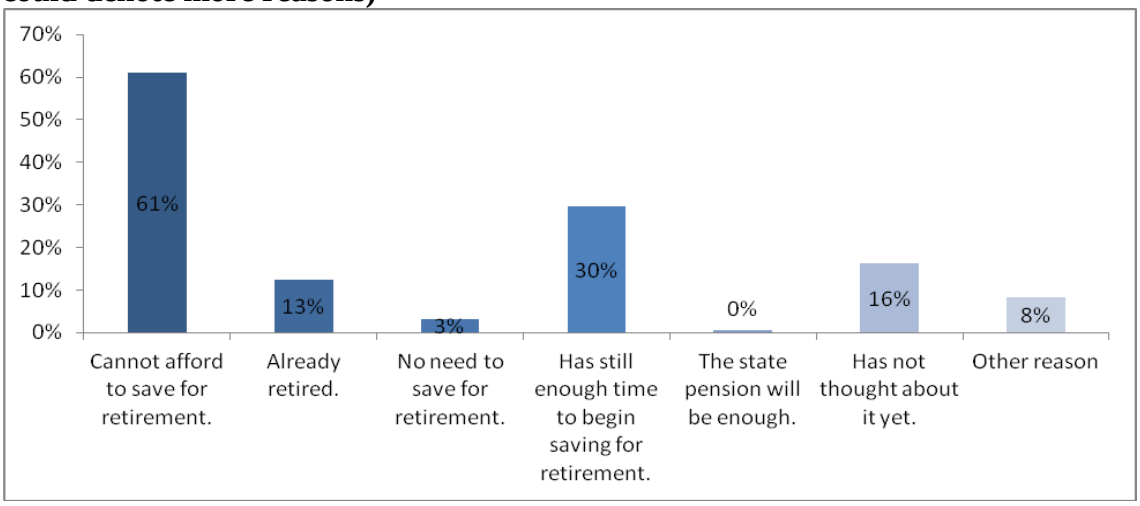


Table 2 draws a conclusion from the answers with respect to the previous responses on retirement saving. Hereafter, table 3 presents an overview of responses conditional on the type of the saving product used.

Table 2: Cross-tabulation - answers to question "Do you think that your current and planned reserves for retirement will be sufficient?" and saving

	Consider their reserves sufficient		Consider their reserves insufficient		DK whether their reserves are sufficient or not		Total of respon-dents
Save for retirement	25%		55%		20%		317
		77%		51%		68%	
Do not save for retirement	10%		77%		13%		216
		21%		48%		29%	
DK whether save for retirement	28,5%		28,5%		43%		7
		2%		1%		3%	
Total of respondents		103		344		93	540

Table 3: Answers to question: "Do you think that your current and planned reserves for retirement will be sufficient?" conditional on saving product used

	Consider their reserves sufficient	Consider their reserves insufficient	DK whether their reserves are sufficient or not	Total
Czech building saving scheme ("penzijní spoření")	28%	51%	21%	127
Saving (generally)	35%	39%	26%	85
Supplementary pension scheme ("penzijní připojištění")	22%	58%	20%	253
Life insurance scheme	32%	50%	18%	131
Investments in stocks, funds, bonds	46%	38%	16%	56
Property investments	53%	33%	14%	43
Others	41%	47%	12%	32

As demonstrated, 55% of respondents who save for retirement consider their current and planned reserves insufficient. Above that, 77% of those, who stated that do not save, suppose that their savings for retirement will not be enough. Saving is an important assumption of satisfaction with individual reserves for retirement since 77% of respondents, who consider their pension reserves sufficient, save.

An important aspect of the perception of own reserves for pension are characteristics associated with the usage of certain saving products. 53% of participants, who invest in property, consider their pension reserves satisfactory. An explanation for this can be found in the higher level of financial resources that respondents who invest in property usually possess. The same explanation can be applied also for 46% of respondents who invest in stocks, funds and bonds.

Based on the obtained data we can conclude that some groups of people do not save or are not able to do so optimally. There is a high portion of respondents who consider their savings insufficient and despite this fact they do not save. The most frequently stated reason for the failure to save is insufficient income, which is in accordance with the essential economic assumption for saving. Nevertheless, respondents reported also other reasons why they do not save sufficiently. What might lead people not to save optimally for retirement even if they consider it beneficial? This may be related to another advanced personal characteristic: the subjective discount rate.

5.3.3. Data on the Subjective Discount Rate

Based on the survey, I obtained raw values of the respondents' monthly subjective discount rate in the present and in a 1-year horizon. The data was then sorted into 6 intervals and arithmetic average interval values were assigned to individual subjective discount rates. Table 4 presents the distribution of the final values of elicited subjective discount rates.

As the table shows, a time consistent individual discount rate was evidenced only for 63% of respondents. The remaining 37% of respondents have revealed a subjective discount rate that is not stable over time: 21% of individuals exhibited a present-biased discount rate (higher discount rate in the present, lower discount rate in the future i.e. less patient in the present, more patient in the future) and 16% of respondents displayed a so-called future-biased discount rate (more patient in the present, less patient in the future).

Table 4: Distribution of the current and future subjective discount rate (% of total respondents)

Values of current subjective discount rate	Values of future subjective discount rate						
	0,01	**0,06**	**0,3**	**1,25**	**5,5**	**10**	**Total**
0,01	32%	4%	2%	1%	0%	1%	41%
0,06	8%	9%	2%	0%	0%	0%	20%
0,3	6%	1%	12%	2%	1%	0%	23%
1,25	2%	0%	1%	5%	1%	0%	9%
5,5	1%	0%	0%	0%	2%	1%	5%
10	1%	0%	0%	0%	0%	2%	3%
Total	51%	15%	18%	8%	4%	4%	100%

63%	Constant over time
16%	Future-biased
21%	Present-biased (hyperbolic)

I will investigate how the subjective discount rate differs based on observable personal characteristics. The following table provides a tabulation of means of subjective discount rate in terms of different sub-groups of respondents.

Table 5: Discount rates in terms of different sub-groups (means, standard deviations in parentheses)

	Current subjective discount rate			**Future subjective discount rate**		
	All	Male	Female	All	Male	Female

Overall sample	0.74643	0.62517	0.86679	0.79254	0.67524	0.90897
	(1.9743)	(1.8231)	(2.1101)	(2.1858)	(2.0712)	(2.2918)
Aged up to 29 years	0.63669	0.30179	0.89538	0.68401	0.32089	0.96448
	(1.6898)	(0.91807)	(2.0668)	(1.9034)	(1.2011)	(2.2688)
Aged 30-44 years	0.32367	0.33389	0.31054	0.84813	1.1039	0.51929
	(0.97699)	(1.1074)	(0.78787)	(2.4166)	(2.8574)	(1.6580)
Aged 45-59 years	1.1482	1.2336	1.0760	0.92021	0.81568	1.0087
	(2.5691)	(2.5904)	(2.5741)	(2.4632)	(2.3314)	(2.5889)
Aged 60 years +	1.4878	1.3671	1.7628	0.93695	0.73976	1.3861
	(3.0731)	(3.0206)	(3.2617)	(2.3615)	(1.9224)	(3.1659)
Basic + Secondary education[13]	1.4277	1.2928	1.6076	1.2775	1.0758	1.5465
	(2.7400)	(2.6639)	(2.8535)	(2.7739)	(2.5219)	(3.0820)
Upper secondary education	0.75890	0.56536	0.92504	0.82743	0.75320	0.89115
	(1.9797)	(1.6943)	(2.1892)	(2.2908)	(2.3153)	(2.2780)
Higher + high education	0.31279	0.20250	0.41885	0.45706	0.31120	0.59731
	(1.1019)	(0.78530)	(1.3331)	(1.5115)	(1.2638)	(1.7108)
Financial knowledge score 0-1[14]	1.8852	1.6392	2.0672	1.9111	1.4608	2.2444
	(3.2091)	(3.0223)	(3.3592)	(3.4955)	(2.9753)	(3.8306)
Financial knowledge score 2	0.60045	0.55305	0.63283	0.62347	0.72585	0.55350
	(1.4592)	(1.3236)	(1.5496)	(1.6323)	(2.0285)	(1.2991)
Financial knowledge score 3	0.46920	0.41447	0.55050	0.54088	0.45380	0.67020
	(1.6135)	(1.5862)	(1.6578)	(1.8530)	(1.7710)	(1.9704)
Employed and self-employed	0.55420	0.57353	0.53286	0.71957	0.74394	0.69266
	(1.5701)	(1.7234)	(1.3865)	(2.0870)	(2.2680)	(1.8742)
Student	0.75896	0.42164	1.0240	0.66280	0.51691	0.77743
	(1.9290)	(1.2556)	(2.3002)	(1.9752)	(1.6807)	(2.1840)
Retired	1.6467	1.2794	2.1363	1.2157	0.73250	1.8600
	(3.2076)	(2.8418)	(3.6370)	(2.7931)	(1.8697)	(3.6254)
Unemployed + taking care of a child[15]	0.88929			1.2639		
	(2.2915)			(2.5790)		

First, I have identified the gender differences in average subjective discount rates. Women exhibited a current as well as a future mean discount rate higher than men in most comparisons. Thus, women appear to be less patient on average than men in the present and even in the future time frame.

Second, the results indicate a U-shaped relationship between the average current subjective discount rate and age. The relationship between the average future discount rate and age follows an increasing trend. Both relationships are consistent with the result that the highest mean discount rate was identified for retirees.

Third, a negative relationship between the subjective discount rate and the level of education has been identified in the present and in the future as well. The decreasing

[13] Due to a very small sample of respondents with basic education, it was merged with secondary educated people

[14] Due to a very small samples of groups of respondents with financial knowledge score 0 and 1, they were merged

[15] Only 8 men in the sample

tendency of current mean discount rate with the level of education was shown by Harrison et al. (2002). Bauer & Chytilová (2009a) also suggest that the discount rate can be formed by education and thus more educated individuals are more patient. There is also a similar impact of financial knowledge: individuals who score better in the financial quiz have a lower present and future discount rate.

Fourth, I found that employed and self-employed individuals exhibit on average a lower current discount rate than students, retirees, the unemployed or people on parental leave. In case of the future discount rate, sub-group of students displayed the lowest average discount rate. It is to be emphasized that the low discount rate of students is associated with a higher current discount rate. This means that on average students exhibit a present-biased time discounting. This pattern seems to be driven by female students.

6. The Subjective Discount Rate

Research question no. 1: Do subjective discount rates significantly differ across individual people and across time periods?

Research question no. 2: Specifically, does the level of financial knowledge determine the subjective discount rate?

6.1. Analysis of Time Discounting Correlates

There were some correlations between the subjective discount rate and observable characteristics suggested by descriptive statistics. Moreover, as shown above, the elicited discount rate differs not only across different individuals but also across time periods. In case of the discounting reversals I distinguish a present-biased discount rate (current discount rate > future discount rate) or a future-biased discount rate (current discount rate < future discount rate).

The future bias is neither well described nor modeled in the up-to-date research. It refers to a situation when the patience of individuals decreases within a certain time horizon. Ashraf et al. (2006) believe that this type of discount rate reversal represents mostly noise in survey responses and no explanatory variable should predict it at a statistically significant level.

In order to quantify the statistical significance of the mentioned relationships with controlling for more variables, I decided to run a set of regressions. For more information on the methodology and assumptions of the said regressions refer to Appendices 2 and 3. For analyzing the subjective discount rate determinants I have constructed a model of the following form:

$$SDR(current\ /\ future)_i = \alpha + X_i'\beta + \varepsilon_i \qquad (6.1.a)$$

where $X_i' = \left(Female_i, Age_i, Age_i^2\right)$ is a vector of exogenous personal characteristics. $Female_i$ is a dummy with value 1 if an individual *i* is female and 0 if male, Age_i indicates the age of the individual *i*, Age_i^2 is a variable indicating a non-linear relationship between age and the individual discount rate and ε_i is an error term for the individual *i*. Regressions for the *current* and *future* measures of the subjective discount rate (*SDR*) are run separately.

Because in the case of the time discounting reversals I analyze the binary variables P_bias_i (1 = the individual *i*'s discount rate is present-biased, 0 = otherwise) and F_bias_i (1 = the individual *i*'s discount rate is future-biased, 0 = otherwise), I use probit estimation. The model has the following form:

$$P\left[(P/F)\_bias_i = 1\right] = \Phi\left(\alpha + X_i'\beta + \varepsilon_i\right) \qquad (6.1.b)$$

Table 6 summarizes the estimates.

Table 6: Exogenous determinants of time discounting (OLS estimates and marginal effects, robust standard errors and standard errors in parentheses)

Estimator	OLS with robust standard errors		Probit (binary dependent variable)	
Explanatory variables	Dependent variable			
	Current subjective discount rate	**Future subjective discount rate**	**Present-biased discounting=1**	**Future-biased discounting=1**
Intercept	0.7709	0.3343		
	(0.6942)	(0.6969)		
Female	0.2834 *	0.2439	0.0662 *	0.0035
	(0.1636)	(0.1867)	(0.1232)	(0.1320)
Age	-0.0218	0.0160	-0.0073	0.0054
	(0.0351)	(0.0350)	(0.0218)	(0.0293)
Age^2	0.0004	-0.0002	0.0000	-0.0000
	(0.0004)	(0.0004)	(0.0003)	(0.0004)
Sample size	540	540	540	540
(McFadden) R-squared	0.0165	0.0034	0.0092	0.0129

Level of significance: * 10%; ** 5%; *** 1%

The OLS outcomes show a difference between the male and female current discount rate. Women exhibit a higher monthly current discount rate by 28.3 percentage points. This difference is significant at the 10 % level. A similar relationship was also revealed for the future discount rate but without a statistical significance at a convenient

level. This outcome suggests that the gender difference in time discounting is country- or culture- specific. An adverse correlation has been inferred by Bauer & Chytilová (2009b) from elicited subjective discount rates of Indian villagers. Contrary to the Czech population, the Indian women tended to have lower subjective discount rates than men.

The probit outcomes show that being a woman increases the probability of having a present-biased discount rate with a 10% statistical significance. Although its statistical significance is not high, the similar result has been found by Ashraf et al. (2006) who has found that Philippine women more tend to be present-biased than men. Furthermore, neither sex nor age predicts future-biased discounting at a convenient level of statistical significance.

To further explore the determinants of time discounting, I will run regressions where the vector of observable variables X_i will be extended. Based on the bivariate analysis the level of education is expected to be a significant determinant of the subjective discount rate. Financial knowledge is also supposed to be correlated with the measures of patience. Therefore I will add $Financial\_knowledge_i$ indicating the score in the financial knowledge quiz (with values 1 for 0-1 correctly answered questions, 2 for 2 correctly answered questions and 3 for 3 correctly answered questions) and $Education_i$, indicating the level of education (with values 1 for basic + secondary education[16], 2 for upper secondary education, 3 for higher + high education).

Hereafter, I will also control for variables indicating economic status (dummies of being self-employed, a retiree and a student). The base for a comparison will be represented by the other persons at productive age i.e. a group of employed persons, the unemployed and parents taking care of a child.

Collinearity diagnostics were used to examine possible multicollinearity issues among the explanatory variables. No problems were discovered. Table 7 presents the outcomes of the regressions:

[16] Basic and secondary education groups were merged due to low number of respondents with basic education

Table 7: Other determinants of time discounting (OLS estimates and marginal effects, robust standard errors and standard errors in parentheses)

Estimator	OLS with robust standard errors					
Explanatory variables	Dependent variable					
	Current discount rate			**Future discount rate**		
	All	Male	Female	All	Male	Female
Intercept	1.4943 * (0.7787)	0.3030 (0.8393)	2.5951 ** (1.1922)	1.7599 ** (0.8861)	0.1484 (1.0140)	3.2455 ** (1.3509)
Female	0.1867 (0.1578)			0.1432 (0.1808)		
Age	0.0407 (0.0380)	0.0635 (0.0401)	0.0273 (0.0565)	0.0440 (0.0407)	0.0873 * (0.0466)	0.0077 (0.0590)
Age^2	-0.0005 (0.0005)	-0.0005 (0.0004)	-0.0006 (0.0007)	-0.0007 (0.0005)	-0.0009 * (0.0005)	-0.0005 (0.0007)
Financial knowledge	-0.3933 ** (0.1700)	-0.2781 (0.2479)	-0.4622 ** (0.2273)	-0.4076 ** (0.1907)	-0.3045 (0.2488)	-0.4719 * (0.2720)
Level of education	-0.3687 ** (0.1474)	-0.3226 * (0.1897)	-0.4477 * (0.2299)	-0.3074 * (0.1710)	-0.2596 (0.2105)	-0.3758 (0.2639)
Student	0.2809 (0.1885)	0.3849 ** (0.1705)	0.1550 (0.3108)	-0.1336 (0.2177)	0.2446 (0.2358)	-0.4957 (0.3444)
Retired	1.0368 * (0.5949)	0.0915 (0.6653)	1.9385 ** (0.9324)	0.8969 (0.5622)	0.0633 (0.5308)	1.7270 * (0.9446)
Self-employed	-0.1443 (0.1893)	-0.1007 (0.2898)	-0.2307 (0.1913)	-0.0977 (0.2998)	0.1772 (0.4550)	-0.5039 ** (0.2207)
Sample size	540	269	271	540	269	271
R-squared	0.0883	0.0876	0.1188	0.0532	0.0401	0.0908
Estimator	Probit					
Explanatory variables	Dependent variable					
	Present-biased discounting=1			**Future-biased discounting=1**		
	All	Male	Female	All	Male	Female
Female	0.0656 * (0.1256)			0.0012 (0.1355)		
Age	-0.0012 (0.0265)	-0.0012 (0.0413)	-0.0025 (0.0357)	-0.0019 (0.0350)	0.0108 (0.0584)	-0.0124 (0.0459)
Age^2	0.0000 (0.0003)	0.0000 (0.0005)	0.0000 (0.0004)	-0.0000 (0.0004)	-0.0002 (0.0007)	0.0001 (0.0006)
Financial knowledge	0.0029 (0.0922)	-0.0201 (0.1463)	0.0225 (0.1216)	-0.0106 (0.0994)	-0.0174 (0.1539)	0.0040 (0.1356)
Level of education	0.0125 (0.0917)	0.0372 (0.1408)	-0.0045 (0.1260)	-0.0066 (0.0993)	-0.0407 (0.1507)	0.0280 (0.1465)
Student	0.0929 * (0.1823)	0.0008 (0.2799)	0.1684 ** (0.2457)	-0.0735 * (0.2051)	-0.0370 (0.3095)	-0.0929 (0.2784)
Retired	-0.0002 (0.2826)	-0.0759 (0.4343)	0.0997 (0.3743)	-0.0259 (0.3410)	0.1766 (0.5096)	-0.1382 (0.5974)
Self-employed	-0.0324 (0.2459)	-0.0856 (0.3454)	0.0661 (0.3654)	0.0063 (0.2390)	-0.0186 (0.3300)	0.0477 (0.3644)
Sample size	540	269	271	540	269	271
McFadden R-squared	0.0157	0.0116	0.0262	0.0206	0.0396	0.0375

Level of significance: * 10%; ** 5%; *** 1%

In accordance with the previous research, the level of education and the level of financial knowledge appear to matter the most in predicting the current and future discount rate. The correlations are robust when controlling for the other observable variables and they are also robust with respect to the alternative estimation techniques as can be found in Appendix 4.

The statistical significance of the negative correlation between the level of education and the measures of the discount rate was also confirmed by Harrison et al. (2002) for the Danish population who argued that the longer investments in education are substantially associated with lower discount rates. The relationship also appears to be robust with respect to different environments. Bauer & Chytilová (2009a, 2009b) have found the same relationship for Ugandan as well as Indian villagers. They mention possible reasons why the level of education determines time discounting. Schooling may improve cognitive skills and the ability to plan for the future. Highly educated persons are also less likely to be income constrained and thus are more patient with regard to financial decisions.

Also, those, who have less financial experience, exhibit higher subjective time discounting. The relationship between the level of financial knowledge and the subjective discount rate is supported by some studies (e.g. Shelbecker et al., 1990; Grable, 2000). A possible explanation consists in determining the risk aversion profile. People, who have more financial knowledge, are better aware of risk and risky situations. Those people tend to have a common psychological profile that makes them more patient. This result also sheds some light to the discussed reasons of under-saving for retirement. Financial education can affect financial decision-making via determining the subjective discount rate. Nevertheless, I suppose the causality to be able to go in both directions. People exhibiting lower subjective discount rates may be more interested in acquiring financial knowledge.

Moreover, status of being a retiree determines a higher current discount rate with a 10% statistical significance. It was also showed by Harrison et al. (2002) in a discount rate elicitation of the Danish population. This result is more or less intuitive and corresponds to an increasing tendency of the subjective discount rate after middle age. This can be explained by a decreasing survival probability that affects time discounting.

The probit outcomes have discovered that the significant determinants of the subjective discount rate indeed do not significantly correlate with its inconsistencies. Rather the result that females are more likely to have a present-biased discount rate is robust when controlled for more observable characteristics. Moreover, I have identified that being a student increases the probability of a present-biased discount rate at a 10% level of statistical significance. Little else predicts the future-biased discount rate. Only being a student decreases the probability of being future-biased at 10% significance level. Students are less likely on average by 7.4 percentage points to have a future-biased discount rate compared to the other population at productive age.

Based on the sub-sample analysis, I have identified some differences in the impacts of the economic status dummies on the male and female discount rate. Compared to the base group, status of being self-employed predicts a lower future discount rate for females at a 5% level of statistical significance. Contrary to females, the correlation between being self-employed and the future discount rate is positive for males, though not statistically significant. The correlation between the retired status and the subjective discount rate appears to be driven by women since it is not statistically significant for men. While status of being a student predicts a higher male current discount rate compared to the base group, the correlation proved to be significant at a 5% level. The same correlation is not significant for females. The impact of being a student on the future discount rate is ambivalent for males and females, though not significant at a convenient level for any of them.

Moreover, as we can see from the results, age and its squared form are significant (a 10% level) determinants of the male future discount rate. No significant correlation between age and the discount rate has been identified for women.

In order to examine statistical significance of the gender differences in the impacts of the stated explanatory variables on time discounting, I construct the following models:

$$SDR(current/\ future)_i = \alpha + \beta \times Female_i + Y_i' \chi + \gamma (y_k * Female)_i + \varepsilon_i \quad (6.1.c)$$

and

$$P\left[(P/F)\_bias_i = 1\right] = \Phi\left(\alpha + \beta \times Female_i + Y_i'\chi + \gamma\left(y_k * Female\right)_i + \varepsilon_i\right) \quad (6.1.d)$$

where

$$Y_i = \left(Age_i, Age_i^2, Education_i, Financial\ \_knowledge_i, Student_i, Retiree_i, Selfemployed_i\right)$$

y_{ki} is the *k*th element of the vector Y_i, $k = 1,...,7$; thus $\left(y_k * Female\right)_i$ is an individual *i*'s interaction term of a given characteristic and the dummy of being female.

The estimates of marginal effects of the interaction terms are to be found in the following table:

Table 8: The gender differences in the impacts of observable characteristics on time discounting (OLS estimates and marginal effects, robust standard errors and standard errors in parentheses)

Estimator	OLS with robust standard errors			
Explanatory variables	Dependent variable			
	Current subjective discount rate		**Future discount rate**	
	$\hat{\gamma}$	R-squared	$\hat{\gamma}$	R-squared
Age*Female	-0.0189 (0.0127)	0.0934	-0.0104 (0.0115)	0.0545
Age^2*Female	-0.0002 (0.0001)	0.0923	-0.0000 (0.0001)	0.0539
Education*Female	-0.0986 (0.2392)	0.0886	-0.1559 (0.2520)	0.0539
Financial knowledge*Female	-0.2629 (0.2989)	0.0905	-0.2747 (0.3283)	0.0552
Student*Female	0.3048 (0.3515)	0.0893	-0.0884 (0.3888)	0.0533
Retiree*Female	0.5271 (0.8242)	0.0901	0.7827 (0.7273)	0.0564
Self-empl.*Female	-0.3858 (0.3344)	0.0889	-0.8321 * (0.4854)	0.0557
Sample size	540		540	
Estimator	Probit			
Explanatory variables	Dependent variable			
	Present-biased discounting=1		**Future-biased discounting=1**	
	Marginal effect	McFadden R-squared	Marginal effect	McFadden R-squared
Age*Female	-0.0008 (0.0081)	0.0159	0.0002 (0.0099)	0.0206
Age^2*Female	-0.0000 (0.0000)	0.0157	0.0000 (0.0001)	0.0207
Education*Female	-0.0248 (0.1615)	0.0162	0.0660 (0.1790)	0.0260

Financial knowledge*Female	0.0234 (0.1711)	0.0161	0.0508 (0.1855)	0.0236
Student*Female	0.1417 (0.2891)	0.0199	-0.0329 (0.3229)	0.0211
Retiree*Female	0.0916 (0.3861)	0.0167	-0.1178 (0.56302)	0.0247
Self-empl.*Female	0.1163 (0.4878)	0.0167	0.1302 (0.4790)	0.0226
Sample size	540		540	

Level of significance: * 10%; ** 5%; *** 1%

The regression outcomes show that the gender differences identified in sub-sample analyses are insignificant with respect to the overall sample analysis. The only economic status that appears to determine the future subjective discount rate for women is the status of being self-employed. The self-employed females are ceteris paribus more patient in the future time frame compared to the base group with a 10 % statistical significance.

As the results in table 8 indicate, neither potential determinant of discount rate reversals proved to be statistically significant when interacted with the dummy of being female. Thus there are no statistically significant differences among different gender sub-groups.

To sum up, I have elicited individual monthly discount rates for the Czech people in the present and in the 1 year horizon. Bivariate and regression analyses demonstrated that there are variations in the current as well as future discount rate across socioeconomic characteristics.

The most robust are the negative correlations between the level of education and the subjective discount rate and the level of financial knowledge and the subjective discount rate. More educated individuals are significantly more patient in the current as well as future time frame. Individuals with better financial knowledge exhibit a significantly higher patience. Moreover, compared to the base group, retirees are significantly more impatient in the current and future time frame. Although I have identified the gender differences in the impacts of observable characteristics on time discounting, I have found only one statistically significant determinant that predicts the

subjective discount rate if interacted with the sex dummy: the self-employed women are significantly more patient.

I have also found that the elicited discount rate can vary even with respect to the time horizon, however a few observable characteristics can significantly predict those reversals. It supports the suggestion of other studies (e.g. Bauer, Chytilová, Morduch, 2010) that not many observable explanatory variables can predict the subjective discount rate reversals. The outcomes have shown that females are more likely to be present-biased. The status of being a student also increases the probability of having present-biased time discounting. The probability of future-biased time discounting appears to be determined only by being a student.

Based on the results, I confirm the hypothesis introduced by behavioral economics that discount rates differ across individuals with respect to their socioeconomic characteristics. The empirical results also confirmed that people can have dynamically inconsistent discount rates, even though a few observable variables are able to predict them.

The level of financial knowledge predicts the elicited measure of the subjective discount rate with a statistical significance. Thus the second behavioral hypothesis was confirmed. As a result, financial education can be an important factor for decision-making associated with pension saving. However it is probably not able to influence the present-bias that causes self-control problems because the level of financial education has not proven to be a statistically significant predictor of the time discounting reversals.

7. The Subjective Discount Rate and the Czech Pension Reform Plan

Research question no. 3: If there are some people exhibiting a present-biased discount rate, are they more likely to prefer the commitment features of the planned private funded scheme (i.e. automatic enrollment, deposit-side feature, withdrawal-side feature)?

7.1. The Model

The core of my thesis is to investigate whether an individual subjective discount rate and its inconsistencies is correlated with the probability that a specific feature of the pension reform plan will be chosen. In each choice task that will follow, the final option represents a binary outcome (1 = feature is chosen; 0 = feature is not chosen). That is why I will run probit regressions in the following form[17]:

$$P(y_i = 1) = \Phi(\alpha + \beta \times P\_bias_i + \gamma \times F\_bias_i + \delta \times SDR(current / future)_i + X_i'\varphi + \varepsilon_i) \quad (7.1.a)$$

X_i is a vector representing the observable characteristics. Regressions will be run separately for the current and future discount rate.

An omitted alternative, the dynamically consistent discount rate, will represent a base for which marginal effects of the subjective discount rate reversals will be compared.

7.2. Effect of Subjective Discount Rate on Saving Behavior of Participants

Before I start analyzing the preference for specific features, I will discuss whether the subjective discount rate can affect the saving behavior of participants. Table

[17] For assumption and more details of the probit model estimation refer to Appendix 3.

9 shows the average proportions of "savers" and those who consider their savings sufficient with respect to the elicited discount rate and discount rate reversals.

Table 9: The subjective discount rate and pension saving of participants (means and standard deviations in parentheses)

	Current subjective discount rate		**Future subjective discount rate**		**Time-inconsistent**		**Time-consistent**
	Lower	Higher	Lower	Higher[18]	Present-biased	Future-biased	
Create reserves for retirement	0.6216 (0.4855)	0.4607 (0.5013)	0.6112 (0.4880)	0.5113 (0.5027)	0.5877 (0.4944)	0.5765 (0.4971)	0.6018 (0.4903)
Consider their retirement savings sufficient	0.2345 (0.4243)	0.2105 (0.4104)	0.2366 (0.4255)	0.2000 (0.4027)	0.1546 (0.3634)	0.2466 (0.4340)	0.2527 (0.4354)
Total of respondents	451	89	452	88	115	85	340

Based on results of t-test for equality of means[19], I have obtained evidence that there are differences in proportions of retirement "savers" among lower and higher discount rate groups. This result is consistent for both measures of the discount rate. The differences are significant at the 10% level.

Moreover, a more significant difference has been identified in proportions of participants who consider their retirement savings sufficient. Relative to the consistent discount rate group, a significantly (5% level) lower proportion of participants exhibiting a present-biased discount rate consider their pension savings sufficient. However proportions of participants who stated that they save for retirement are not statistically different among groups exhibiting time-consistent and inconsistent discount rates, individuals exhibiting a present-biased discount rate are on average less satisfied with their savings. That could mean that those individuals are aware of the need to save and intend to do so like the others but are more likely to save insufficiently.

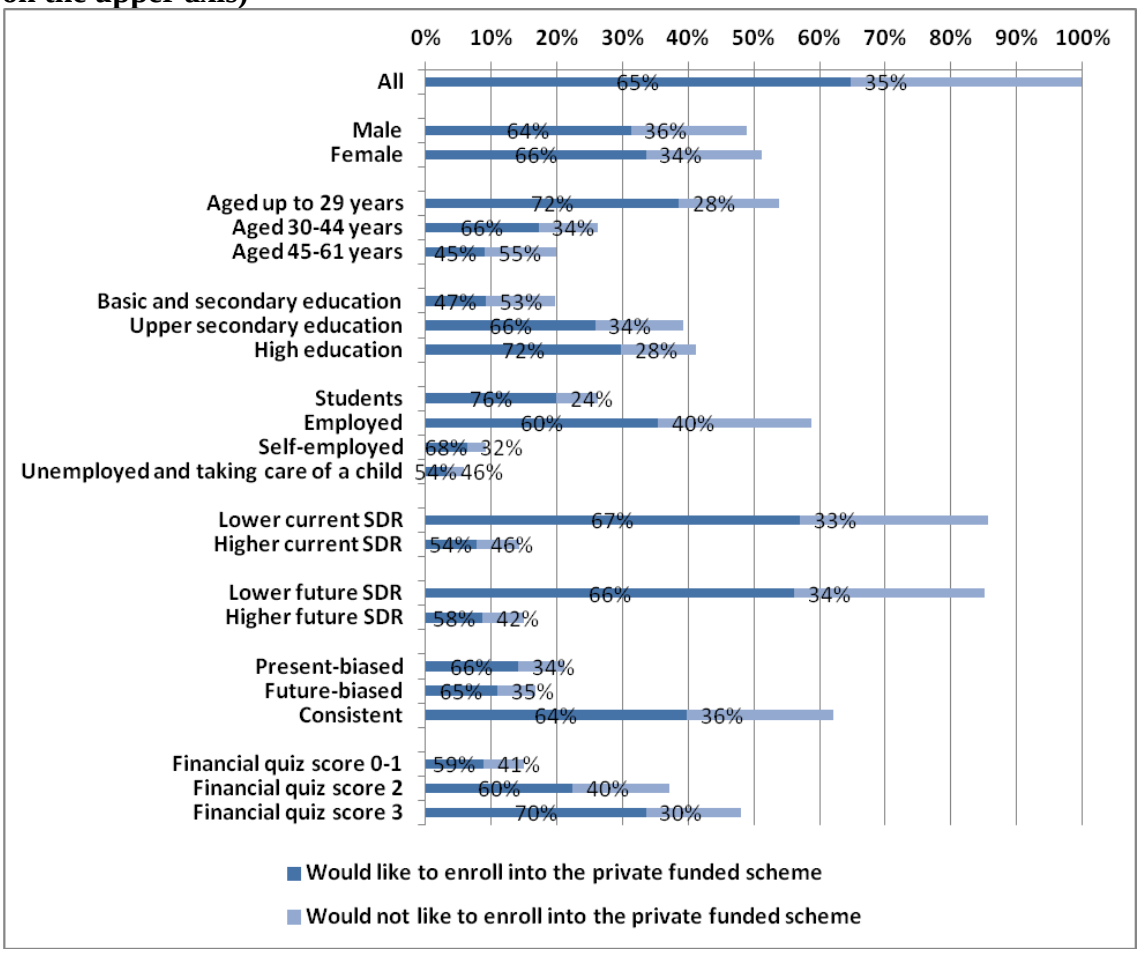
With respect to the results, I can reasonably suppose that time discounting is a possible determinant of behavior associated with saving for retirement. Based on this consideration, I will attempt to test my core research questions.

[18] The lower discount rate comprises values 0,01-0,3.
The higher discount rate comprises values 1,25-10.
[19] The standardized two-group mean comparison test with assumption of equal variance

7.3. Enrollment Into the Private Funded Scheme

First, I provided respondents with some basic information concerning the planned Czech pension reform[20]. The text of the introduction stemmed from the information published by the Ministry of Labor and Social Affairs in June 2011[21]. Based on the information, respondents were asked to indicate whether they would enroll into the private funded scheme or not. Retirees have not been included in the dataset used in the following part as the pension reform program covers only persons who have not retired yet. However, an interesting fact is that 32 % of retirees stated that they would like to enroll.

Chart 10: Respondents who would enroll into the private funded scheme per different categories (percentages of individual categories and weighted percentages on the upper axis)



[20] For the text of this part of the questionnaire refer to Appendix 1
[21] Published on the website of the Ministry of Labor and Social Affairs: http://www.mpsv.cz/cs/

As chart 10 shows, relative to other age groups, the highest proportion of respondents aged up to 29 years would enroll into the private funded scheme. Among education groups, the highest rate of enrollment occurs in the group with high education. Similarly, the individuals with the highest financial knowledge score are the most likely to enter. It is also apparent that a higher proportion of respondents with lower measures of the discount rate revealed their preference for the private funded scheme. No significant differences in the rate of hypothetical enrollment have been identified between individuals characterized by time-consistent and inconsistent discount rates.

In order to quantify the effect of the discount rate in the context of other observable variables, I run a set of probit models. The estimates are to be found in table 10. The estimated marginal effects suggest that there are gender differences in the directions of marginal effects of the subjective discount rate and its reversals on the decision to enter the private funded scheme. Even though neither of these results is statistically significant, the probability of a positive decision to enter the private funded scheme is increased by lower discount rates for men and higher discount rates for women. Similarly, ambivalent results can be found for the impact of present-biased and future-biased discounting.

Rather age and the level of education matters in predicting such a decision. As the probit outcomes show, there is a negative correlation between the probability to enter the private funded scheme and age. Also, the probability of enrollment increases with education.

Table 10: The subjective discount rate and enrollment into the private funded scheme (marginal effects, standard errors in parentheses)

Estimator	Probit					
Explanatory variables	Dependent variable					
	An individual would like to enroll into the private funded scheme=1					
	All	Male	Female	All	Male	Female
Current discount rate	0.0097	-0.0094	0.0247			
	(0.0378)	(0.0561)	(0.0571)			
Future discount rate				0.0028	-0.0033	0.0088
				(0.0320)	(0.0449)	(0.0488)
Present-biased discounting	0.0032	-0.0688	0.0542	0.0087	-0.0774	0.0611
	(0.1545)	(0.2322)	(0.2145)	(0.1547)	(0.2283)	(0.2161)

Future-biased discounting	-0.0060 (0.1662)	-0.0987 (0.2389)	0.0940 (0.2409)	-0.0110 (0.1761)	-0.0930 (0.2605)	0.0800 (0.2496)
Female	0.0040 (0.1245)			0.0044 (0.1245)		
Age	-0.0070 *** (0.0060)	-0.0040 (0.0084)	-0.0100 *** (0.0090)	-0.0070 *** (0.0060)	-0.0042 (0.0083)	-0.0102 *** (0.0090)
Education	0.0870 *** (0.0915)	0.1180 ** (0.1355)	0.0601 (0.1347)	0.0837 ** (0.0907)	0.1207 ** (0.1344)	0.0504 (0.1332)
Financial knowledge	0.0347 (0.0940)	0.0065 (0.1441)	0.0564 (0.1291)	0.0320 (0.0933)	0.0089 (0.1433)	0.0512 (0.1285)
Student	0.0578 (0.1664)	-0.0195 (0.2391)	0.1051 (0.2390)	0.0600 (0.1662)	-0.0222 (0.2384)	0.1079 (0.2390)
Self-employed	0.0933 (0.2184)	0.0383 (0.2740)	0.1463 (0.3660)	0.0922 (0.2183)	0.0398 (0.2742)	0.1472 (0.3667)
Sample size	477	233	244	477	233	244
McFadden R-squared	0.0596	0.0517	0.1040	0.0589	0.0512	0.0999

Level of significance: * 10%; ** 5%; *** 1%

Similarly as in the previous cases, I will include interaction terms of the sex dummy and other characteristics to examine marginal effects for different gender sub-groups. The model has the following form:

$$P\left(Pension\_Funds\_Entry_i = 1\right) = \Phi[\alpha + \beta \times Female_i + Z_i' \chi + \gamma\left(z_k * Female\right)_i + \varepsilon] \quad (7.3.a)$$

where

$Z_i = [(SDR(current/future)_i, P\_bias_i, F\_bias_i, Age_i, Education_i, Financial\_knowledge_i, Student_i, Retiree_i, Selfemployed_i]$

is a vector of characteristics for an individual *i*.

Table 11: Gender differences in the impacts of personal characteristics on the enrollment into the private funded scheme (marginal effects, standard errors in parentheses)

Estimator	Probit			
Explanatory variables	Dependent variable			
	An individual would like to enroll into the private funded scheme=1			
	Marginal effect	McFadden R-squared	Marginal effect	McFadden R-squared
Current discount rate*Female	0.0376 (0.0750)	0.0626		
Future discount rate*Female			0.0211 (0.0596)	0.0604
Present-biased discounting*Female	0.1040 (0.3028)	0.0611	0.0982 (0.3019)	0.0603
Future-biased discounting*Female	0.1542 (0.3262)	0.0628	0.1557 (0.3268)	0.0622
Age*Female	-0.0078 ** (0.0103)	0.0665	-0.0080 ** (0.0103)	0.0662

Education*Female	-0.0316	0.0600	-0.0321	0.0593
	(0.1650)		(0.1650)	
Financial knowledge*Female	0.0090	0.0596	0.0086	0.0589
	(0.1732)		(0.1732)	
Student*Female	0.1856 *	0.0658	0.1869 **	0.0652
	(0.2877)		(0.2877)	
Self-employed*Female	0.0548	0.0598	0.0551	0.0591
	(0.4527)		(0.4532)	
Sample size	477		477	

Level of significance: * 10%; ** 5%; *** 1%

No gender differences with respect to marginal effects of the discount rate and its reversals have been found. As probit estimates further revealed, there is a statistically significant interaction between the dummy of being female and age. This result proved my suggestion that the marginal effect of age on the probability of a hypothetical enrollment into the private funded scheme is driven by females. A similar result has been obtained for the interaction between being female and being a student. Being a female student significantly increases the probability of the willingness to enter into the private funded scheme.

I analyzed a hypothetical decision to enter into the private funded scheme. The results have not proved discount rate reversals to be a statistically significant determinant of enrollment. Nevertheless, at this point, my research is limited because the final real decision of respondents to enter can differ from the hypothetical one. Even though the respondents mean to enroll into the private funded scheme, some obstacles can prevent them from really entering. One of the obstacles can stem from the dynamic inconsistency of the subjective discount rate, as discussed further.

7.4. Automatic Enrollment into the Private Funded Scheme

In the other task, respondents were required to choose the form of enrollment into pension funds they would prefer. Two forms of enrollment were then offered: voluntary enrollment and automatic enrollment.

As for the Czech pension reform plan, entry into the private funded scheme is to be on a voluntary basis. Participants can decide to enroll and then take some actions to do so. The default option is not to enroll. As my empirical results demonstrated, some

people exhibit a present-biased discount rate which can cause that they may have difficulties with voluntary entry even if they are interested in the private funded scheme.

Based on examples of other counties, e.g. the United Kingdom, there is a reverse option of being enrolled into the private saving plan by default with a possible opt-out which can help present-biased individuals to overcome their procrastination. The logic behind default options is that maintaining a status quo leads to no activity and the easiest outcome is to procrastinate. That is why setting default options can be a powerful tool because defaults reduce decision-making costs of individuals which may imply significant effects on their financial choices.

I would like to examine whether the preference for automatic enrollment (if there is any) is determined by the said bias of the discount rate. If it is so, automatic enrollment would be a very helpful tool to assist "problematic enrollees" with their saving for retirement.

Chart 11 shows that in the category of lower discount rates, there is a higher proportion of participants who chose automatic enrollment compared to the category of more impatient individuals. In accordance with my expectation, the category of present-biased individuals includes a materially higher proportion of automatic enrollment proponents than categories of future-biased and consistent individuals. Furthermore, participants aged 30 – 41 years, participants with high education and the highest financial knowledge score and unemployed/on parental leave are more likely, relative to the other categories, to prefer automatic entry into pension funds.

To analyze the marginal effects of the subjective discount rate and its inconsistencies in the context of the other observable variables, I ran another probit model. The estimates are presented in table 12.

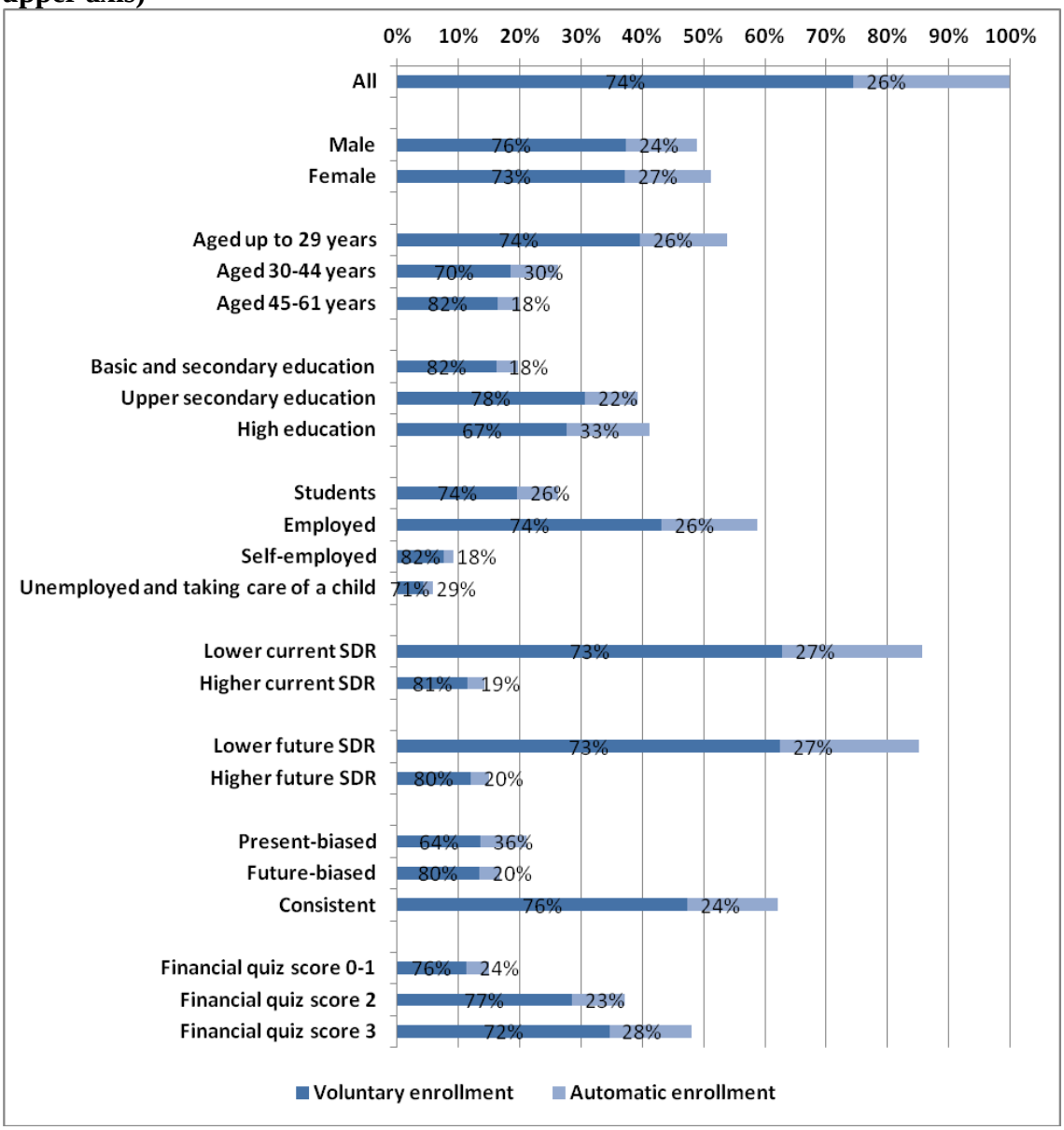
Table 12: The subjective discount rate and the preference for automatic enrollment into the private funded scheme

Estimator	Probit	
Explanatory variables	Dependent variable	
	Automatic enrollment is preferred=1	
Current discount rate	-0.0064	
	(0.0414)	
Future discount rate		-0.0034

		(0.0365)
Present-biased discounting	0.1182 **	0.1135 **
	(0.1546)	(0.1545)
Future-biased discounting	-0.0507	-0.0452
	(0.1831)	(0.1939)
Observable characteristics	yes	yes
Sample size	477	477
McFadden R-squared	0.0372	0.0369

Level of significance: * 10%; ** 5%; *** 1%

Chart 11: Respondents who would prefer automatic enrollment per different categories (percentages of individual categories and weighted percentages on the upper axis)



The probit outcome proved within the 5% statistical significance that an individual's present-biased discounting raises the probability of her/his preference for automatic enrollment into pension funds. The result is robust when controlling for both

measures of the subjective discount rate. Signs of marginal effects of the current and future discount rate are negative, as expected, but statistically insignificant.

The results confirm the behavioral hypothesis and demonstrate that people who have self-control problems do seek the tools that will help them to fulfill their long-term goals. Respondents exhibiting present-biased time discounting, who realized some possible difficulties with their enrollment, found the default automatic enrollment useful. Although this commitment feature proved to be important because it may assist some people with their action to begin saving, the possibility to opt-out is necessary as well because the people who have no difficulties with their financial behavior should be free to save for retirement in the ways they consider optimal.

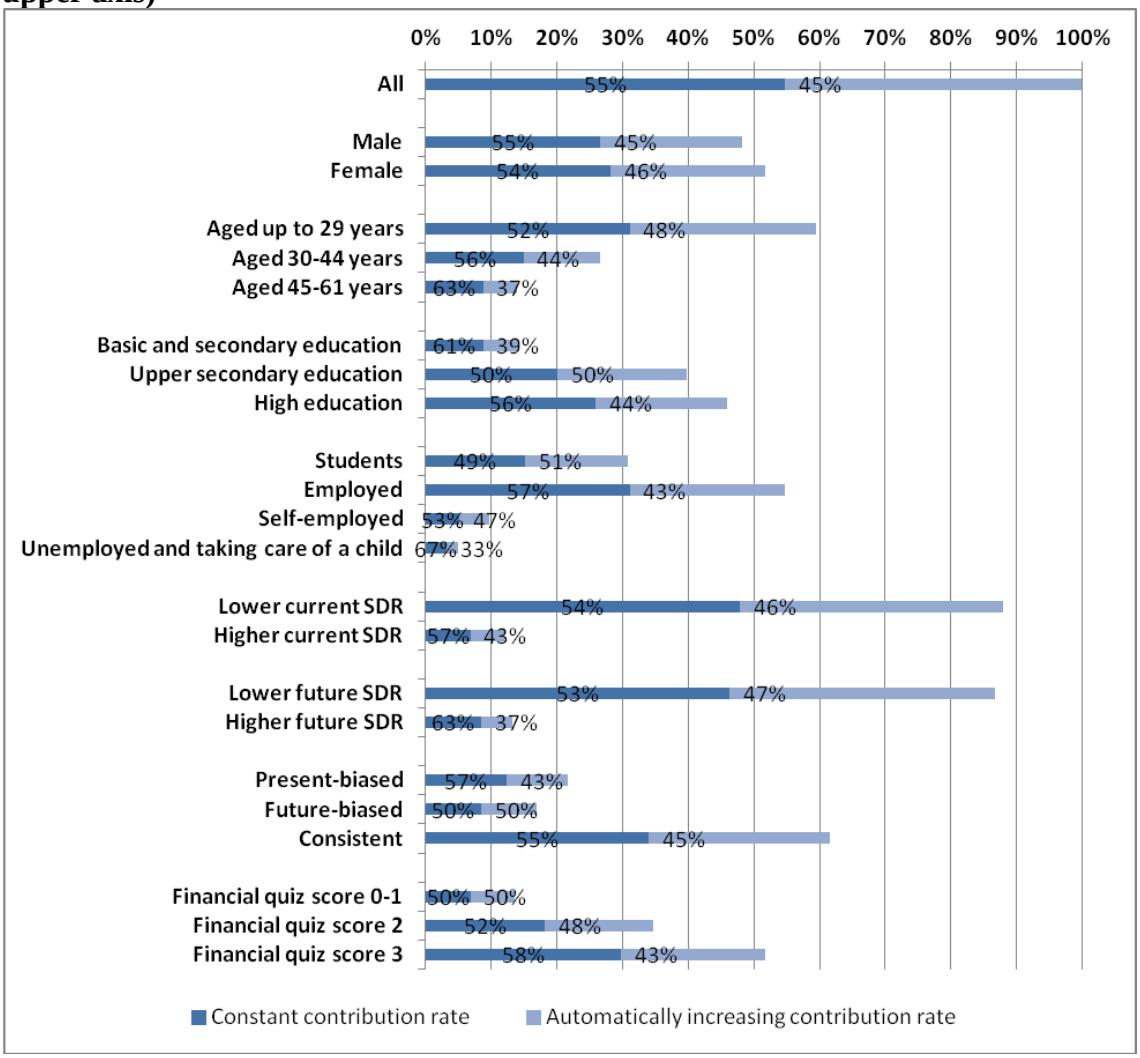
7.5. Contributions Increasing With Wage Rise by Default

Another task attempted to investigate potential determinants of preference for another tool that was included in the SMarT plan designed by Thaler & Benartzi (2004) for individuals with a dynamically inconsistent discount rate to overcome their problem of insufficient saving. Respondents, who would enter the private funded scheme, were asked to choose from two options of the contribution rate in pension funds: a constant contribution amounting to 5% (3% pay-as-you-go opt-out and additional 2%) of the assessment base (but anytime there is the possibility to save more) or a contribution rate with an initial amount of 5% of the assessment base that increases by a pre-defined amount with every wage rise (that is higher than a pre-set percentage threshold). The contribution rate can rise up to its pre-defined maximum.

As the results above indicated, even if present-biased individuals save for retirement, they are still more likely to save insufficiently or fail to save compared to future-biased and consistent individuals. Many of present-biased people can think they should be saving more, and plan to do so, but never follow through. The essence of the pre-defined increase in the contribution rate is that there is a lag between the commitment to save more and a real increase in the contribution rate. That is convenient for such people. Moreover, the linkage between wage rise and increase in contribution rate should mitigate the perceived loss aversion of a cut in take-home wage.

Nevertheless, there is not enough evidence whether this particular tool would be attractive for present-biased individuals who are aware of their insufficient savings to use it as a device for their limited self-control or it is just one inseparable ingredient of the complex SMarT plan.

Chart 12: Respondents who would prefer the deposit-side feature of the private funded scheme (percentages of individual groups, weighted percentages on the upper axis)



The chart above demonstrates that 45 % of all respondents, who would enroll into the private funded scheme, would prefer the automatically increasing contribution rate. The highest proportions of persons preferring the feature occur in the group of the youngest participants, in the group of individuals with upper secondary education, in the group of students and in the group of potential enrollees with lower measures of the

subjective discount rate. An interesting result is that the rate of preference for the deposit-side feature decreases with the financial knowledge score. An explanation can be found in the fact that people having better financial knowledge are more likely to make appropriate financial decisions and may prefer to use other ways of saving and investing if they wish to increase their contribution rate.

I will also examine the preference for this feature in the context of the Czech pension reform through another probit model. The obtained results can be seen in table 13. I have not obtained empirical evidence that the default increasing contribution rate is perceived as an attractive feature by individuals displaying an inconsistent discount rate. I obtained more adverse results than originally expected. Even though the marginal effect is not statistically significant, there is a negative correlation between the dummy of having a present-biased discount rate and the probability of a preference for a pre-set increasing contribution rate. A positive correlation is to be found for the dummy of being future-biased, albeit not statistically significant. The only significant outcome is that being more patient in the future time frame increases the probability of choice of the saving feature.

Table 13: The subjective discount rate and the preference for contribution rate increasing with wage rise

Estimator	Probit	
Explanatory variables	Dependent variable	
	Increasing contribution is preferred=1	
Current discount rate	-0.0201	
	(0.0449)	
Future discount rate		-0.0272 *
		(0.0391)
Present-biased discounting	-0.0118	-0.0323
	(0.1837)	(0.1840)
Future-biased discounting	0.0553	0.1013
	(0.2010)	(0.2120)
Observable characteristics	yes	yes
Sample size	309	309
McFadden R-squared	0.0137	0.0182

Level of significance: * 10%; ** 5%; *** 1%

The deposit-side feature of the pension saving scheme in a form of an automatic escalation of the saving rate was introduced by Thaler and Benartzi in their program Save More Tomorrow. The SMarT program has been implemented in the United States and successfully helped to increase savings of the participants and many United States retirement-plan administrators have adopted its idea. The Czech empirical results have

shown that a high proportion of respondents willing to enroll the private funded scheme revealed their hypothetical preference for this feature, however no statistically significant correlation between the present-bias of respondents and the preference for the automatic increase in the contribution rate has been found. The behavioral hypothesis that the present-biased people prefer deposit-side feature was thus not confirmed. In other words, the group of people with self-control problems for who the feature was specifically designed does not prefer to use this tool. Instead, the group of more patient people was interested in the deposit-side feature. Nevertheless, as I have shown, those respondents were most likely to save and had least troubles with doing so.

7.6. Deposit-side Commitments to Save

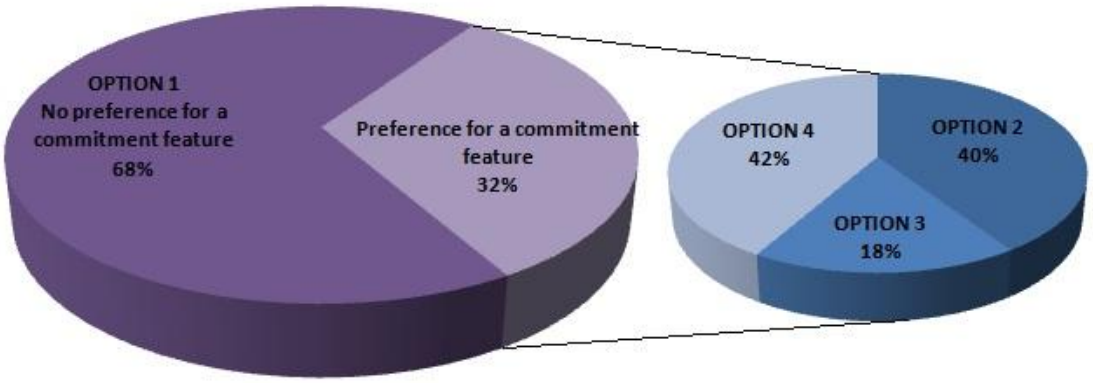
In the last task, respondents willing to hypothetically enroll into the private funded scheme were required to rank four possibilities of access to deposits in pension funds. The following options were offered:

- Option 1: *It is possible to withdraw the deposits whenever I ask for it.*
- Option 2: *First I fix the amount that I want to save up in the funds and then once my savings reach the fixed amount, I can withdraw the deposits. (in case of a premature death the saved money is subject to inheritance proceedings)*
- Option 3: *First I fix the date when I can withdraw the deposits. I can withdraw it only after this date. (in case of a premature death the saved money is subject to inheritance proceedings)*
- Option 4: *It is possible to start withdrawing the deposits after having met the requirements for the entitlement to receive old-age state pension. (in case of a premature death the saved money is subject to inheritance proceedings)* – this is planned in the Czech pension reform proposal.

The options 2, 3 and 4 represent different variants of the deposit-side commitment device that might be used to help individuals with self-control problems to save a sufficient amount until their retirement. As for behavioral economics, individuals exhibiting a present-biased discount rate are more likely to perceive these devices as attractive and useful for pension saving to help them to maintain the adequate deposits.

For each individual, I have selected the option that was perceived by her/him as the most suitable[22]. The following chart illustrates distribution of all the most suitable options.

Chart 13: Distribution of options marked as the most suitable



As illustrated, nearly one third of respondents expressed a preference for some form of a commitment device out of which the highest proportion preferred Option 4. The results demonstrate that the withdrawal-side feature can be a useful feature in the pension reform scheme architecture. In order to investigate the relationships between the preference for the options and personal characteristics I ran probit models for each option and I have obtained the following results.

Table 14: The subjective discount rate and the preference for no commitment (Option 1)

Estimator	Probit	
Explanatory variables	Dependent variable	
	Option 1 is the most preferred=1	
Current discount rate	0.0013	
	(0.0471)	
Future discount rate		0.0265
		(0.0469)
Present-biased discounting	-0.0871	-0.0731
	(0.1912)	(0.1919)
Future-biased discounting	-0.0526	-0.0895
	(0.2158)	(0.2249)
Observable characteristics	yes	yes
Sample size	299	299
McFadden R-squared	0.0447	0.0521

Level of significance: * 10%; ** 5%; *** 1%

[22] 10 respondents who had not been able to rank the offered alternatives were omitted from the analysis.

Table 15: The subjective discount rate and the preference for commitment (Options 2, 3 or 4)

Estimator	Probit					
Explanatory variables	Dependent variable					
	Option 2 is the most preferred=1		**Option 3 is the most preferred=1**		**Option 4 is the most preferred=1**	
Current discount rate	-0.0055		-0.0044		0.0057	
	(0.0593)		(0.0884)		(0.0544)	
Future discount rate		-0.0185		-0.0018		-0.0059
		(0.0637)		(0.0662)		(0.0608)
Present-biased discounting	-0.0115	-0.0228	-0.0216	-0.0231	0.1143 **	0.1139 **
	(0.2488)	(0.2516)	(0.3311)	(0.3318)	(0.2181)	(0.2183)
Future-biased discounting	0.0437	0.0678	0.0020	0.0045	0.0078	0.0147
	(0.2539)	(0.2634)	(0.3280)	(0.3453)	(0.2777)	(0.2884)
Observable characteristics	yes	yes	yes	yes	yes	yes
Sample size	299	299	299	299	299	299
McFadden R-squared	0.0904	0.1023	0.0467	0.0452	0.0395	0.0394

Level of significance: * 10%; ** 5%; *** 1%

As can be seen, option 1 (no commitment) is preferred by more impatient individuals and the average probability preferring option 1 for persons displaying a consistent discount rate is higher than if the persons are present or future-biased. Nevertheless, none of these results are statistically significant. Marginal effects are also statistically insignificant for options 2 and 3, however signs of the marginal effects suggest that the probability of choosing any of the two options decreases with being present-biased and increases with being future-biased.

Results for option 4 confirmed my hypothesis that being dynamically inconsistent increases the probability of preference for the commitment device represented by this option. The estimated coefficient for present-biased discounting is statistically significant at the 5% level. The explanation why persons, who are likely to have self-control problems, choose option 4 as the most suitable can be found in its link to the retirement entitlement. The main purpose of this option is to prevent a pre-mature withdrawal of pension funds deposits until a person retires. Hence there is no possibility to use the money for other purposes. The other options, 2 and 3, are not directly linked to retirement as they provide their own set of rules for withdrawing savings. For people with a dynamic inconsistency in the discount rate, the rules do not represent a device as useful for securing pension savings as the restricted withdrawal until retirement.

The commitment to save until retirement included in the plan for an introduction of the private funded scheme appears to be a useful device in terms of behavioral economics. Although its main purpose is to ensure stability of the private funded scheme, the by-product is providing a commitment mechanism which individuals with dynamically inconsistent time discounting demand.

The robustness of my result is supported by study by Ashraf et al. (2006). Similarly, based on data coming from a field experiment on Philippines they have found that individuals who exhibited a lower discount rate for future relative to current trade-offs were significantly more likely to open a bank account with a limited withdrawal of deposits without further benefits. The demand for commitment devices was also found in the Indian context by Bauer, Chytilová and Morduch (2010). The authors examined demand for microcredits with respect to behavioral features. The study presents evidence that individuals with present-biased time preferences are more likely to borrow through microcredit institutions. It can be explained by the fact that the microcredit contracts may represent a form of commitment device that enhances borrowers' self-discipline.

I can conclude that the demand for the commitment features to overcome procrastination and inertia is a robustly evidenced behavioral attribute. People with present-biased time discounting who recognize their self-control problems prefer the commitment features also in the retirement savings domain. The empirical results confirmed the behavioral hypothesis that individuals exhibiting a present-biased discount rate prefer the withdrawal-side feature of the private funded scheme in form of an irrevocable decision to save into pension funds until retirement.

8. Discussion and Conclusions: the Czech Pension Reform Plan through the Lens of Behavioral Economics

My study provides the Czech pension reform plan with an inspiration. The inspiration stems from the assumption of behavioral economics that dynamically inconsistent time discounting is a possible determinant of irrational pension saving decision-making. The architecture of the Czech pension reform plan thus can influence the selection of persons who enroll into the private funded scheme.

The results based on the data collected in my survey of Czech people's characteristics demonstrated that different persons exhibit different elicited discount rates. Moreover, discount rates can be time-inconsistent. Based on the collected data, I have shown that individuals exhibiting present-biased time discounting are statistically significantly more likely to consider their reserves for retirement to be insufficient compared to other persons. Behavioral economics explains this result by their limited self-control which is the cause of the failure to save adequately. Contrary to other persons whose behavior is not affected by self-control problems and who are able to take actions in favor of their interests, individuals with a dynamically inconsistent discount rate welcome tools that can help them overcome their weakness for hedonic behavior.

In terms of better incentives for the "problematic savers", there are possibilities for the Czech pension reform plan to include such features into its architecture. One of the possible features that reflect the needs of present-biased people is automatic enrollment into the private funded scheme. My results revealed a preference of present-biased people for this feature with a statistical significance. The present-bias is associated with a status quo bias and procrastination which prevent people with self-control problems to enter the private funded scheme even if they consider it beneficial. That is why they demand a mechanism that will overcome these obstacles. Nevertheless, in case of an introduction of automatic enrollment, the problem that arises is the choice of a pension fund into which to automatically enroll. The planned voluntary enrollment into the private funded scheme will comprise of many pension funds and the assumption is that each person interested in the private funded scheme

will choose a pension fund that will suit her/him best. In case the participants were to enter automatically, a set of rules of how to choose a pension fund would need to be prepared in order to mitigate potential risks.

In terms of the whole Czech population, the introduction of automatic enrollment would also require a further assessment of how large is the proportion of Czech policy-holders with self-control problems who demand a commitment device. In my data sample only 21 % of respondents exhibited present-biased discounting, however, the data sample was not representative due to high proportions of young and highly educated people. It is possible that in the Czech population the proportion of individuals with a time-inconsistent discount rate will be different.

Even in case of a higher proportion of respondents who do not want automatic enrollment, it can still have its rationale. If there are some people who have difficulties with self-control and some people who do not, it can be useful to introduce automatic enrollment under the assumption that it is possible to opt-out. People, who do not want to save in pension funds and have no self-control problems, could opt-out more easily than people with self-control problems, who want to save in pension funds, enroll into the private funded scheme.

Practical examples of how lessons from behavioral economics can be taken to design retirement saving plans can be seen in the United Kingdom or the United States. The United Kingdom is a country where automatic enrollment has been introduced in relation with occupational pension scheme. In the United States, the SMarT program including the deposit-side commitment feature in the form of a contribution rate increasing with wage rise has become very popular and has had an impressive impact on saving rates of enrollees. Even in the Czech pension reform context, the respondents revealed their preference for this deposit-side feature but it was not preferred by people with present-biased subjective discount rates. Although my empirical evidence revealed that a high proportion of respondents who would like to enter into the private funded scheme would also prefer the mentioned deposit-side feature, there is no evidence that it would represent a tool for individuals with self-control problems. It is a paradox that this feature is most demanded by persons who proved to have least problems with savings for retirement.

The results have further revealed that there is one feature already included in the planned private funded scheme that best suits the people with the present-bias. It is the irreversible decision to save in pension funds which represents a commitment tool for securing the saved deposits. As it has been robustly demonstrated that people with dynamically inconsistent discount rates demand commitment devices, the limited access to individual deposits until retirement can serve this purpose. Nevertheless, if people do not have self-control problems and thus do not seek commitment tools, this feature can represent an obstacle for them to enter as it may be associated with many potential risks and prevents them from changing to a more optimal way of investing their deposits.

Finally, except for other goals, my study also discussed the importance of financial education. Financial literacy is also considered an important factor for introducing the Czech pension reform. My survey outcomes showed that individuals exhibiting lower measures of the discount rate are statistically significantly more likely to save for retirement. Statistical analysis revealed that the discount rate can be determined by some personal characteristics. One of the most significant determinants was the knowledge of basic economic concepts which predicts that people are more patient. There is a possibility that financial education may decrease people's subjective discount rate which may improve their propensity to save. Nevertheless, the causality between financial knowledge and the subjective discount rate is not clear. There is an objection that those who acquire financial knowledge already possess a lower subjective discount rate. I suggest the causality to go in both directions as both directions have its rationales. Nevertheless, there is room for further research to confirm or reject this suggestion.

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List of appendices