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THE IMPACT OF ECONOMIC CIRCUMSTANCES ON RISK AVERSION

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Thesis Supervisors:

Erik Wengström and Hossein Asgharian

Author:

Darius Jost Fischer
born: 13.02.1986 in Hamburg

Blumenstrasse 16
22301 Hamburg
Germany

E-Mail:
darius.fischer.212@student.lu.se

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ABSTRACT

The objective of this paper is to find out whether economic circumstances can have an impact on the level of risk aversion using a sample of data from the Netherlands. The testing strategy is based on the DNB Household Survey, which is issued by CentERdata. Launched in 1993, this database contains panel data up until the year 2011. Using such data allows for the study of psychological as well as economic aspects of financial behaviour of in total 2,000 households. In order to assess how economic circumstances influence an individual's attitude towards risk, GDP figures from the OECD have been used. Despite other possible indicators, GDP growth rates are employed as they serve as a proxy for the economic circumstances of the country from which the sample has been drawn.

The paper's main finding is the existence of a significant correlation between economic circumstances and the degree of risk aversion. The random effects model, which is employed in the statistical analysis, indicates a negative and significant correlation. Thus, the better off the economy is, the less risk averse individuals will tend to be. Lower risk aversion means individuals will be more willing to take on financial risks. Crucial economic events such as the 2008 financial crisis and the dot.com crisis of 2000 tend to influence individual attitudes towards risk. The model indicates that individuals become more risk averse in the years following such crises.

KEYWORDS: Risk aversion, attitude towards risk, economic circumstances, financial risks, dot.com bubble, financial crisis, expected utility theory, random effects model.

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1 INTRODUCTION

Since the financial crisis in 2008 a great deal of studies has been conducted concerning a change in investor risk aversion. It has now become clear that the financial crisis was not a transient one, but rather a systematic crisis with penetrative consequences, which has resulted in persisting uncertainty in financial markets. Many studies were also conducted after the burst of the 'dot-com bubble' in 2000. Amongst other things, how investor behaviour has changed from before to after the burst, has been analysed. Wheale and Amin (2003) conclude that investors' preferences and beliefs could not be assumed to be in line with the normative economic model or Bayesian rationality.

In general, any economic and financial crisis will have dramatic consequences concerning the economic situation of the countries involved and indeed the global economy. The degree of severity of a crisis is reflected, typically, through economic indicators such as levels of production, employment, interest rates and price indices. This changing environment in any given economy affects the lives of individuals directly and can indeed lead to a change in behavioural patterns. Many scholars have given special attention to the changing behaviour of investors. In particular, the study of the behavioural patterns of financial investors has focused on changes in attitudes toward risk. In order to measure changes in investor attitudes towards risk, both past and recent research has focused on changes in risk aversion by examining differences in interest rates in the course of time. Higher risk premiums required by the economic actors can be associated with a higher degree of risk aversion, amongst other indicators.

Von Hagen et al. (2011) assess differences in bond spreads of US-Dollar bonds and Euro-denominated bonds relative to US and German benchmark bonds before and

after the start of the financial crisis. They find that a significant increase in spreads on non-benchmark bonds could be detected due to a general increase in risk aversion. Similarly, Haugh et al. (2009) find that differing fiscal policies, mainly their impact on future governmental household budget, is one of the key determinates in explaining bond yield spreads in the euro area. Information asymmetries might have led to an abnormally low general risk aversion before the crisis, reflecting the artificial adjustment of interest rates for government bonds of the European member states to the level of interest rates for German government bonds.

Barrios et al. (2009) break down the reasons for government bond yield differences within the euro area into three main determinants. According to their findings, the spreads in the government bond markets in the euro area indicate the fiscal vulnerabilities and risk of default of the corresponding member states. Secondly, the spreads may reflect their liquidity constraints and thirdly, movements in yield differences might be affected by changes in risk aversion amongst investors. Other scholars (Aït-Sahalia et al. 2001; Scheicher 2003; Tarashev et al. 2003; Beber and Brandt 2006) employ option prices as a source of information in order to estimate the risk aversion of economic actors. According to their approach, option prices capture investors' evaluation of future movements in stock prices and consequently, the degree of risk aversion. In other words, to settle option prices investors employ their preferences weighted with probabilities of different possible future market trends over the fixed period.

Several scholars also study how risk aversion itself is determined and they find that characteristics such as gender and age for instance have an impact on the attitude towards risk (Croson and Gneezy 2009, Borghans et al. 2009, Barsky et al. 1997, Dohmen et al. 2011). Needless to say, the perspective from which these studies are taken renders them rather limited in the sense that they focus more on which individual characteristics can determine different attitudes towards risk. However, the economic circumstances of the country from which the sample was drawn, has never played an important role.

Despite the aforementioned approaches of finding proxies for risk aversion, the approach of this paper is to link risk aversion to economic circumstances using a sample of data from the Netherlands. Instead of particularly focussing on the behavioural pattern of financial investors by means of option pricing or government bond yield spreads, the objective is to assess to what degree economic circumstances generally impact individual attitudes towards risk, within a given population. Therefore, not only economic actors buying or selling government bonds, for instance, are taken into account, but rather more generally the individuals of a population. In doing so, severe downturns of economic circumstances caused by financial and economic crises during the observed period are incorporated into the analysis.

The testing strategy is based on the DNB Household Survey issued by CentERdata research institute, located on the Tilburg University campus. This Survey was launched in 1993 and contains panel data from 1993 up until 2011. By means of this panel data the development of attitudes towards risk of the individuals within the sample can be analysed over the course of time. In order to see how economic circumstances impact risk aversion, data from the Organisation for Economic Cooperation and Development (OECD) has been used. In particular the local trend of Gross Domestic Product (GDP) has been implemented in the model to approximate the economic circumstances of the country the sample has been drawn from. Despite the existence of other indicators, the GDP is, typically, a solid indicator of economic circumstances. This is further discussed in the theoretical background.

The statistical analysis is based on the random effects model. This model has been employed in the analysis, since the typical statistical tests revealed that the random effects model is appropriate. The findings of the analysis indicates the existence of a significantly negative correlation between economic circumstances and the degree of risk aversion. Therefore, living in a booming economy makes people less risk averse according to the model. Crucial events such as the dot.com crisis in 2000 and the financial crisis in 2008 affect the attitude towards risk. The model indicates that in the years following such crises individuals become more risk averse.

Furthermore, the model indicates a significantly negative correlation between risk aversion and income, as well as the level of education. Age, on the other hand, has a positive effect on risk aversion, meaning that the older an individual gets, the more risk averse they become. Gender, typically, exhibits a very strong correlation with risk aversion. It is found that females are more risk averse than men. In case individuals are in charge of the household's financial administration, they are likely to be less risk averse.

The paper is structured as follows: Section 2 provides the theoretical foundation and economic concepts upon which the research of this paper relies. Section 3 provides the details of the data that will be used in the analysis and additionally, the dependent and independent variables are described. Descriptive statistics for each variable are presented in order to obtain a clear understanding of the data. Section 4 describes the methodology and regression equation. It also includes a discussion around the statistical model, which is considered to be the most adequate. Section 5 provides the output of the regression models presented in a table, and a discussion of the findings as well as limitations of the model. Section 6 concludes.

2 THEORETICAL BACKGROUND

Decision-making under risk has always been an important and highly discussed theme in economic research. In order to analyse changes in attitudes towards risk on the individual level, the concept of risk aversion itself as well as the underlying assumptions are going to be reviewed. Furthermore, a review of past approaches used to study risk aversion will be provided, along with a discussion of the contribution made by this paper.

2.1 EXPECTED UTILITY THEORY

The concept of risk aversion is integrated into the expected utility theory. This theory was first proposed by Daniel Bernoulli in 1738, who introduced a counterexample contradicting the conventional theory at that time, which assumed it would be reasonable to pay anything up to the expected value of a gamble. He proved that the value of a gamble to an individual is not equal to its expected monetary value. This proof is known as the so-called “St. Petersburg Paradox”. He developed a theory, which proposed that individuals make decisions according to a utility function. Hence, when making decisions on a gamble, individuals refer to the expected utility of the gamble rather than the expected value of a gamble (Starmer 2000). On this foundation, Expected Utility Theory (EUT) has led to a perpetual discourse whereupon in this process the theory has developed and expanded. In the following the development of EUT is going to be discussed.

Von Neumann and Morgenstern (1947) developed certain assumptions showing that the expected utility hypothesis could be derived from a set of axioms on the preferences of individuals. The motivation of these pioneers was to constitute a normative model of how a rational individual should make decisions about

alternative choices rather than constitute a descriptive, respectively positive rationalisation about how individuals actually make decisions. The basic assumption or rather, axioms can be reviewed in Plous (1994). If these axioms hold there is a continuous utility function, which represents individuals' preferences.

2.2 THE CONCEPT OF RISK AVERSION

Risk aversion is basically assumed, if preferences of individuals can be represented by means of a utility function $U(w)$ exhibiting a diminishing marginal utility. This is due to the concavity of the utility function implicating that the utility function is increasing in wealth ($\delta U(w)/\delta w > 0$), but increasing at a decreasing rate (therefore $\delta^2 U(w)/\delta w^2 < 0$). Thus, in the process of decision making regarding a choice between multiple alternatives with same expected values a risk averse individual would prefer the one with the smallest possible risk. The risk of potential losses in wealth outweighs the possibility of potential gains in wealth. Consequently, for the utility function of a risk averse individual holds: $E[u(w)] < U[E(w)]$. In other words the expected utility from the payoff is smaller than the utility from the expected payoff.

Pratt (1964) and Arrow (1970), who developed a measurement for individuals' attitude towards risk, derived this concept of risk aversion independently. They built the foundation for measuring individuals' attitude towards risk using the curvature of the utility function, which was discussed in the previous paragraph. Suppose a utility function ($\delta U(w)/\delta w > 0$; $\delta^2 U(w)/\delta w^2 < 0$) by means of the Arrow-Pratt measurement it is possible to assess how risk aversion changes in income for the given utility function. Thus, according to their approach there is dependence between income and the level of risk aversion, which they intended to model. From a normative perspective they concluded, "*Normatively, it seems likely that many decision makers would feel they ought to pay less for insurance against a given risk, the greater their assets*" (Pratt 1964, p. 123). Many scholars followed this approach and used experimental methods to study risk aversion of individuals by estimating individuals' preferences regarding risk (Binswanger 1980, Holt and Laury 2002,

Harrison et al. 2007). It was shown that individuals exhibit significant risk aversion even over modest stakes.

However, a lot of concerns have been made regarding the EUT in the course of time. Maurice Allais (1953) and Daniel Ellsberg (1961) for instance documented fundamental violations of the basic assumptions of the EUT. Daniel Ellsberg (1961) constructed an example of choice indicating that individuals do not necessarily behave according to the aforementioned axioms. He suggested that for individuals having to choose between two alternatives and the probability distribution of only one alternative is known; they would choose the known alternative by the majority. This behaviour can lead to a contradiction of the independence axiom of decision-making postulated by von Neumann and Morgenstern. In this context, new non-conventional theories have emerged focusing on a new perspective of behavioural patterns of individuals. In particular, the findings of Kahneman and Tversky (1979) has been given considerable attention and their approach persisted in the further discourse popularised as Prospect Theory. Kahneman and Tversky found that individuals exhibit a greater sensitivity towards losses than towards gains, defined formally as a sharp bend of the utility function at the corresponding reference point. Starmer (2000) provides a solid review of the literature by giving an all-encompassing overview of the development of the Expected respectively Non-Expected Utility Theory.

2.3 CONTRIBUTION

As stated and developed in the introduction, the previous literature has given considerable attention to changes in behaviour concerning risk aversion of financial investors. Financial markets and risk premiums served as an approximation in order to be able to measure risk aversion of the corresponding investors. Bond spreads become wider as the level of risk aversion increases. Option prices comprise information of investors preferences, thus they settle option prices employing their preferences weighted with probabilities of different possible future market trends over the corresponding fixed period. It is questionable whether those

findings can be applied to describe how risk aversion has changed within the population, since it is basically focused on investors of a particular market from which the data is obtained. A typical investor would be someone, who trades options regularly for instance and thus, has a certain degree of experience regarding financial risk. A financial investor is also likely to have attained a higher level of education and his or her income is likely to be relatively high in comparison to the average income of the population. Hence, focussing on behavioural patterns of financial investors does not necessarily allow for the drawing of conclusions about the behavioural patterns of the population in general.

Other scholars, on the other hand, concentrate on how risk aversion has developed within the population. They study this topic particularly on how cognitive skills affect risk aversion, or the heterogeneity in risky choice behaviour within the population (Bonsang and Dohmen 2012, von Gaudecker et al. 2011). Others intend to find out if there are any differences in risk aversion between men and women (Jianakoplos and Bernasek 1998, Croson and Gneezy 2009, Borghans et al. 2009). Even though these studies consider many aspects, which could have an effect on risk aversion, they do not take the economic circumstances into account. However, every individual within the population makes financial decisions regularly, such as taking a loan from a bank, raising a mortgage or investing in financial assets or fixed deposits. In doing so, they consider the economic circumstances in order to determine how much risk they want to bear when making such decisions.

The contribution of this paper is to find out how behavioural patterns amongst the general population, regarding risk taking are affected by economic circumstances. In line with previous studies the analysis takes common control variables into account, such as cognitive skills, gender, income etc. in order to avoid confounding effects. The main focus, however, is on economic conditions of the country from which the sample was drawn, for the purpose of finding out how these affect the level of risk aversion of the underlying population. In order to approximate economic circumstances, typically, a great deal of measurements would be available. Production, employment, interest rates and the price levels are all economic

determinants, which can be used to measure economic fluctuation. However, the GDP can be considered as the most adequate measurement in this context, since it is the most general one not concentrating on only one market such as the employment rate for instance.

For interpreting the results of this paper it is crucial to emphasise at this point that the analysis of this paper does not assume that changes in behavioural patterns are necessarily based on changes in individuals' preferences per se, but rather on changing background risks individuals are facing. Making a decision whether to take on financial risks or not, involves an assessment of the potential background risks. Kimball (1963) finds that given an agent with a utility function, which exhibits standard risk aversion, the degree of risk aversion would increase in background risk. Similarly, Guiso and Paiella (2008) show that the changing environment of the economy affects risk aversion. Individuals who are facing income uncertainty or running into a liquidity constraint exhibit a higher degree of risk aversion. Franke et al. (1998) come to the conclusion that differences in risk taking behaviour is not explained by differences in the shape of utility functions, but rather due to the degree to which agents are facing non-hedgeable background risks. The intention of this paper ties in with these approaches assuming that the source of changes in behavioural patterns lies in changing background risks such as labour market risk or inflation risk. As aforementioned, the GDP serves as a proxy summarising the economic environment of the economy. It is assumed that the healthier the economy (which means in turn the higher the GDP) the more willing are people to take on financial risks. Living in a booming economic environment, which analogously reduces potential background risks is supposed to trigger incentives to be relatively less risk averse concerning financial decisions.

In this context, the crisis of the last two decades cannot be ignored. The bust of the dot.com bubble led to a decrease of the NSDAQ-100 by 39% and a dramatic collapse of stock prices (Wheale and Amin 2003). This profound downturn is supposed to have generated a change in individuals' perception and behavioural patterns. Similarly, the recent financial crisis cannot either be ignored. It has become

apparent that the financial crisis, which has now transformed into a prolonged economic meltdown, has the characteristics of a persistent systematic crisis similar to the 1930s Depression. As von Hagen et al. (2011) conclude, after the start of the financial crisis an increase in the level of risk aversion became persistent. Correspondingly, the analysis in this paper will take into account the effects of both the dot.com bubble and the recent financial crisis.

3 DATA & COMPOSITION OF VARIABLES

The analysis makes use of two sources of data. Panel data is obtained from the DNB Household Survey issued by the CentERdata research institute, located on the Tilburg University campus. This panel data reflects the composition of the Dutch-speaking population. GDP growth rates of the Dutch economy are obtained from the Organisation for Economic Cooperation and Development (OECD), with the primary source being the Netherlands Central Bureau of Statistics (CBS) located in Voorburg. According to the approach discussed in Section 2, the development of the GDP is incorporated in the model in order to approximate economic conditions of the country from which the sample was drawn.

The DNB Household Survey panel is executed yearly. The first panel wave was launched in 1993 and 2011 is the latest available. The survey allows for the study of psychological as well as economic aspects of financial behaviour. In particular, the data of this wide-ranging survey comprises of information on work, pensions, housing, mortgages, income, possessions, loans, health, economic and psychological concepts and personal characteristics. The survey is administered via the Internet and those households without Internet available were equipped with a box for their television set allowing them to access the Internet through their television. In case the household does not have a television, CentERdata provided one. In total CentERdata has been collecting data from 2,000 households participating in the panel.

The data analysis of this paper encompasses 17 waves including the year 1995 until the last wave of 2011. Note that the first and second panel waves are ignored in the

analysis since throughout the first two panel waves the structure, and more importantly some questions have been altered. Thus, including the first and second waves has turned out to be troublesome. Even though in some waves from 1995 onwards changes have also been made regarding the structure of the survey, yet the corresponding questions themselves remain the same. Consequently, by excluding the first two panel waves it is possible to refer to the same questions throughout all waves without having the exigency of obtaining the information from different types of question or sources. This allows for a sound and efficient assessment of changes in behaviour of the respondents.

Nevertheless, the panel has to be declared as an unbalanced panel dataset due to the following: Firstly, some respondents have not participated in every wave due to mortality, whereas others have left the panel at some point for unknown reasons or missed out some years. Secondly, some participants entered the panel in between the years. However, it can be considered to be unproblematic due to the assumption that new individuals entering the panel are as randomly drawn from the population as the individuals of the very first panel wave. Participants leaving or interrupting the panel is also assumed to be a random process.

In the following sections, the dependent and independent variables are presented as well as the control variables. Descriptive statistics are provided and discussed for each variable.

3.1 DEPENDENT VARIABLE

The analysis of risk aversion relies on a question, which can be found in the section *Economic and Psychological Concepts* of the DNB Household Survey, addressing a respondent's attitude towards financial risk. The wording of this question is the following:

Please indicate on a scale from 1 to 7 to what extent you agree with the following statements, where 1 indicates 'totally disagree' and 7 indicates 'totally agree'. If you really don't know, use 'don't know':

*"I am prepared to take the risk of losing money,
when there is also a chance to gain money."*

Intuitively an individual is associated with being fully risk averse in case of choosing '1' and conversely fully risk loving in case of choosing '7', thus the smaller the reported value the more risk averse the respondent is.

As aforementioned the wording of the question has remained unaltered throughout the waves. For all waves there are overall 33,338 observations available for this particular question, in which 6,193 times no answer was given. 33% of the individuals report that they entirely disagree with the statement given in the question (see Table 1). On average throughout all observed years the individuals can be considered as rather risk averse, since the mean is 2.62 with a corresponding Standard Deviation of 1.54.

Table 1: Distribution of Dependent Variable

Level of Risk aversion		Frequency	Percent
Risk averse	1	8,956	33%
.	2	5,849	22%
.	3	3,864	14%
.	4	4,906	18%
.	5	2,438	9%
.	6	831	3%
Risk loving	7	301	1%
Total		27,145	100%
Mean		2.62	
Std. Dev.		1.54	

Source: DNB Household Survey issued by the CentERdata research institute

3.2 INDEPENDENT VARIABLES

The independent variable is constructed from data obtained from the OECD (the primary source is the CBS as mentioned before). The aim is to find an approximation for economic circumstances, which are believed to affect the individuals within the survey. For this purpose the growth rate of the national GDP per annum is taken into account. Consequently, a dramatic downturn of the economy at the end of an observed year for instance can have a significant impact on the annual GDP growth rate for the given year.

It needs to be considered that all the DNB Household Surveys were mostly conducted in the middle of the year. In doing so, the time frame of the execution of the survey varies over the years. Due to the fact that the status of information whilst completing the questionnaire does not cover all the events taking place within all twelve months of the year, the independent variable was constructed from one-year lagged data. This way, confounding and misleading conclusions can be avoided, since it is assured that the status of information is the same for all respondents.

The aforementioned argumentation can rather be considered as a technical reason of why constructing a lagged independent variable. Disregarding this technical issue it is assumed that individuals tend to make use of information that is not most up to date when it comes to considering economic conditions. Typically, the observed individuals cannot be considered to be all experienced and informed professional investors who are at any time fully aware of the development of the economy and respectively financial markets. In the same vein, they are unlikely to be capable of predicting the consequences of an economic downturn.

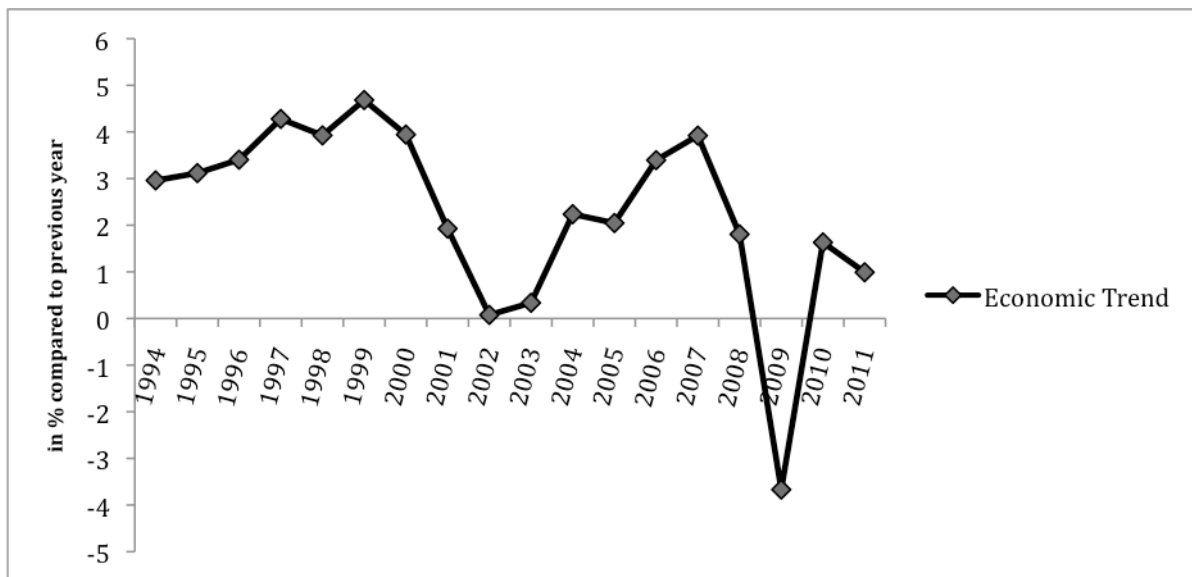
Since the composition of the survey is supposed to make it representative of the Dutch population, it is rather reasonable to assume that the majority of individuals do not monitor economic trends thoroughly and are always up to date. It takes time for individuals to grasp the economic trend entirely and comprehend the consequences of an economic downturn. Thus, individuals' capacity to absorb and

process information is assumed to be lagged. Hence, whenever respondents answer a question regarding their attitude towards risk, and in doing so take economic circumstances into evaluation, they do not assess exact up to date information but rather process the general economic trend perceived in the near past.

Apart from the lagged perception of information, when making long-term financial decisions in general (as taking a loan from a bank, raising a mortgage, investing in financial assets or fixed deposits) not only expected future performance, but also past economic trends are taken into account automatically in order to obtain an in-depth picture of the economic situation. This may also support the argument to use one-year lagged data.

In line with the argumentation the independent variable is the GDP growth rate with one-year lag. Correspondingly, due to the linkage between GDP growth rate and economic trend the variable serves as a solid approximation of the economic circumstances.

Figure 1 displays the development of the growth rate of the Dutch GDP serving as an approximation of the economic trend of the Netherlands starting in 1994 until 2011 and hence, covers all observed waves of the analysis of this paper. Figure 1 shows a profound drop after the burst of the dot.com bubble in 2000. Between the years 1999 and 2003 the GDP growth rate dropped by about 4.6 percentage points. An even more radical collapse can be clearly observed after 2007 reflecting the severe consequences of the financial crisis. The severity of this economical downturn becomes apparent by looking at the steep fall of the graph between the years 2007 and 2009. In this period of time the GDP growth rate declined by even 7.5 percentage points approximately. After the GDP growth rate has reached its lowest point in 2009 (-3.67 GDP growth rate compared to the previous year), the Dutch economy started to recover slowly.

Figure 1: Independent Variable - Development of the Dutch GDP Growth Rate

Source: OECD.Stat (originally: Netherlands Central Bureau of Statistics)

Additionally, a regression analysis is provided in Section 8 using growth rates of the national GDP per annum of the current year instead of one-year lagged data (1. Model, Appendix 2). In the same table another regression analysis can be found employing growth rates of the first six months of the current year (2. Model, Appendix 2). This has been done in order to find out how sensitive the results are to this kind of change.

3.3 CONTROL VARIABLES

A set of control variables is incorporated in the regression analysis in order to absorb confounding effects. It has been controlled for income, age, gender, education, children, location and whether the respondent is in charge of the financial administration of the household or not. In this section the set of control variables are described and corresponding descriptive statistics are provided. All the control variables are constructed from data obtained from the DNB Household Survey and can be found in the section *General Information on the Household* (except for the total net income, which is calculated separately).

As discussed in the theoretical background, Pratt (1964) and Arrow (1970) postulate the correlation between income and an individual's attitude towards risk. Pratt implies a negative correlation between income and risk aversion meaning that the level of risk aversion decreases in income (Pratt 1964). Many scholars have studied the impact of income or wealth on risk aversion. Shaw (1996) concludes that wage growth exhibits a positive correlation with preferences for taking risks. Others, in turn, do not find a clear systematic pattern of risk aversion being correlated with income, wealth or taxes (von Gaudecker 2011, Pålsson 1996). Nevertheless, in order to avoid any possible confounding effects, the logarithm of the individuals' total net income is incorporated in the model.

Three dummy variables are included in the model, controlling for the level of education. The first dummy variable controls for pre-university education completed, the second for vocational colleges completed and the third for university completed. In line with common findings, for instance Shaw (1996) and von Gaudecker et al. (2011), a negative impact of education on the level of risk aversion is assumed.

Several scholars have conducted a variety of studies regarding the impact of age and cognitive skills on risk attitudes. A large number of empirical literature in behavioural economics indicates a systematic relationship between risk aversion and age (Pålsson 1996, Barsky et al. 1997, Borghans et al. 2008, Dohmen et al. 2011). According to their findings, individuals become more risk averse the older they get, since these studies reveal a gradually lower willingness to take risks in older cohorts. The model incorporates age as well as age squared, because the partial effect of age on risk aversion is supposed to be non-constant. It is believed that individuals become proportionally more or less risk averse at a certain age, thus a turning point within the graph is expected.

It is also controlled for gender, since a common finding in the literature is that gender has an effect on the attitude towards risk of the individual. Several studies conclude that women are more risk averse than men (Jianakoplos and Bernasek

1998, Croson and Gneezy 2009, Borghans et al. 2009). Hence, in order to absorb confounding effects, a dummy variable is included in the model controlling for gender.

Apart from this, it is controlled for whether the household has children or not, assuming that the additional responsibility of having a children makes parents more risk averse. Taking on the risk of losing money when there is also a chance to gain money is not likely to be in line with preferences of parents, since they are concerned about additional future expenses such as their children's education for instance. In other words, they are assumed to be reluctant to gamble with their children's future. Thus, safe investments without the risk of losing money are supposed to be preferred by households with children.

Furthermore, in accordance with the findings of von Gaudecker et al. (2011) being the household's financial administrator is supposed to have a negative effect on risk aversion. Being in charge of the financial administration is supposed to positively affect the confidence level concerning financial issues. Having this confidence could, in turn, lower the attitude towards financial risks. Therefore, a dummy variable is included controlling for whether the respondent is the financial administrator of the household or not.

It is also controlled for location by incorporating a dummy for the household being in one of the three largest cities in the Netherlands (Amsterdam, Rotterdam and Den Haag). By including this dummy variable it can be controlled whether there is a difference concerning the attitude towards risks of people living in an urban environment or in an environment, which might be ranked as provincial or rural.

In order to obtain a picture of the presented set of control variables, which are incorporated in the regression model, Table 2 displays descriptive statistics for all the control variables.

Table 2: Summary Statistics for Control Variables

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
log of income	24,638	10.02	1.07	0	14.75
pre-university	33,232	.12	.33	0	1
vocational colleges	33,232	.22	.41	0	1
university completed	33,232	.10	.30	0	1
age	33,337	58.66	15.57	16	112
age ²	33,337	3,685	1,851	256	12,544
female	33,336	.45	.49	0	1
children	33,335	.42	.49	0	1
financial administrator	33,338	.63	.48	0	1
location: 3 largest cities	33,297	.16	.37	0	1

Source: DNB Household Survey issued by the CentERdata research institute

Furthermore, controlling for time fixed effects is necessary to absorb all time-specific variations within the model. Thus, a variable called *time trend* has been constructed and included in the model in order to do so. To take into account the general increase in the level of risk aversion due to the long-ranging consequences of the financial crisis, a dummy variable for the years after the crisis has been incorporated in the model (*financial crisis*) including the years after 2007. Thus, it is possible to capture the assumed severe impact of the financial crisis raising the level of risk aversion of the individuals systematically. In the same way, a dummy variable has been constructed (*dot.com*) capturing the impact of the dot.com crisis on risk aversion. This variable includes the following three years after the burst of the dot.com bubble in 2000. Note that the variables *time trend*, *crisis* and *dot.com* are not presented in Table 2, since the descriptive statistics do not reveal any essential information, which needs to be displayed.

4 METHODOLOGY

In this part of the paper the methodology is discussed, which is employed to estimate the model. The former discussion boils down to the following model:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \beta_k C_{k,it} + \alpha_i + \varepsilon_{it}$$

Risk aversion is the dependent variable and is represented by Y . The independent variable is represented by X , which reflects the economic trend in the country from which the sample was drawn, approximated by means of the growth rate of the national GDP. C consists of the set of control variables incorporated in the model. α represents an individual specific component and a remaining idiosyncratic error component is denoted by ε . The error term ε is assumed to be independent and identically distributed ($\varepsilon_{it} \sim \text{IID} (0, \sigma_\varepsilon^2)$). In the following it is discussed whether or not the fixed effects model or the random effects model should be used. These approaches differ in terms of the assumption made about the individual specific error term α . The random effects model assumes α to be independent and identically distributed ($\alpha_{it} \sim \text{IID} (0, \sigma_\alpha^2)$). By utilising the fixed effects model, it is assumed that the individual specific error terms α vary over the individual units i ($E(\alpha_i | X_{it}, \alpha_i) \neq 0$).

As is known, in the fixed effects model to eliminate these unit effects, every observation is subtracted from the individual specific mean over time. Therefore, the fixed effects model ignores variations between the individuals, but measures variations within characteristics of individuals of the sample over time. The model is based on the within variance of individuals exclusively. Consequently, this model is

suitable if the objective is to find out how changes in the independent variables cause the dependent variable to vary around a mean within the unit.

However, the main aim of this paper is to draw conclusions about to what extent risk aversion is affected by the economic circumstances of the economy the sample was drawn from. Hence, the value of some individual's α_i is not of particular interest, but the focus is rather on arbitrary individuals who have certain characteristics. Needless to say, economic circumstances per se are not part of individuals' specific characteristics, but an exogenous occurrence affecting individuals' behavioural patterns. In this sense, employing the fixed effects model indicating the subtraction of every observation from the mean value could distort the interpretation of the coefficient with regards to the variable representing economic circumstances. In this respect, the random effects model would be more suitable, since it uses information from the between estimator. In doing so, it averages observations over a unit and regresses the dependent variable's average on the independent variable's average to look at differences across units. Furthermore, the random effects model accounts for variables that do not change over time e.g. gender.

Despite the former discussion regarding which model is the most suitable for this research objective, the Hausman test is, typically, executed for evaluating the estimator of the fixed effects model versus the alternative estimator of the random effects model. The aim is to find out statistically which model corresponds to the data. Additionally, a LM test is conducted in order to identify whether a random effects regression or a simple OLS regression is preferred. After having executed the diagnostic tests in order to decide which model is adequate for the analysis the corresponding regression and the coefficients are finally discussed.

5 RESULTS

Section 5.1 deals with the diagnostic tests, which are executed and also presents the regression models employed for the analysis. The Hausman test and the LM test are conducted in order to decide which model is best suited to the data. After having carried out the diagnostic analysis, Section 5.2 is concerned with the discussion of the corresponding regression, in which the variables and coefficients are analysed.

5.1 REGRESSION TABLE & DIAGNOSTIC TESTS

In the regression table provided in Appendix 1 (Section 8), the first two columns of the table present the fixed effects model and the random effects model. It has to be pointed out that the variable *economic circumstances* is excluded from the first two models because the economic trend variable is an exogenous variable and not a individual specific characteristic. Considering that the idea of the fixed effects model is to eliminate the unit effects by subtracting every observation from the individual specific mean over time, the model is based on the within variance of individuals exclusively. Correspondingly, only variables that change over time and can be referred to as individual specific characteristics are included in the first and second model. Due to the fact that the dummy variable *female*, which controls for gender, does not change over time, it has been dropped in the fixed effect model.

The Hausman test is executed in order to find out which model fits the data best, statistically. The test yields a χ^2 -Teststatistic of 23.92 with a corresponding p-value of 0.0209. Hence, the null hypothesis (H_0 : difference in coefficients is not systematic) cannot be rejected at a tested significance level of 5%. Consequently, the random effects estimator is supposed to be efficient and consistent. On that account, the random effects model is preferred over the fixed effects model.

Furthermore, in column three and four of Appendix 1 the pooled OLS model is compared to the random effects model. In both regressions the entire set of explanatory variables are incorporated in the model. The Breusch and Pagan Lagrange multiplier test (LM test) for random effects is employed to decide between the random effects regression and a simple OLS regression (H_0 : Variances across entities is zero). The LM test yields a χ^2 -Teststatistic of approximately 13,198 with a corresponding p-value of 0.00, thus the null hypothesis has to be rejected. Correspondingly, there is a significant difference across units, meaning a panel effect exists.

According to the diagnostic tests the random effects model is appropriate and thus, employed for the interpretation of the coefficients and any further discussions. Table 3 presents the random effects model using a stepwise procedure. The first model includes the variable *economic circumstances* and the set of control variables. The second model incorporates additionally the dummy variables for the dot.com and the financial crises. Finally, in the third model all variables including the time trend variable are taken into account.

Table 3: Impact on the Risk Aversion

Explanatory variable	1. Model	2. Model	3. Model
	Random Effects Coeff (t-ratio)	Random Effects Coeff (t-ratio)	Random Effects Coeff (t-ratio)
economic circumstances	0.053*** (11.52)	0.037*** (7.75)	0.029*** (5.81)
log income	0.104*** (7.86)	0.089*** (6.69)	0.062*** (4.51)
pre-university	0.161*** (3.80)	0.159*** (3.76)	0.161*** (3.82)
vocational colleges	0.093*** (2.77)	0.109*** (3.23)	0.120*** (3.57)
university completed	0.348*** (7.43)	0.366*** (7.83)	0.375*** (8.03)
age	-0.022*** (-3.20)	-0.022*** (-3.25)	-0.026*** (-3.84)
age ²	0.000 (1.27)	0.000 (1.19)	0.000 (1.54)
female	-0.538*** (-15.87)	-0.553*** (-16.31)	-0.570*** (-16.77)
children	0.081*** (2.81)	0.050* (1.72)	0.017 (0.59)
financial administrator	0.078*** (2.58)	0.083*** (2.76)	0.095*** (3.16)
location: 3 largest cities	0.036 (0.90)	0.029 (0.71)	0.024 (0.59)
dot.com	-	-0.049** (-2.03)	-0.053** (-2.19)
financial crisis	-	-0.281*** (-12.25)	-0.150*** (-5.15)
time trend	-	-	-0.022*** (-7.36)
R ² (overall)	0.081	0.087	0.088
Number of obs	21,229	21,229	21,229

*** = significant at 1% ** = significant at 5% * = significant at 10%

Source: DNB Household Survey issued by CentERdata and OECD.Stat (originally: Netherlands Central Bureau of Statistics)

Using this stepwise procedure it can be shown in the first step that the main variable of interest being the variable *economic circumstances* has a significant

impact on the attitude towards risk. The second interest is the crises, which are incorporated in the second regression in order to capture the impact of the dot.com bubble as well as the financial crisis on risk aversion. Thirdly, incorporating the time trend as a control variable can account for time fixed effects in order to absorb all time-specific variations within the model.

5.2 DISCUSSION OF REGRESSION OUTPUT

The signs of the coefficients are in line with the theoretical assumptions. Before looking at the coefficients of the random effects model, presented in Section 5.1 Table 3, the measurement of the dependent variable should be recalled. The dependent variable consists of a ranking that relates to the perception regarding risk aversion of the respondents of the DNB Household Survey. A scale from '1' to '7' indicates the attitude towards risk, whereby the ranking '1' implies that the individual is fully risk averse and '7' that the individual is fully risk loving respectively.

The variable *economic circumstances* being the main variable of interest, has a negative and highly significant effect on risk aversion. This holds for all three models presented in Table 3. Thus, the better off the economic circumstances, the less risk averse the individuals become or analogously, the better off the economic circumstances the more individuals are willing to take on financial risk. This finding supports the theoretical assumption that the economic situation of the country has a significant effect on behavioural patterns of the country's population. As discussed before, individuals have to make financial decisions regardless of whether he or she is a financial investor who is constantly monitoring economic trends and analyses the markets i.e. with the advantage of being able to relate to experience and perhaps specific theoretical knowledge. Albeit seeming trivial, deciding whether to put spare money on a saving account for a fixed interest rate or invest it in a financial asset with the chance to gain money but also the risk to lose money, is already a crucial financial decision any individual has to make regularly. The economic circumstances seem to play a significant role in these financial decisions. In case an individual is

indecisive whether to invest in a financial asset with the risk of losing money, living in an economy that has been booming in recent times might trigger incentives to settle for it.

In accordance with the findings of all three models of Table 3, the pooled OLS model provided in Section 8 (Appendix 1) also reveals a significantly negative impact on risk aversion. Furthermore, the results of the regression analyses employing the economic circumstances variable without one-year lagged data of GDP growth rates, but with the data from the current year instead, imply a significantly negative effect on the level of risk aversion (see Section 8, Appendix 2, 1. Model). Similarly, using the growth rates of the first six months of the current year, which has been done in the second model (also Section 8, Appendix 2), reveals a significant and negative impact on risk aversion. Thus, it has been proved that the results are not too sensitive to a change of time frame. However, it is noteworthy that the dummy variable controlling for the dot.com crisis is not significantly different from zero, neither in the first model nor in the second. Furthermore, the dummy variable *financial crisis* becomes less significant in both models. This may substantiate the postulated assumption (see Section 3.2.) that individuals' capacity to absorb and process information is lagged. Therefore, whenever economic circumstances are taken into evaluation, individuals' do not assess exact up to date information but rather process the general economic trend perceived in the near past.

However, concerning the model using one-year lagged data both the years after the dot.com crisis and financial crisis have had an impact on the level of risk aversion (see 2. and 3. Model, Table 3). The sign of the variable *financial crisis* is negative and the coefficient is highly significant. Correspondingly, this crisis has led to an increase in the level of risk aversion due to persistent uncertainty within the population. The same applies for the dummy variable *dot.com*, controlling for consequences of the dot.com crisis, even though the coefficient is not as significant as the coefficients of the dummy variable controlling for the financial crisis. These findings hold also for all four models of the regression analyses in Appendix 1.

The third model of Table 3 takes all variables including the time trend variable into account. The dummy variable *time trend* indicates a positive and significant effect on the level of risk aversion. Thus, a positive linear time trend can be assumed, which holds for all regression analyses presented in this paper.

Regardless of which model of this paper is taken into consideration, the level of income is found to always have a negative correlation with risk aversion, which is in line with Shaw (1996). This finding is in accordance with the dependence between income and the attitude towards risk, postulated by Pratt (1964), who implies that risk aversion decreases in income.

The level of education also has a significantly negative effect on risk aversion, which agrees with the findings of Shaw (1996) and von Gaudecker et al. (2011). All three coefficients of the dummy variables, indicating the different levels of education are significant and positive. Comparing the three dummy variables regardless of which model of Table 3, it is noticeable that the highest level of education (being the completion of the university) has the strongest negative effect on the level of risk aversion. The t-ratio is twice as high as the t-ratio of the other two dummy variables namely 'completion of pre-university education' and 'completion of vocational colleges' respectively.

In line with Pålsson (1996), Barsky et al. (1997), Borghans et al. (2008), Dohmen et al. (2011) all three models of Table 3 indicate a significantly positive correlation between age and risk aversion. The older the respondents are, the more risk averse they become. It was assumed that the partial effect of age on risk aversion is not-constant, meaning that the function exhibits a turning point. For this reason the square of age was incorporated in the model. Due to the fact that the variable age^2 has no significant effect on risk aversion it cannot be assumed that the function exhibits a turning point.

Assessing the dummy variable that controls for gender, it becomes apparent that gender has a strong effect on the attitude towards risk regardless of which model of

this paper is examined. The sign of the dummy variable *female* is negative and the coefficient exhibits very strong significance in all models. Correspondingly, women can be considered to be more risk averse than men according to the models. This finding corresponds to the studies of Jianakoplos and Bernasek (1998), Croson and Gneezy (2009), Borghans et al. (2009).

Being the household's financial administrator has a significantly negative effect on risk aversion, which is congruent with the finding of von Gaudecker et al. (2011). It is noticeable that in all regressions presented in this paper, the coefficients indicate that being in charge of the household's financial administration has a negative impact on the degree of risk aversion. It can be assumed that being the financial administrator and thus, dealing with financial issues regularly endows the individual with experience regarding these matters and in turn increases the level of confidence. Having this confidence seems to decrease the level of risk aversion.

In case all variables are incorporated into the model, having children does not have any significant impact on the attitude towards risk, which becomes apparent considering the third model of Table 3. Neither does the location of the household. The p-values of both coefficients indicate that they are not significantly different from zero. Strikingly, every model in this paper indicates that the location of the household does not have any significant impact on risk aversion.

5.3 LIMITATIONS

Using the random effects model reveals conclusions about the population from which the sample was drawn. Therefore, the discussion of the coefficient reported in Section 5.2 allows for the drawing of conclusions about the extent to which risk aversion is affected by the economic circumstances of the country. However, it needs to be reiterated that the underlying population is the population of the Netherlands. To what degree the characteristics of this population resemble the characteristics of other European member states requires careful consideration. It would require further research in order to conclude whether the results of this

analysis (based entirely on a sample of the Dutch population – the Dutch being part of the European Union) do hold for the population of other European member states and indeed the OECD. However, the objective of this paper is not to draw conclusions about the entire member states of the European Union, since this would go beyond the scope of this research. The intention is neither to necessarily analyse the behavioural patterns of the Dutch population per se, but rather it is simply to use an arbitrary sample of any population and assess to what degree the attitude towards risk is affected by the economic circumstances of the country. The assessment of the sample employed in this paper indicates that there is indeed a correlation and it also finds that certain events such as the financial crisis can have an impact on risk aversion.

6 Conclusion

The objective of this paper is to find out whether economic circumstances impact the level of risk aversion using a sampled data from the Netherlands. The testing strategy is based on the DNB Household Survey, which was issued by CentERdata and launched in 1993, containing panel data until 2011. This survey allows for the study of psychological as well as economic aspects of financial behaviour. For assessing how economic circumstances influence the attitude towards risk, the paper uses OECD data on GDP growth rates of the Netherlands. GDP growth rates thus, serve as a proxy for the economic circumstances of the country.

For the statistical analysis the random effects model is employed. The random effects model was found to be statistically appropriate. The main finding of the analysis is that there is a significant correlation between economic circumstances and the degree of risk aversion. The random effects model indicates a negative and significant correlation. Thus, the better off the economy, the less risk averse individuals are, or analogously the more they are willing to take on financial risks. Crucial events such as the financial crisis in 2008 and the dot.com crisis in 2000 can influence the attitude towards risk. The model indicates that in the years following these crises individuals tend to become more risk averse.

Furthermore, the analysis shows that the level of income has a significantly negative correlation with the degree of risk aversion. The model indicates also a significantly negative correlation between risk aversion and the level of education. On the other hand, the model indicates that age has a positive effect on risk aversion, meaning that older individuals are more risk averse. However, the finding does not support the assumption that the partial effect of age on risk aversion is not-constant. Thus, it cannot be concluded that individuals become proportionally more or less risk

averse at a certain age. Gender, typically, exhibits a very strong correlation with risk aversion. It is found that women are more risk averse than men. Individuals who are in charge of the household's financial administration are found to be less risk averse. It is expected that dealing with financial issues regularly endows the individual with experience and increases the level of confidence, which in turn lowers the aversion towards financial risks.

It needs to be pointed out that the intention of this paper is not to generalise by claiming that the characteristics of the population from which the sample was drawn resemble the characteristics of other European member states. Neither is the intention to analyse behavioural patterns of the Dutch population in particular, but rather use an arbitrary sample of any population and analyse to what degree the attitude towards risk is affected by the economic circumstances of the population's economy. The assessment of the sample employed in this paper indicates that there is indeed a correlation and further discovers that certain events such as the financial crisis and the dot.com crisis have had an impact on risk aversion. Concerning the enduring financial crisis it can be expected that due to the severity of this penetrative crisis it is likely that people's attitude towards risks will also be affected in the upcoming years according to the paper's finding that individuals tend to rely on the recent past when making financial decisions.

7 References

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7.2 SURVEY AND REFERENCED WEB RESOURCES

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8 Appendices

Appendix 1: Impact on the Risk Aversion

Explanatory variable	1. Model	2. Model	3. Model	4. Model
	Fixed Effects Coeff (t-ratio)	Random Effects Coeff (t-ratio)	pooled OLS Coeff (t-ratio)	Random Effects Coeff (t-ratio)
economic circumstances	-	-	0.032*** (4.97)	0.029*** (5.81)
log income	0.040** (2.13)	0.066*** (4.80)	0.098*** (7.47)	0.062*** (4.51)
pre-university	0.006 (0.07)	0.157*** (3.73)	0.251*** (7.68)	0.161*** (3.82)
vocational colleges	-0.032 (-0.49)	0.115*** (3.41)	0.141*** (5.52)	0.120*** (3.57)
university completed	-0.016 (-0.12)	0.368*** (7.88)	0.465*** (13.87)	0.375*** (8.03)
age	-0.571 (-0.53)	-0.027*** (-3.95)	-0.032*** (-6.44)	-0.026*** (-3.84)
age ²	0.010 (0.96)	0.000 (1.63)	0.000*** (3.35)	0.000 (1.54)
female	-	-0.567*** (-16.69)	-0.557*** (-23.38)	-0.570*** (-16.77)
children	0.026 (0.53)	0.017 (0.59)	0.026 (1.07)	0.017 (0.59)
financial administrator	0.153** (2.50)	0.095*** (3.17)	0.076*** (3.33)	0.095*** (3.16)
location: 3 largest cities	-0.091 (-0.62)	0.022 (0.54)	-0.001 (-0.03)	0.024 (0.59)
dot.com	-0.069*** (-2.62)	-0.072*** (-3.01)	-0.057* (-1.93)	-0.053** (-2.19)
financial crisis	-0.147*** (-4.69)	-0.161*** (-5.56)	-0.158*** (-4.36)	-0.150*** (-5.15)
time trend	-0.029*** (-7.48)	-0.027*** (-8.97)	-0.020*** (-6.35)	-0.022*** (-7.36)
R ² (overall)	0.007	0.087	0.088	0.088

Number of obs	21,229	21,229	21,229	21,229
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*** = significant at 1% ** = significant at 5% * = significant at 10%

Source: DNB Household Survey issued by CentERdata and OECD.Stat (originally: Netherlands Central Bureau of Statistics)

Appendix 2: Impact on the Risk Aversion

Explanatory variable	1. Model	2. Model
	Random Effects Coeff (t-ratio)	Random Effects Coeff (t-ratio)
economic circumstances	0.032*** (5.17)	0.055*** (3.41)
log income	0.063*** (4.59)	0.064*** (4.61)
pre-university	0.161*** (3.80)	0.159*** (3.76)
vocational colleges	0.117*** (3.47)	0.115*** (3.43)
university completed	0.372*** (7.96)	0.370*** (7.93)
age	-0.028*** (-4.01)	-0.028*** (-4.00)
age ²	0.000* (1.68)	0.000* (1.66)
female	-0.569*** (-16.75)	-0.569*** (-16.75)
children	0.015 (0.50)	0.015 (0.52)
financial administrator	0.093*** (3.08)	0.094*** (3.12)
location: 3 largest cities	0.021 (0.53)	0.021 (0.53)
dot.com	0.008 (0.28)	-0.030 (-1.10)
financial crisis	-0.070** (-2.07)	-0.091** (-2.55)
time trend	-0.026*** (-8.70)	-0.027*** (-9.23)
R ² (overall)	0.088	0.087

Number of obs	21,229	21,229
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*** = significant at 1% ** = significant at 5% * = significant at 10%

Source: DNB Household Survey issued by CentERdata and OECD.Stat (originally: Netherlands Central Bureau of Statistics)

To the best of my knowledge and belief, this Master Thesis is my own work. All sources have been properly acknowledged, and the paper contains no plagiarism. I have not previously submitted this work or any version of it for assessment to the University of Lund, its partner institutions, or any other institution.

I acknowledge that this assessment submission may be transferred and stored in a database for the purposes of data matching to help detect plagiarism.

Student's Signature: _____

Place and date of signing: _____