UNIVERSITY OF LJUBLJANA
SCHOOL OF ECONOMICS AND BUSINESS

MASTER'S THESIS

SAVING BEHAVIOR OF SLOVENIAN HOUSEHOLDS IN A LOW-INTEREST-RATE ENVIRONMENT: AN EMPIRICAL ANALYSIS

Ljubljana, September 2021 HANA KONČAN

AUTHORSHIP STATEMENT

The undersigned Hana Končan, a student at the University of Ljubljana, School of Economics and Business, (hereafter: SEB LU), author of this written final work of studies with the title 'Saving behavior of Slovenian households in a low-interest-rate environment: an empirical analysis', prepared under the supervision of Denis Marinšek, Ph.D.

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LIST OF ABBREVIATIONS

sl. – Slovene

ANOVA – (sl. analiza variance); Analysis of variance

BOE – (sl. Angleška banka); Bank of England

DFR – (sl. obrestna mera za depozite); Deposit facility rate

ECB – (sl. Evropska centralna banka); European Central Bank

ELB – (sl. efektivna spodnja meja); Effective lower bound

ESRB – (sl. Evropski odbor za sistemska tveganja); European Systemic Risk Board

EURIBOR – (sl. medbančna obrestna mera); Euro Interbank Offered rate

GDP – (sl. bruto domači proizvod); Gross Domestic Product

HICP – (sl. harmonizirani indeks cen življenjskih potrebščin); Harmonised Index of Consumer Prices

IMF – (sl. Mednarodni denarni sklad); International Monetary Fund

MRO – (sl. operacije glavnega refinanciranja); Main refinancing operations

NIRP – (sl. politika negativnih obrestnih mer); Negative interest rate policy

NPISH – (sl. neprofitne institucije, ki služijo gospodinjstvom); Non-profit institutions serving households

OECD – (sl. Organizacija za gospodarsko sodelovanje in razvoj); Organisation for Economic Co-operation and Development

SURS – (sl. Statistični urad Republike Slovenije); Statistical Office of the Republic of Slovenia

US – (sl. Združene države); United States

INTRODUCTION

After the global financial crisis of 2008–2009, the last decade will undoubtedly be characterized as an era of historically low interest rates. This is especially true for developed countries such as the United States and EU member states. It is often argued that monetary policy has played an important role in this situation. Indeed, major central banks have not only lowered policy rates to historically low levels, but have also taken a number of unconventional measures to lower nominal interest rates and flatten the yield curve. Yields have fallen across the range of financial assets, including bank deposits, which have long been the most popular form of household savings. The problem of low interest rates has been exacerbated following the COVID-19 outbreak, prompting major central banks to respond once again with unprecedented monetary stimulus to stabilise financial markets and contain the economic impact of the pandemic. Interest rate cuts and large-scale asset purchases were among the quick and forceful responses by central banks. This increases the chances of another sustained period of very low interest rates, especially if the COVID-19 situation has long-term economic effects that negatively impact household disposable income. Such developments have triggered a debate on whether they will have a negative impact on household saving and investment behaviour (Georgievska, 2020).

While the reasons for low interest rates are still debated, the impact on households seems quite clear: low, zero or even negative interest rates are expected to discourage households from saving and encourage them to invest in riskier assets that they would not have considered otherwise (Rupprecht, 2018).

The purpose of this Master's thesis is to analyse the interest rate-savings relationship, to observe possible disruptions and discontinuities in households' saving behaviour due to persistently low interest rates, and to examine the role of interest rates in shaping households' saving decisions in relation to other determinants. The goal of this Master's thesis is to conduct a comprehensive analysis of the trends in Slovenian households' saving and investment behaviour in the context of the low interest rate environment and to compare results with other Euro Area countries.

The aim of this Master's thesis is to answer the following research questions:

- Are there differences in household saving behaviour between Euro Area countries?
- Is there a shift towards riskier investments among households in a low-interest-rate environment?
- How do Slovenian households behave in a low-interest-rate environment?

This Master's thesis will provide an overview of Slovenian households' saving and investment behaviour in light of the low and negative interest rate environment. The first – theoretical – part of the thesis will be dedicated to a detailed description of the current global macroeconomic conditions, interest rate developments and factors contributing to the

persistent low interest rate environment. In addition, the first part will also address the most critical issue to consider when analysing low and negative interest rates – how policy rates affect other interest rates that matter in the economy as a whole (Ulate, 2020). Considering that everyone who has financial assets pays the price of ultra-low interest rates by foregoing the typical return on those assets (Elmendorf, 1996), this Master's thesis will next discuss the importance of rates of return on household saving behaviour. In order to find out what drives households' saving behaviour, the thesis will present various households' saving motives. People base their consumption on the real income they expect to earn over their lifetime. In this respect, household saving is a way to smooth consumption in the face of income changes over long-term horizons – for example, by saving for retirement – as well as over shorter time horizons, in the case of temporary or unexpected income fluctuations (ECB, 2009). The saving motives will be represented by three basic theories: the life-cycle hypothesis, the permanent income hypothesis and the precautionary saving motive. Then, the determinants that influence households' saving decisions besides the interest rates will be presented theoretically and graphically. This will portray the starting point of the empirical part of the Master's thesis. In order to capture the similarities and differences between Euro Area countries and to place Slovenia next to the mentioned countries, a clustering according to the most important savings determinants will be performed. In addition, a bivariate analysis of real long-term interest rates and the savings rates over time will be constructed using scatter plots. Furthermore, the evolution of household saving behaviour in the Euro Area will be analysed to see what has happened in the wider environment. The last part of the Master's thesis will focus on the general trends of household saving and financial operations in Slovenia, in particular on the trends in the structure of savings and how interest rate changes have contributed to household saving and investment behaviour.

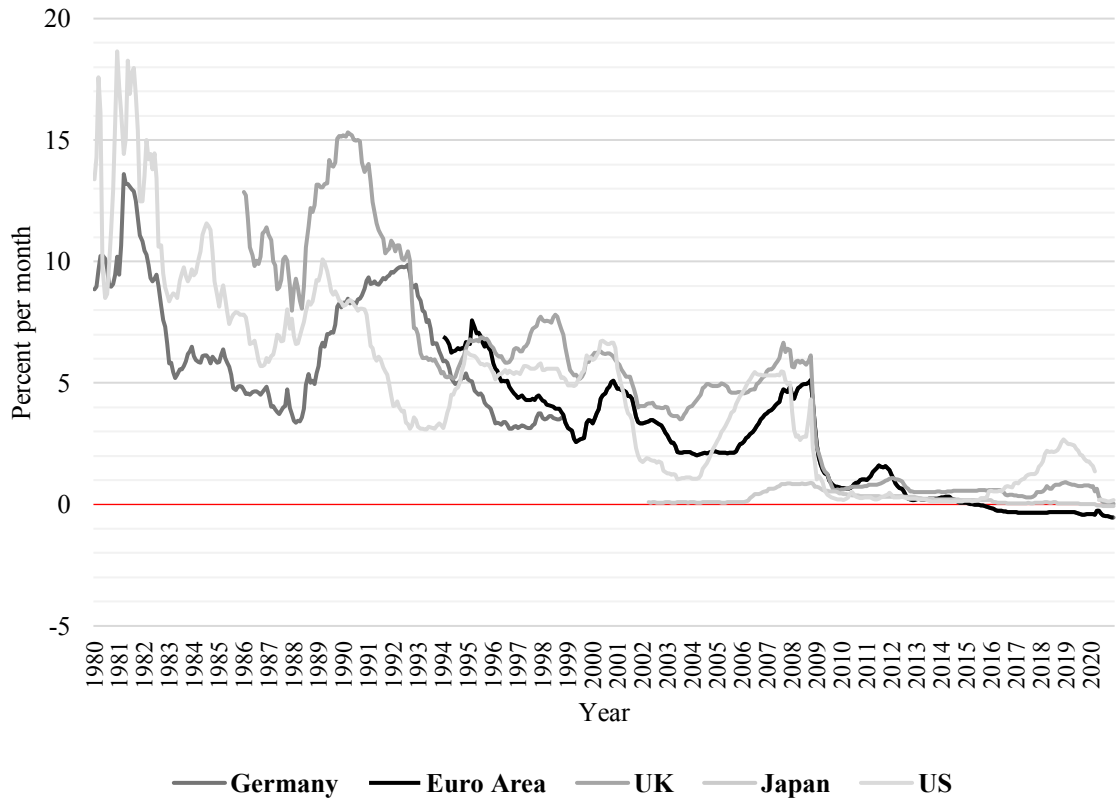
In the theoretical part, the Master's thesis will mainly rely on secondary data obtained by reviewing relevant literature found in academic articles, journals and books. This will help to define different aspects of an observed phenomenon, to provide systematisation and to conduct an analytical review of the topic at hand. With the aim of presenting the theory, the method of observation and description will be used.

In the empirical part, the necessary aggregated data will be extracted from Eurostat, Bank of Slovenia, SURS and OECD for the period 2005–2020 (if possible). The data will be further analysed using statistical softwares Excel and R. Descriptive analysis will help to substantiate the trends in household saving behaviour and the proxies of the determinants that have potentially contributed to it. The clustering technique will help to group similar Euro Area countries according to the main determinants of saving. In addition, bivariate analysis will help to identify relationships between saving behaviour and interest rates over time in the same countries used for clustering. For analysing households' saving behaviour developments in Slovenia, an analysis of time series will be used.

1 MACROECONOMIC ENVIRONMENT AND INTEREST RATES CONDITIONS

In advanced economies, the current macroeconomic climate is characterised by unusually low nominal interest rates. The global phenomenon of falling short[1]- and long[2]-term interest rates began in the mid-1980s (Figure 1 and Figure 2) and coincided with a decline in real interest rates, a substantial and sustained decline in inflation, and a period of low macroeconomic volatility (referred to as the 'Great Moderation'). The decline intensified with the onset of the global financial crisis. The slack in the economy and persistently low inflation rates contributed to further reductions in nominal interest rates as monetary policy became more accommodative in late 2008 and early 2009, including through unconventional measures. Even at long maturities, significant compression of risk premia and flight to safety pushed nominal interest rates into negative territory in some countries (ECB, 2017).

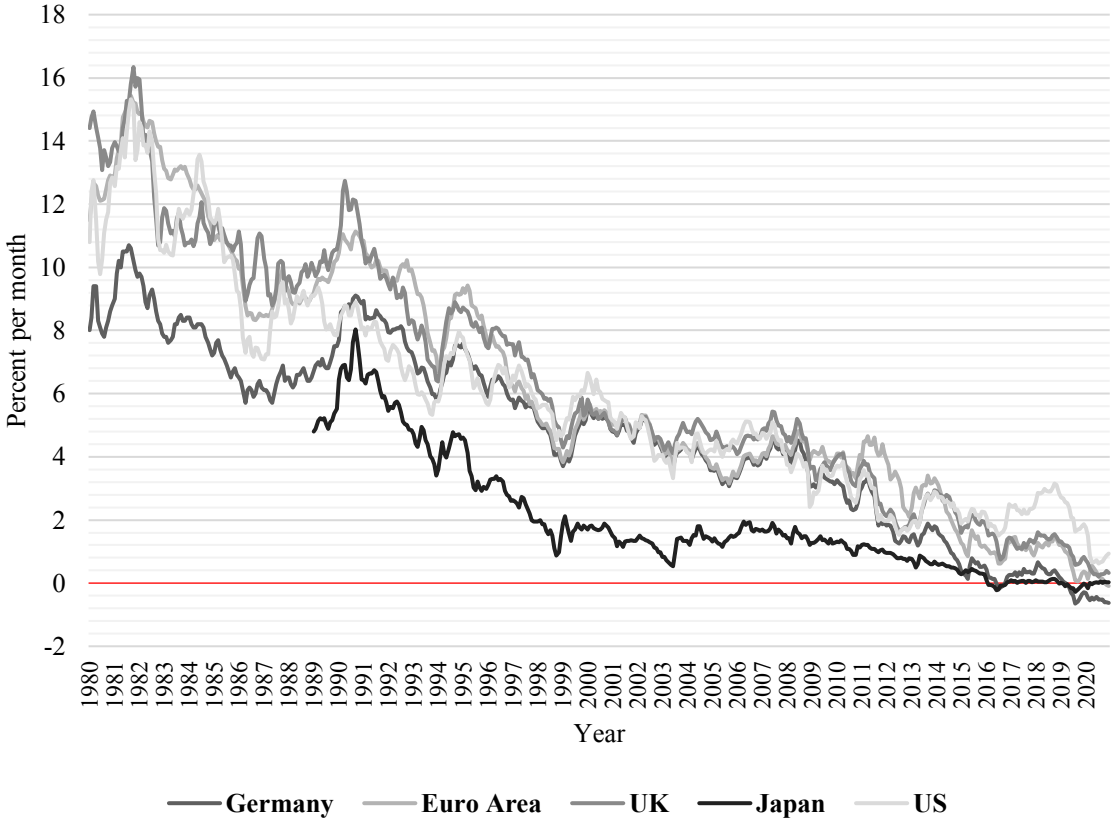
Figure 1: Short-term interest rates in Germany, Euro Area, UK, Japan and US, 1980–2020



Adapted from OECD (2021a).

[1]Short-term interest rates are the rates at which financial institutions borrow money for a short period of time or at which short-term government securities are issued and traded in the market (OECD, 2021a).
[2]Long-term interest rates apply to government bonds with a maturity of ten years (OECD, 2021b).

Figure 2: Long-term interest rates in Germany, Euro Area, UK, Japan and US, 1980–2020



Adapted from OECD (2021b).

Due to the consequences of the sovereign debt crisis and the new measures taken by the European Central Bank (ECB) to restore the proper functioning of the monetary policy transmission mechanism and provide further monetary policy accommodation when policy rates reached the effective lower bound (ELB), long-term interest rates in the Euro Area have fallen faster than in the United States since mid-2013. Short- and long-term interest rates fell, reducing the cost of funding for banks, non-financial firms, individuals and governments to historically low levels (ESRB, 2021).

Understanding why interest rates have fallen is critical for both monetary policy and financial stability. In normal times, when nominal and real interest rates are low, the presence of the ELB policy rate can constrain monetary policy and potentially reduce the central bank's ability to maintain price stability following a recessionary shock (Kiley & Roberts, 2017). The chance of achieving ELB policy rates is greater than previously thought because the real interest rate required to match the supply and demand for funds when output is at its potential, unemployment is at its natural level, and inflation is at the target level has fallen (Christensen & Rudebusch, 2017). Low nominal and real interest rates may also pose risks to financial stability by reducing the profitability and resilience of financial institutions, increasing the likelihood of bubbles, and potentially leading to excessive risk-taking by investors (ECB, 2017).

1.1 Causes of low interest rates

The concept of an equilibrium (or neutral) real interest rate, which is determined by long-run economic variables and is independent of monetary reasons, has been useful in studying the causes of low interest rates. The equilibrium interest rate is a common concept used by monetary authorities as a benchmark for assessing economic performance and making policy adjustments. In this sense, policymakers can be guided by the deviation of the real interest rate (current nominal interest rate minus projected future inflation) from its equilibrium value, while raising or lowering the short-term nominal interest rate (the interest rate that would be consistent with output at its potential level). Since the equilibrium interest rate is unobservable, it is usually calculated as the real risk-free rate at which economies can function at full employment on average, and is symbolised by r^* (ECB, 2016a).

Various demand and supply parameters have led to a structural imbalance between investment demand and savings supply at the global level, resulting in lower global equilibrium real interest rates (ESRB, 2021). The exact causes of such a decline are still under debate. There are a number of different factors that can affect the equilibrium interest rate. A growing literature addresses the question of whether this decline in r^* is related to the following factors:

- Demographic transition:

Demographic variables such as increasing life expectancy, an ageing society, and low population growth all contribute to a decrease in the real interest rate (Krueger & Ludwig, 2007). In order to meet retirement expenses, increased life expectancy requires a higher savings rate. As a result, desired savings should rise globally. Lower population growth slows the growth rate of the capital stock, which reduces the need for investment. Therefore, at the aggregate level, savings should grow faster than investment, putting downward pressure on real interest rates (Demary & Voigtländer, 2018).

- The secular stagnation phenomenon:

The economies of developed countries are unbalanced due to an increasing tendency to save and a decreasing tendency to invest. As a result of the imbalance between saving and investment, excessive saving acts as a drag on demand, which lowers growth and inflation, and real interest rates fall (Summers, 2016).

- The global savings glut theory:

Globalisation, especially trade and financial integration, has contributed to the formation of a global market in which national forces are gradually playing a lesser role. Financial integration implies that a larger share of global savings goes to cross-border investment financing. In this context, Bernanke (2005) posits the theory of the 'global savings glut', according to which the real interest rate falls to bring the global savings market into

equilibrium as desired savings exceed desired investment and savings from China and other emerging markets keep long-term interest rates low.

- The safe asset shortage hypothesis:

Caballero (2006) asserts that as a result of growing global demand, there is a 'shortage of safe assets', emphasising the limited supply of local safe assets in emerging markets with rapid development and large savings in their underdeveloped capital markets. As emerging economies move from being net borrowers to net lenders, demand for safe assets produced by advanced economies has increased, and risk-free interest rates have fallen as a result (Bernanke, 2005).

- Rising share of intangible assets:

Compared to tangible assets such as machinery and buildings, investments in intangible assets (e.g. IT) require lower capital expenditures. Firms that place a greater value on intangible capital save more money. A shift from tangible to intangible investment would cause desired investment growth to exceed desired savings at a slower rate, putting downward pressure on real interest rates (Demary & Voigtländer, 2018).

- Low degree of innovation and slow productivity growth:

In several developed countries, the level of innovation, as measured by the improvement in total factor productivity, is low. If this is the case, investment should be modest, as new machinery does not offer a significant advantage over existing machinery. Total factor productivity forecasts are difficult, although some advances such as information technology, biotechnology and new materials have the potential to improve it (Mokyr, 2014).

Some of these dynamics may reverse over time, especially if we experience a smoother recovery from the crisis and if public policies to address demographic trends and productivity growth are strengthened (e.g. the successful widespread adoption of artificial intelligence, innovations in automation, and increased infrastructure investment). At present, however, downward pressure on the equilibrium real interest rate is a significant constraint on the options available to central banks (ECB, 2020a). With weak growth and inflation in developed countries following the global financial crisis and a declining r^*, central banks are struggling with interest rates close to zero (Williams, 2015).

1.2 Negative interest rate policy

When conventional options for easing monetary policy were exhausted, central banks introduced negative interest rate policies (hereafter NIRP) against a background of low r^*. The Swedish central bank was the first to move one of its policy rates into negative territory in July 2009. The central banks of Denmark (July 2012), ECB (June 2014), Switzerland (January 2015) and Japan (February 2016) were the next to do so (Claeys, 2021).

The ECB introduced its NIRP in the Euro Area in June 2014, when the ECB Governing Council decided to lower the deposit facility rate (DFR) [3] – the key policy rate influencing market interest rates since the global financial crisis – below 0 percent to −0.1 percent for the first time, and has continued to fall gradually since then (Schnabel, 2020). NIRP has re-emerged as a result of the COVID-19 crisis, which occurred in an environment where many central banks lack conventional monetary policy space (Brandao-Marques, Casiraghi, Gelos, Kamber, & Meeks, 2021).

If NIRP becomes a frequent monetary policy tool, it is critical to understand precisely the impact of persistent negative interest rates on the economy. Central banks that have participated in this experiment are generally positive about the use of negative interest rates (Schnabel, 2020) when it comes to achieving their objectives (whether that objective is to bring inflation closer to target, as in the Euro Area, or to reduce unemployment, as in Sweden, or to stabilise the exchange rate, as in Switzerland and Denmark). NIRP, on the other hand, is divisive and has been shown to have significant negative consequences, especially for the banking sector. This is why the US Federal Reserve and the Bank of England (BoE) have refrained from adopting NIRP, even though they have gone through the same crises as the countries that have applied it. The reason is that the effects of NIRP could be different from those of traditional interest rate cuts in positive territory, and the net effect could be more ambiguous due to various frictions in the economy such as the presence of cash yielding a nominal interest rate of 0 percent, cognitive biases of investors and households, and financial and legal constraints (Claeys, 2021).

NIRP is expected to provide significant monetary accommodation and increase aggregate demand. NIRP stimulates economic activity and inflation in the same way as traditional interest rate cuts. However, compared to interest rate cuts above zero, NIRP can lead to discontinuities in the behaviour of households, firms, and financial intermediaries, with different consequences (Brandao-Marques et al., 2021).

Some banks in certain European countries have already introduced fees or negative interest rates, while others are considering doing so. While some banks are responding to even lower ECB interest rates by introducing negative interest rates, others are responding by introducing various fees or charges. Initially, banks introduced negative interest rates or charges only on corporate deposits, while more and more banks have recently decided to introduce them on household deposits as well. Banks opt to introduce negative interest rates or levies for larger savers or those customers whose account amount exceeds a pre-determined value. Negative interest rates or levies have already been introduced in the Euro

[3] The DFR is one of the three interest rates set by the ECB every six weeks as part of its monetary policy. The rate determines the amount of interest banks receive on overnight deposits with the central bank. The rate on main refinancing operations (MRO) and the rate on the marginal lending facility are two other important interest rates. The MRO rate is the rate at which banks can borrow money from the central bank for a week. If banks need money immediately, they can borrow from the marginal lending facility at a higher rate (ECB, 2016b).

Area or will soon be introduced by some banks in Germany, Italy, Luxembourg and the Netherlands. In addition to the countries that are part of the common currency area, they have also appeared in Denmark and Switzerland. In addition to the Euro Area, the central bank interest rate is also negative in Switzerland, Denmark, Sweden and Hungary. According to the latest publicly available data, about 20 percent of all corporate deposits and about 5 percent of all household deposits in the Euro Area received negative interest rates in 2019 (Bank of Slovenia, 2020).

1.3 Interest rate pass-through

When analysing low or negative policy rates, one of the most important issues to consider is how they translate to other interest rates that matter in the economy as a whole. The interest rate commercial banks charge for loans (referred to as the 'lending rate') and the interest rate commercial banks pay their customers for deposits (referred to as the 'deposit rate') are two examples of such interest rates. The pass-through of the policy rate to the lending and deposit rates is a critical component in determining the effectiveness of a cut in the policy rate in the low or negative range (Ulate, 2020).

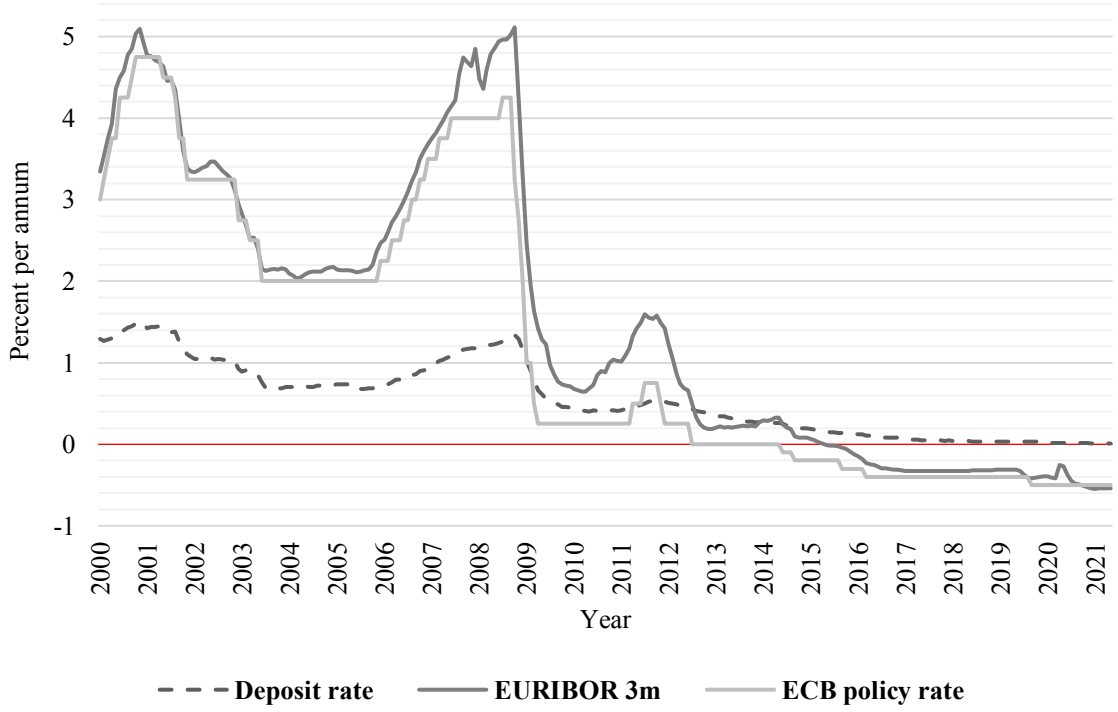
The practice of passing on retail bank interest rates is an essential link in the transmission of monetary policy. Central banks have a strong influence on the money market situation and consequently money market interest rates are influenced by them. Changes in money market interest rates affect long-term market interest rates and retail interest rates of banks to varying degrees. Banks' decisions on the yields on their assets and liabilities affect the spending and investment behaviour of depositors and borrowers, and hence actual economic activity. In other words, monetary policy transmission is reinforced by a faster and more complete pass-through of official and market interest rates to interest rates in banks' customer business. Furthermore, bank pricing affects bank profitability, which in turn affects the soundness of the banking system and financial stability, which in turn may affect economic development (De Bondt, 2002).

Policy rate cuts into negative territory are unique in that, unlike rate cuts above zero, they do not affect all short-term rates equally. Lower, negative policy rates lead to lower, negative short-term debt market rates (e.g. interbank market rates), but not to lower, negative retail deposit rates. While banks are willing to decrease retail deposit rates when rates are positive, they are hesitant, and often powerless, to charge negative deposit rates when rates are negative (ECB, 2021a). Drechsler, Savov and Schnabl (2017) have found that the pass-through of the policy rate to deposit rates is positive but incomplete (say between 0.5 and 0.8) in normal times, and roughly zero in negative teritory (Eisenschmidt & Smets, 2019).

Figure 3 depicts the Euro Area's uneven transmission of negative policy rates to deposit and short-term market rates. Between January 2000 and May 2021, it displays the ECB's main

policy rate[4], the 3-month Euribor (a benchmark for the market rate on unsecured short-term debt), and the average rate on overnight household and business deposits at Euro Area banks. As long as the policy rate is in positive territory, both deposit rates and the 3-month Euribor move in tandem with the policy rate. When the policy rate is lowered below zero in June 2014, the paths of the 3-month Euribor and the deposit rate diverge: the 3-month Euribor decreases in line with the lower policy rate, while the deposit rate remains fairly stable.

Figure 3: Deposit rate, 3-month EURIBOR and ECB policy rate, January 2000 – May 2021



Adapted from ECB (2021b).

Potential explanations for the occurrence of a zero lower bound on retail deposits include the existence of banknotes that provide a method for avoiding negative deposit rates, as well as the low switching costs of households that hold relatively minor savings. Banks are hesitant to decrease retail deposit rates to zero because of competition in the deposit market, the regulatory and commercial importance of deposits owing to their stickiness, and the expenses associated with transitioning to a different business or funding strategy (ECB, 2021c). The real costs of keeping cash rather than deposits influence the stickiness of deposit rates; under these conditions, demand for cash is anticipated to be largest for economic

[4] Until September 2008, the ECB's main policy rate was the MRO rate and, from October 2008, it was the DFR. In that month, the ECB moved to a full allotment with a fixed rate, making the DFR the main policy rate (ECB, 2021a).

agents with significant surplus liquidity and increases if negative interest rates are projected to remain for some time (IMF, 2016).

2 IMPORTANCE OF RETURNS FOR HOUSEHOLDS' SAVING BEHAVIOUR

Anyone with financial assets pays the price for ultra-low interest rates by foregoing the typical return on those assets. Interest rates, according to economic theory, can influence both the amount and structure of savings. While the effect of interest rates on savings is widely thought to be positive, estimating the eventual effect is extremely challenging. In theory, three effects shape the relationship between interest rates and savings levels: *the income effect, the substitution effect, and the wealth effect*. Each of these has a different effect on savings. If interest rates fall, savers will initially receive less income from their savings than expected (a phenomenon known as the income effect), compelling them to save more and consume less today in order to maintain future consumption at the formerly targeted level. Simultaneously, a fall in interest rates might boost present consumption at the expense of future consumption (a phenomenom known as substitution effect). This is because, while households are effectively foregoing less money than previously, the decreased income from saving makes current consumption less expensive. As a result, current income is increasingly directed toward current consumption, reducing savings. A wealth effect is also present, depending on the amount of wealth in a household. Interest rate reductions raise the prices of a household's securities holdings, theoretically boosting the household's spending alternatives. At least, this is the case as long as the price increases are unexpected and believed to be long-term. As a result, the substitution and wealth effects cancel out the income effect. The elasticity of interest rates and the return elasticity of saving are thus determined by which of these effects is prominent (Elmendorf, 1996).

A low-interest rate environment might discourage savings due to substitution effect, but it can also stimulate it due to the income effect, since households may attempt to mitigate the low interest rate by increasing their savings. In addition, when examining the interest rate-savings link, real returns are preferable since they capture the wealth effect by accounting for inflation risk on purchasing power of households (Georgievska, 2020).

Lower interest-rate monetary policy, in theory, is designed to boost present-day consumption, rather than future consumption, by lessening the incentives for deferring consumption. Simply put, lowering the policy interest rate will encourage people to spend and invest while discouraging them from saving. Negative interest rates, which are expected to be implemented as a harsher measure, will not only discourage but also penalise consumers who delay consumption. As a result, negative interest rates may encourage consumers to spend now rather than later, dissuading them from saving (Aizenman, Cheung, & Ito, 2016).

For savers, zero is a significant psychological obstacle. According to an ING (2015) survey of 13,000 bank clients in Europe, the United States, and Australia, roughly 77 percent of respondents would liquidate their accounts if interest rates fell below zero, with considerable variances between nations. The authors relate this to the behavioural idea of 'loss regret', which states that people regret losses twice as much as they regret gains of the same amount. As a result, lowering the interest rate from 0 to −0.5 percent hurts substantially more than lowering it from +1.0 to +0.5 percent. Around half of respondents in some nations answered that they would rather hoard cash than pay negative interest rates. However, the NIRP, which has been in place for seven years, may cause a habituation effect[5], lowering customer resistance over time (European Parliament, 2021).

Another element influenced by interest rates, according to economic theory, is the structure of saving, or investment behaviour. In a low-interest-rate environment, households may be enticed to lengthen the term structure of their portfolios or shift assets to higher-risk, higher-return instruments. However, when looking at household savings, it is crucial to remember that interest rates are a big factor, but they are not the only one. There are various additional factors that might conceivably influence how much and in what form households save (Georgievska, 2020).

Trends in households' disposable income, the level of financial development and the availability of diverse saving instruments, the institutional frameworks, notably the tax and social security systems, as well as demographics and the extent to which the population is financially literate are all important determinants behind households' decisions to save. Households' attitude to risk and their liquidity preferences also seem to influence behaviour (see Chapter 3.3 Determinants of Saving). The low interest rate environment is unlikely to have changed this in any substantial way, with household savings continuing to grow post-crisis despite the subdued returns (Georgievska, 2020).

3 FACTORS DRIVING HOUSEHOLD SAVINGS

Households play a variety of important roles in the economy, including as consumers of final goods and services, as labor providers and recipients of labor income, as owners of unincorporated businesses, and as a source of savings to fund fixed asset investment. What is known as the "household saving rate" summarizes their consumption and saving behaviour (Harvey, 2004). Because of institutional, demographic, and socio-economic variables, household saving rates vary greatly between countries. Individuals' decisions on whether to spend or save are influenced by the availability and cost of credit, as well as their views towards debt (OECD, 2011).

[5] A decrease in response to a stimulus after repeated presentation is called a habituation effect (Cherry, 2020).

Academic economists and policymakers alike consider saving to be a critical issue. While saving is an important instrument for individuals to attain their objectives and enhance their financial well-being, the supply of resources is an important source of investment funding and a factor that influences a country's macroeconomic performance (Attanasio & Banks, 2001).

3.1 Household saving and saving rate definition

Household saving is calculated in national accounts by subtracting household consumption expenditure from disposable income plus the change in household net equity in pension funds (since this component is also a determinant of household disposable income but with an opposite sign). Household disposable income is mostly comprised of earnings from work and unincorporated business operations, as well as interest, dividends, and social benefits, less payments of current taxes, interest, and social contributions. It is worth noting that firm income includes imputed rents 'paid' by home owners. Household consumption expenditure includes cash outlays for consumer goods and services, as well as imputed expenditures that owner occupiers pay to themselves as owners of their dwellings and the production of goods for own-final use, such as agricultural products – the values of which are also included in income (OECD, 2011).

The household saving rate can be defined in a variety of ways, and the definition used is important in determining how household savings trends vary, together with what motivates people to save. Poterba (2002) defines household saving in two ways. According to the first definition, household saving is calculated by subtracting the flow of expenditures from the flow of income during a specified time period. According to the second definition, household saving is defined as changes in household net wealth over time, which equals the first definition plus any capital gain or loss on existing assets over a specified time period. Such capital gains and losses frequently account for more than the saving flow of income minus spending over a given period. Due to the difficulty of assessing capital gains and losses, most previous studies on household saving behaviour have avoided using the second definition. As a result, most studies depend on the first definition (often with the modification to include pension fund reserves) (Ögren, 2018).

Saving rates can be calculated on a net or gross basis. In this Master's thesis, the gross household saving rate will be used. The gross saving rate of households is calculated by dividing gross savings by gross disposable income, with the latter adjusted for changes in households' net equity in pension fund reserves. The portion of gross disposable income that is not spent on final consumption expenditure is referred to as gross saving. The indicator described is calculated using data from institutional sectors' quarterly sector accounts. All households, household firms, and Non-Profit Institutions Serving Households (NPISH) are included in the household sector (Rocher & Stierle, 2015).

3.2 Motives for savings

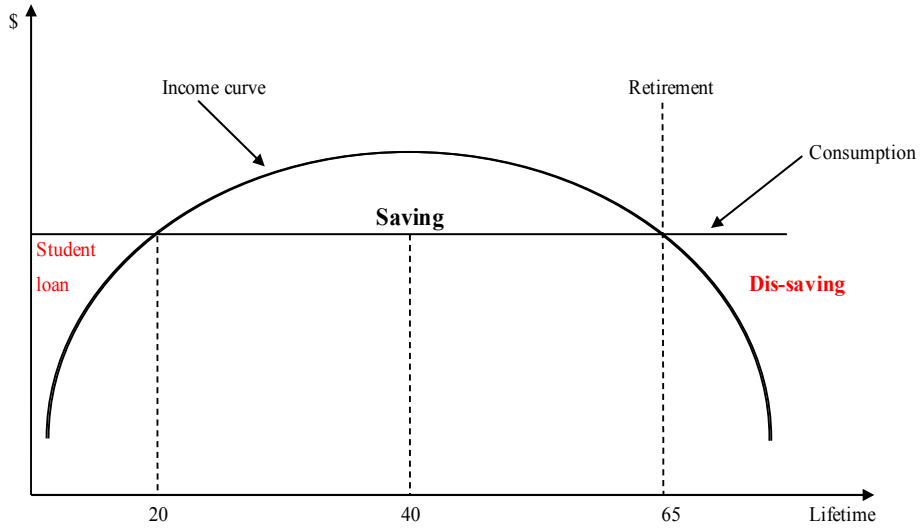
The theoretical literature suggests a variety of motives for household saving. In broad terms, these motives can be grouped into two categories: to smooth the availability of financial resources over time to maintain a more stable consumption profile (life-cycle hypothesis and permanent income hypothesis) and to finance unexpected losses of income (precautionary savings motive).

3.2.1 The life-cycle hypothesis

The life-cycle hypothesis was proposed by Modigliani and Brumberg in the early 1950s. According to the life-cycle hypothesis, an individual's and household's lifetime income will vary over the course of their lives. This is predicated on the premise that people make informed decisions about how much they want to spend at each stage of their lives, limited only by the resources available to them over their lifetime. It is expected that an increase in lifetime resources leads to a commensurate rise in consumption across all life stages for each individual. As a result, consumption is proportional to lifetime resources or, to put it another way, to average lifetime income (Deaton, 2005). One of the most significant ramifications of the life-cycle hypothesis is that people can isolate consumption from income, meaning that consumption is unaffected by the timing of the income (Bérubé & Coté, 2000).

The life-cycle hypothesis consists of three stages (Figure 4). Individual and household consumption follow a fairly predictable pattern in the life-cycle hypothesis model. Individuals in their early years of professional life, as young adults, are inexperienced, relatively unproductive, and so make lesser earnings. As a young adult approaches middle age, his or her salary rises in tandem with his or her level of experience and productivity. As people reach retirement age, their salaries begin to decline once more. According to this notion, consumption patterns will not vary significantly over the course of a person's life, which leads to the inference that households aim to smooth their consumption throughout the course of their lives. When a household's income is low and its spending exceeds its income, the household is obliged to borrow to meet its needs. Individuals in latter phases of their careers pay off their debt and begin investing for retirement. It is at this time that households pay off debt accumulated previously, as well as plan for future consumption in the event that there is no revenue source to fund it (Carlin & Soskice, 2006).

Figure 4: Life-cycle hypothesis



Source: Own work.

While the life-cycle hypothesis has faced numerous challenges over the years, it remains an important part of economists' toolkits because it helps us to think about issues like private and public social security, the effects of demographic change on national saving, and the role of saving in economic growth. The life-cycle hypothesis of saving is occasionally questioned as to whether it is still empirically validated. It has been criticized in several ways. Despite the fact that the theory's applications have evolved, the life-cycle hypothesis remains the framework within which economists think about intertemporal difficulties at both individual and macroeconomic levels (Deaton, 2005).

3.2.2 The permanent income hypothesis

The Friedman's (1957) permanent income hypothesis follows the logic of the life-cycle hypothesis, namely, that consumption should not be solely dependent on current income. It stems from the basic premise that people would want to smooth their consumption rather than have it fluctuate with short-term income variations. Genuinely, the model was created to provide a cohesive framework for explaining crucial scientific data. For example to answer the following question: why is income more volatile than consumption, and why is the long-run marginal propensity to consume out of income larger than the short-run marginal propensity? Friedman theorised that consumers base their consumption on a longer-term view of an income metric, such as a notion of lifetime wealth or wealth over a sufficiently long horizon, to address these concerns. Individuals consume a fraction of their

permanent income in each period, therefore, the average propensity to consume[6] equals the marginal propensity to consume[7]. The propensity itself could be affected by a variety of things, such as interest rates and taste shifter variables, or it could simply reflect uncertainty (Meghir, 2004).

Unlike the life-cycle hypothesis, which assumes that income follows a predictable pattern throughout one's life, the permanent income hypothesis highlights that people's income fluctuates randomly and infrequently from year to year. Friedman separates income into two categories: permanent income and transitory income. Permanent income is defined as income that people expect to continue in the future. Transitory income is defined as income that people do not expect to continue in the future. Simply said, permanent income is average income, while transitory income is income that differs from it. Because people save and borrow to smooth consumption in reaction to temporary changes in income, Friedman suggested that consumption should be based mostly on permanent income (Mankiw, 2007).

If income shocks are permanent, then all future levels of income will be updated by the same amount, resulting in a change in consumption equal to the change in present income. The fact that the consumption plan is independent of the transitory components is crucial (Meghir, 2004).

The vague notion of permanent income makes it difficult to measure, which is a flaw in the theory. The permanent income hypothesis, however, has lasted because, despite its easy intuitive appeal, it concentrates on intertemporal optimisation of consumer behaviour, which is logical and consistent (Meghir, 2004).

3.2.3 Precautionary savings motive

Households are incentivised to save money for two reasons: to cover expenses after retirement or other anticipated life events. As previously stated, with a consistent rate of consumption throughout the life-cycle. The other main purpose for saving is to protect the family from unforeseen shocks that occur throughout the course of their lives. Several sources of risk influence the household throughout its life-cycle, and it is difficult to avoid these risks that could result in income loss. Such as deteriorating health, unemployment, or other unforeseen living expenses that have an impact on a household's standard of living. It's much more difficult to prepare for external hazards, such as a national or global economic crisis, over which the household has no control. Therefore, the scenario of how household spending and saving are conducted vary as the uncertainty of future income increases.

[6] The average propensity to consume (APC) is a measure that assesses how much of one's income is spent rather than saved.
[7] The increased consumption that resilts from an increase in income is referred to as marginal propensity to consume (MPC).

Households will, therefore, accumulate wealth buffers in order to mitigate the impact of such risks and unexpected events (Mody, Ohnsorge, & Sandri, 2012).

Leland (1968) discusses a two-period consumption model, similar to the life-cycle model. It is reasonable to believe that uncertainty about the future has influenced private savings behaviour. If people want to maintain a consistent flow of spending throughout their lives but do not know how much money they will make, they will alter their savings to match their expectations for real income. Consider the two-period scenario, in which the household income for the first period is known but the income for the second period is uncertain. When households calculate their first-period savings (before knowing their second-period income), their first-period savings are based on their predicted second-period income. Agents with a more optimistic outlook will reduce their savings, while those with a more pessimistic outlook will increase their savings. Furthermore, he demonstrates that, given risk aversion assumptions, increased uncertainty increases savings; consumers prefer to increase savings in the first period rather than reduce consumption in the second period.

To understand what factors influence the amount of precautionary savings, one must first analyse household risk aversion. As risk aversion grows, the household accumulates more assets as a safety net. Changing risk aversion is a key factor in explaining the disparities in behaviour amongst households. Although risk aversion influences how much of a precautionary savings buffer households accumulate in the event of unforeseen circumstances, the size of this buffer is determined by how households view their future income and costs. If households want to maintain steady consumption throughout their lives but lack information about future risks and income, their savings will shift to match their income and expenditure expectations (Cagetti, 2003).

3.3 Determinants of saving

Besides interest rates, there are other factors that might influence household saving behaviour. Given both the theoretical and empirical discussion, they can be categorised in four groups: uncertainty (proxy: unemployment and inflation), income and wealth (proxy: GDP per capita), demographics (proxy: old-age dependency) and fiscal policy (proxy: government debt).

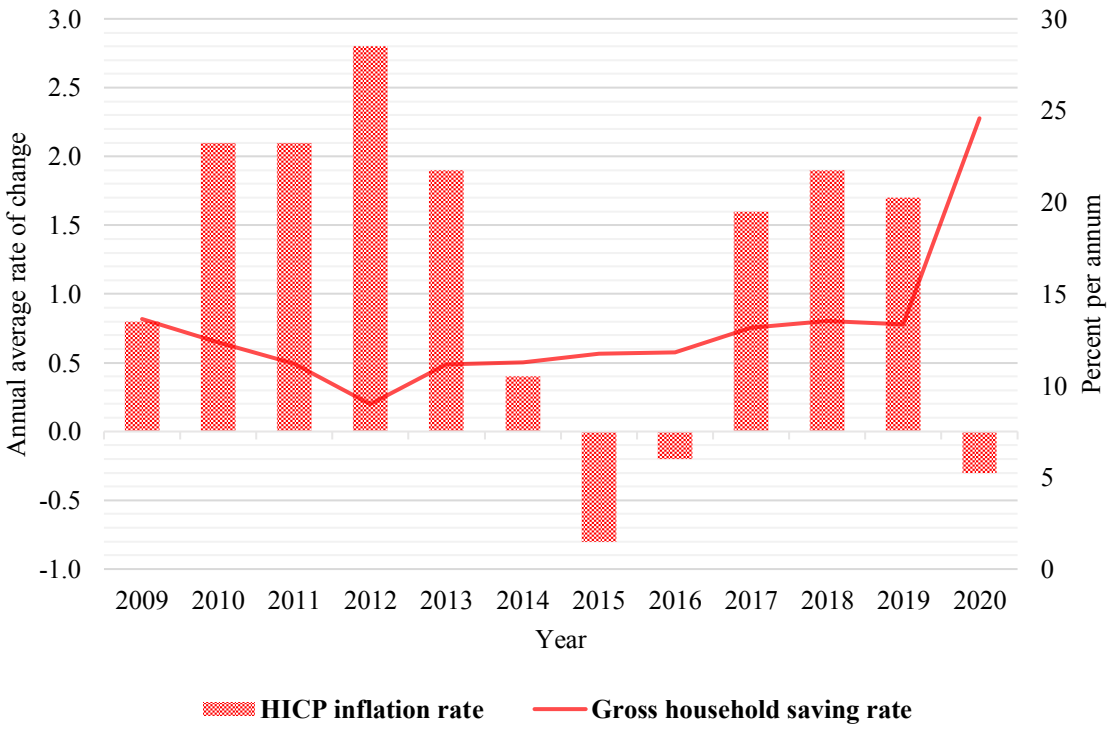
3.3.1 Uncertainty

Uncertainty about future earnings and economic stability motivates households to save (Mody et al., 2021). When people anticipate bad times, they prefer to save more as a precaution. The most often used proxies to measure economic uncertainty are unemployment and inflation (Ögren, 2018).

Inflation fosters a sense of dread and pessimism about the future, which is hypothesised to encourage people to save. As a result, higher inflation variance is likely to be positively associated with household savings. However, when evaluating estimation results, caution is advised because inflation can have a direct impact on consumption and saving (e.g. due to money illusion) (Howard, 1978).

Figure 5 depicts Harmonised Index of Consumer Prices (HICP) inflation rate and the gross saving rate of households in Slovenia. It can be observed that the HICP inflation rate increased in the period from 2009 to 2012, while the gross household savings rate decreased. In 2013 and 2014, both the HICP inflation rate and the household saving rate increased. In 2015 and 2016, the HICP inflation rate declined while the gross household saving rate continued to increase. In the period from 2017 to 2019, both the HICP inflation rate and the household saving rate increased.

Figure 5: HICP inflation rate (left axis) and gross household saving rate (right axis), Slovenia, 2009–2020

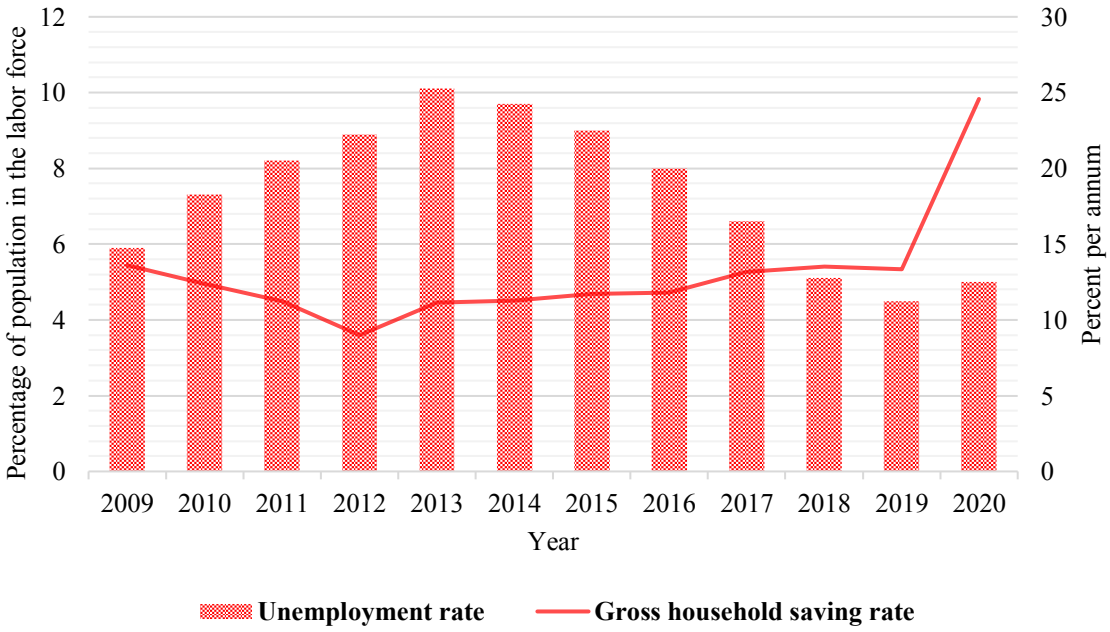


Adapted from Eurostat (2021).

Unemployment has an uncertain effect on household savings. Higher unemployment reduces household disposable income, reducing the ability of households to save. Increased unemployment, on the other hand, brings with it increased uncertainty, which may tempt households to increase their precautionary savings, at least temporarily (ECB, 2009).

Figure 6 depicts the gross saving rate and unemployment rate in Slovenia. It can be observed that the unemployment rate and the household saving rate moved in the opposite direction from 2009 to 2012, possibly indicating lower household disposable income that prevented households from saving. Household saving started to increase in 2013, when the unemployment rate peaked. Since then, unemployment has fallen dramatically year on year, while the household saving rate has risen only marginally (the exception being 2020).

Figure 6: Unemployment rate[8] (left axis) and gross household saving rate (right axis), Slovenia, 2009–2020



Adapted from Eurostat (2021).

3.3.2 Income and wealth

The household's economic position is included in the majority of the determining factors. The way households and people behave is influenced by their income level, as they are reliant on the economy to maintain their standard of living. As a result, significant changes in income are likely to affect people's saving habits (Ögren, 2018).

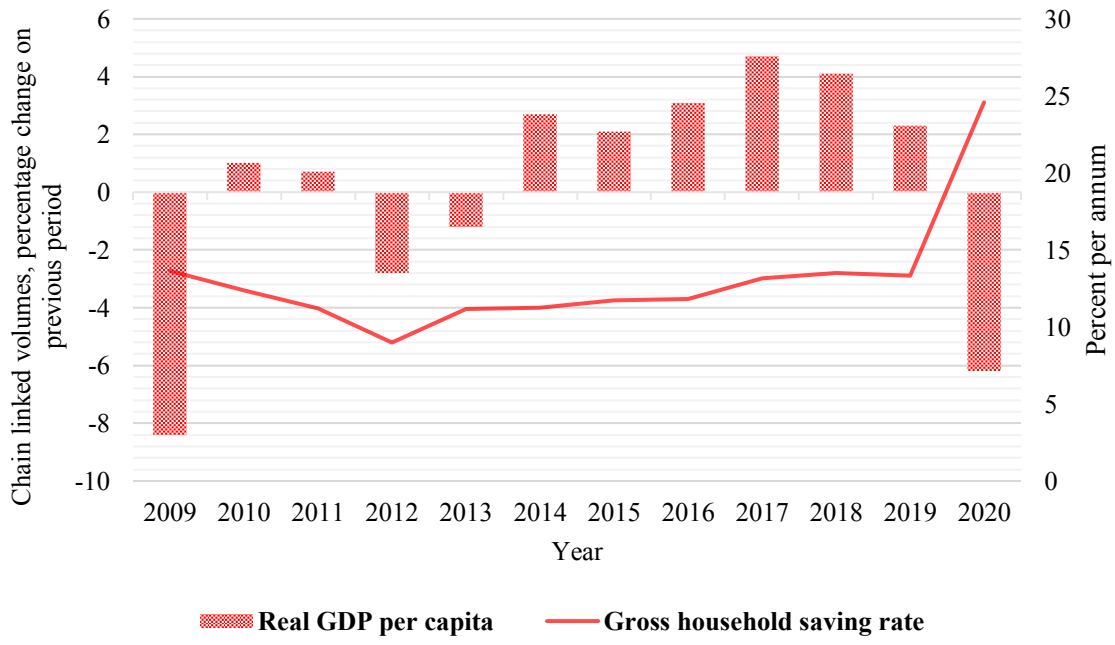
The 'income effect' predicts that the saving rate will grow as income rises. The marginal propensity to save is the percentage of an additional euro in disposable income that is saved. There is strong evidence that as disposable income rises so does the marginal propensity to save. All other things being equal, the 'wealth effect' predicts that wealthier people spend

[8] Unemployment rate is shown as percentage of population in the labor force, in the age class from 15 to 75 years.

more and save less of their income. Wealth can act as a buffer, encouraging people to spend more of their earnings. As a result, higher-income households have lower savings rates. However, because saving leads to wealth accumulation, there is an uncertain causal relationship (ECB, 2009).

The level of GDP per capita and the growth rate of GDP per capita are taken as potential explanatory variables. Figure 7 depicts the gross household saving rate and growth rate of real GDP per capita in Slovenia. In 2009, real GDP per capita deteriorated dramatically. In 2010 and 2011 there was a slight improvement in real GDP per capita, however, gross household saving rate has been on a downward trend. In 2012, we can observe dips in both variables. Since then, the gross household saving rate has been on an upward trend, while real GDP per capita decreased in 2013 and only after that started to improve (with exception of 2020).

Figure 7: Growth in real GDP per capita (left axis) and gross household saving rate (right axis), Slovenia, 2009–2020



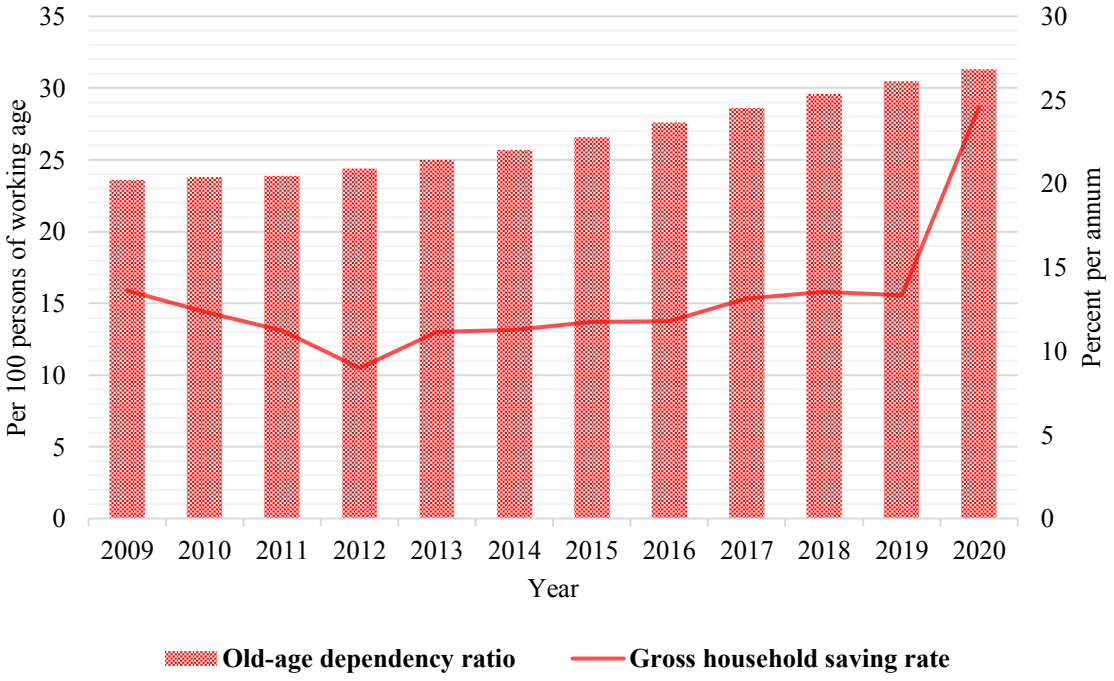
Adapted from Eurostat (2021).

3.3.3 Demographics

According to the life-cycle hypothesis, an individual's saving rate is hump-shaped across their lifetime. Young people tend to save little, working-age people prefer to save a lot, and elderly people tend to dis-save due to consumption smoothing over time (Chapter 3.2.1 Life-cycle hypothesis). As a result, countries with a high level of age dependency are projected to have a lower rate of aggregate household saving (Loayza, Schmidt-Hebbel, & Servén, 2000).

Therefore, old-age dependency ratio[9] is considered as a potential determinant of household saving. Figure 8 depicts old-age dependency ratio and gross household saving rates in Slovenia. It can be observed that both variables are on slightly upward trend since 2012.

Figure 8: Old-age dependency ratio (left axis) and gross household saving rate (right axis), Slovenia, 2009–2020



Adapted from Eurostat (2021).

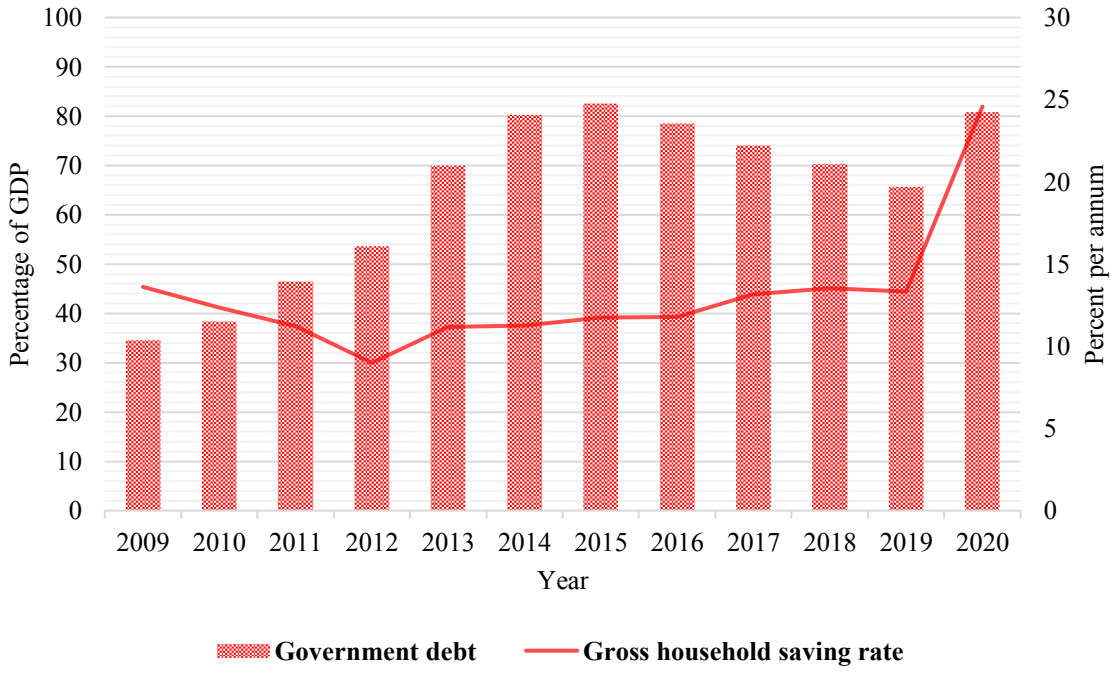
3.3.4 Fiscal policy

Active fiscal policies aimed at encouraging consumption might have a detrimental impact on the saving rate. The government can increase government expenditure and run a budget deficit to boost national consumption and stimulate the economy. However, if individuals anticipate future tax rises to finance government debt, this could depress current household consumption. A decline in predicted future income will depress present consumption and raise current household savings due to consumption smoothing. The Ricardian equivalence hypothesis states that lower household consumption can entirely balance the effect of greater government spending on aggregate demand. As a result, it is projected that public and private saving will move in opposite directions (ECB, 2009).

[9] This indicator is calculated using the ratio of persons aged 65 and over (the age at which they are normally economically inactive) to persons aged 15–64. The value is given in relation to 100 persons of working age (15–64).

The fiscal policy of countries is measured by government surplus in percentage of GDP and the level of public debt in percentage of GDP. Figure 9 depicts government debt as the percentage of GDP and gross household saving rates in Slovenia. During the observed period no specific association between the two can be observed, with the exception of 2020.

Figure 9: Gross government debt as percentage of GDP (left axis) and gross household saving rate (right axis), Slovenia, 2009–2020



Adapted from Eurostat (2021).

4 ANALYSIS OF SIMILARITIES BETWEEN EURO AREA HOUSEHOLDS' SAVING BEHAVIOUR AND ITS DETERMINANTS

The clustering technique was used to analyse the extent to which Euro Area countries differ or are similar in terms of the savings determinants. Clustering was carried out using R statistical software (R-project, 2021) – the exact steps of the analysis are provided in Appendix 1.

The following 16 Euro Area countries were analysed: Belgium, Germany, Ireland, Spain, France, Italy, Cyprus, Latvia, Lithuania, Luxembourg, the Netherlands, Austria, Portugal, Slovenia, Slovakia and Finland. Due to missing data, Estonia and Malta were excluded from the analysis. Data on the HICP inflation rate and the real long-term interest rate were not available for Estonia, while data on the savings rate were not available for Malta. In addition,

Greece was excluded due to its uniqueness (e.g. extremely high government debt and interest rate).

The following five variables were used for the analysis:

- Government debt: general government gross debt as a percentage of GDP
- Inflation rate: HICP inflation rate, average annual rate of change
- Interest rate: long-term interest rate, percent per annum
- Old-age-dependency ratio: persons aged 65 or more relative to the persons aged between 15 and 64, value per 100 persons of working age (15–65 years)
- Unemployment rate: unemployment rate as a percentage of population in the labor force

Chapter 3 also mentioned real GDP per capita as an indicator of income and wealth. However, in the absence of volume data, this variable was excluded from the analysis.

For the analysis, I took the average values of the above variables over the period of 2009 to 2019. The data used for clustering can be seen in Table 1.

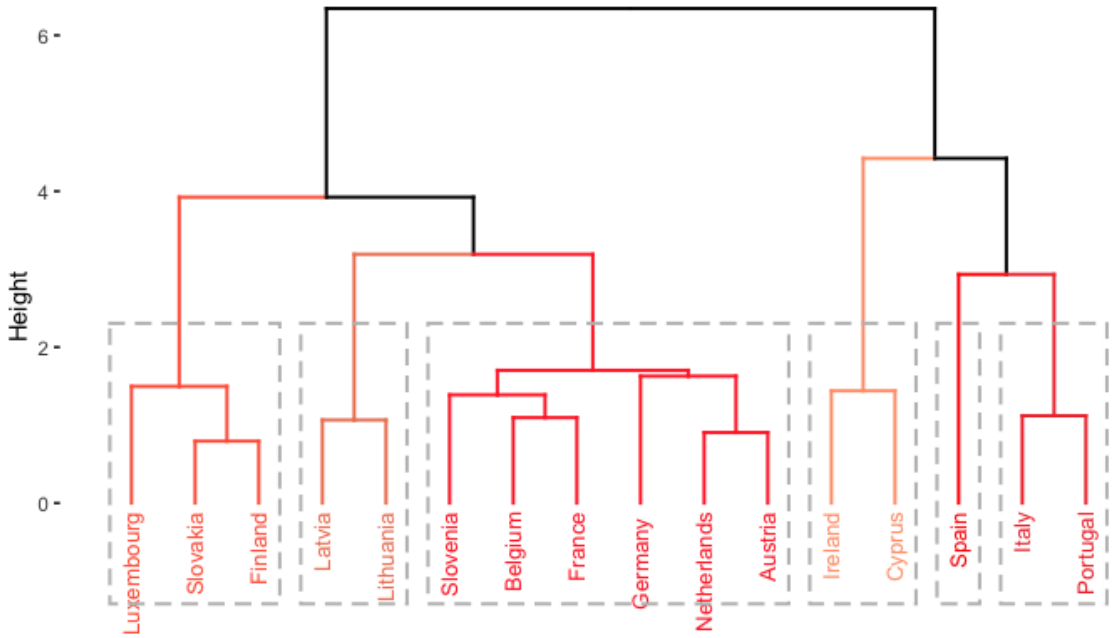
Table 1: Data used for clustering

Country	Government debt	Inflation rate	Interest rate	Old-age-dependency	Unemployment rate	Saving rate
Belgium	102.9	1.6	0.3	27.5	7.5	13.8
Germany	72.7	1.3	−0.1	31.9	5.0	17.5
Ireland	85.5	0.2	3.1	19.0	10.9	10.9
Greece	170.3	0.8	8.3	31.5	20.5	−2.9
Spain	87.0	1.1	2.0	27.0	20.3	7.6
France	93.0	1.2	0.6	28.5	9.6	14.5
Italy	129.4	1.2	2.1	33.2	10.5	10.7
Cyprus	87.9	0.8	3.6	20.3	10.7	2.6
Latvia	40.3	1.6	2.3	28.9	12.1	4.0
Lithuania	37.4	2.0	1.5	27.8	10.9	2.8
Luxembourg	21.0	1.6	−0.1	20.5	5.5	20.3
Netherlands	60.4	1.5	0.1	26.1	5.4	15.9
Austria	80.3	1.8	−0.1	27.0	5.2	13.6
Portugal	120.3	1.0	3.7	30.4	11.5	8.2
Slovenia	63.1	1.3	1.7	26.3	7.6	12.0
Slovakia	48.6	1.5	0.9	19.5	11.2	8.3
Finland	55.8	1.5	0.1	20.0	8.2	8.0

Adapted from Eurostat (2021).

Hopkins statistics was higher than 0.5 (H=0.538), indicating that we have a clusterable data set. Analysis of the above-mentioned data reveals that the optimal number of clusters is 6. Figure 10 depicts a dendrogram showing which country belongs to which cluster. We can observe that Luxembourg, Slovakia and Finland form cluster 1; Latvia and Lithuania form cluster 2; Slovenia, Belgium, France, Germany, the Netherlands and Austria form cluster 3; Ireland and Cyprus form cluster 4; Spain is alone in cluster 5; and Italy and Portugal form cluster 6.

Figure 10: Cluster dendrogram



Source: Own work.

The between clusters sum of square is 84.8 percent, indicating highly distinct clusters of countries. In addition, analysis of variance (ANOVA) shows that all clustering variables are highly statistically significant ($p < 0.05$) and, therefore, all differ between clusters.

It is important to note, however, that not all potential determinants were included in the analysis. The result and, thus, the clusters of countries, could be significantly different if we took all potential determinants into account.

The arithmetic means of the savings determinants and the savings rate can be seen in Table 2.

Table 2: Summary of determinants' arithmetic means – clustering

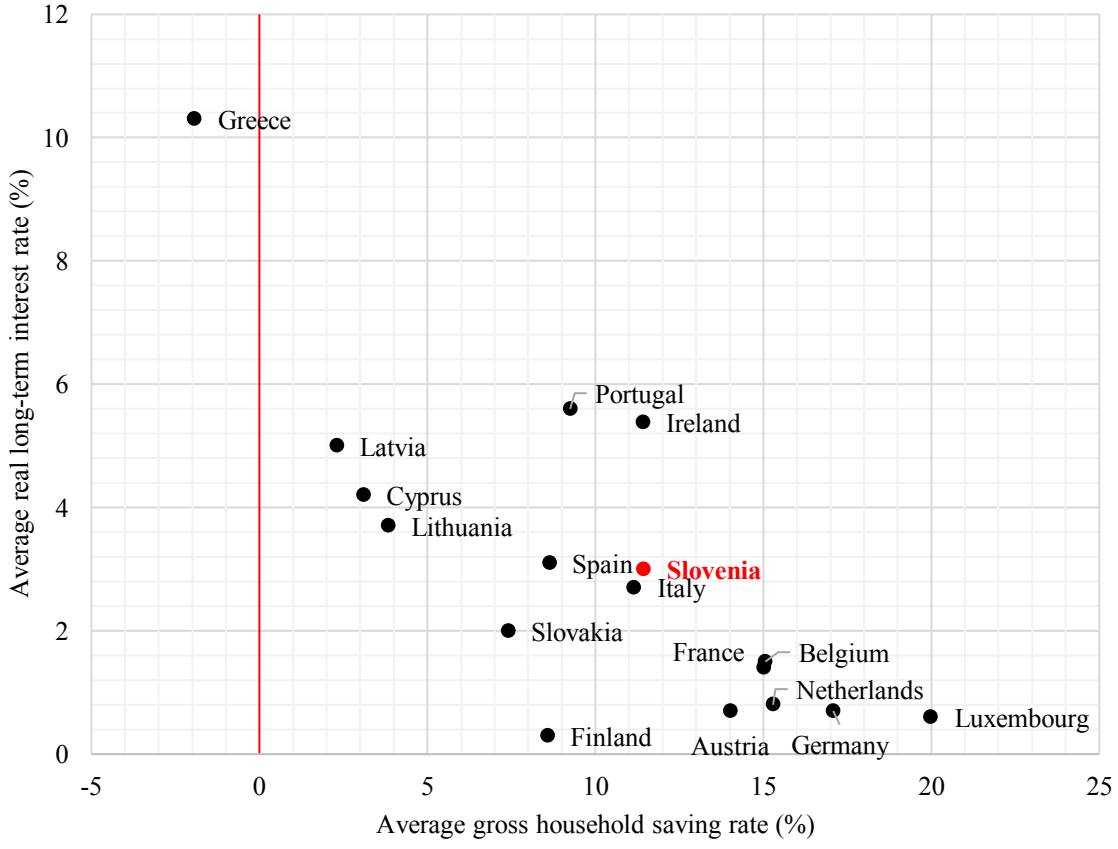
		Government debt	Inflation rate	Interest rate	Old-age dependency	Unemployment rate	Saving rate
CLUSTER 1	Luxembourg Slovakia Finland	41.8	1.5	0.3	20.0	8.3	12.1
CLUSTER 2	Latvia Lithuania	38.8	1.8	1.9	28.4	11.5	3.4
CLUSTER 3	**Slovenia** Belgium France Germany Netherlands Austria	78.7	1.5	0.4	27.9	6.7	14.6
CLUSTER 4	Ireland Cyprus	86.7	0.5	3.4	19.7	10.8	6.8
CLUSTER 5	Spain	87.0	1.1	2.0	27.0	20.3	7.6
CLUSTER 6	Italy Portugal	124.8	1.1	2.9	31.8	11.0	9.5

Source: Own work.

To analyse the relationship between interest rate and saving rate, a bivariate analysis was performed using scatter plots. The relationship was observed in two periods in Euro Area countries. The first period from 2009–2014 reflects the period when the average real long-term interest rate was positive in all countries, while the second period reflects the period when the average real long-term interest rate became negative in some countries.

Figure 11 shows the average gross households saving rate and the average real long-term interest rate in the Euro Area countries over the period 2009–2014. A glance at the figure shows that there is a pattern, indicating a negative relationship between the average real long-term interest rate and the average gross household saving rate. This means that a higher average gross household saving is associated with a lower average real long-term interest rate and vice versa. Greece can be considered an outlier as the average gross household saving rate was negative during the observed period and also the average real long-term interest rate was significantly higher than the predicted pattern of the other countries. Looking only at the relationship between the interest rate and the savings rate, Slovenia was most similar to Spain and Italy during this period.

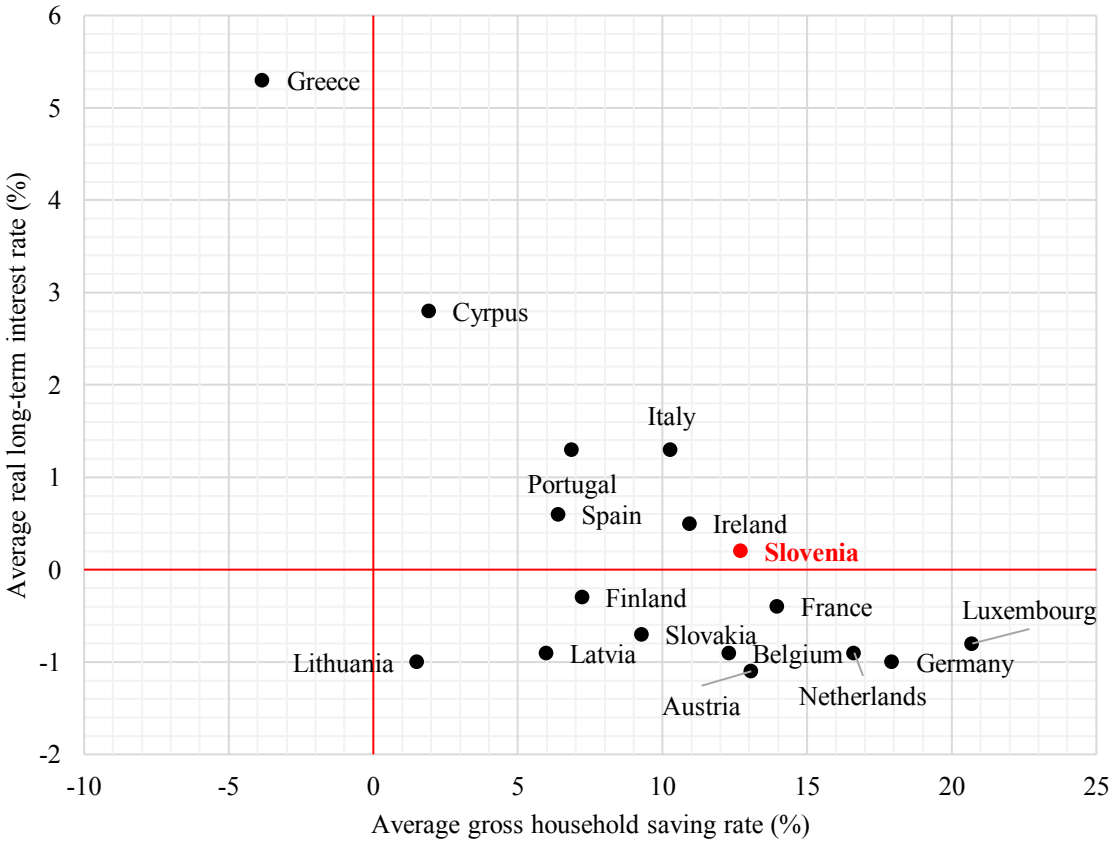
Figure 11: Average gross household saving rate and average real long-term interest rate, Euro Area countries, 2009–2014



Adapted from Eurostat (2021).

Figure 12 shows the average gross household saving rate and the average real long-term interest rate in the Euro Area countries over the period 2015–2019. As mentioned earlier, the average real long-term interest rate was negative in most of the observed countries. Slovenia's average real long-term interest rate was positive during this period. As in the previous period, a negative relationship can be observed between the average gross household saving rate and the average real long-term interest rate. In addition to Greece, Lithuania could also be an outlier in this period, as the average gross household saving rate there was lower than the pattern predicts. Looking only at the relationship between the interest rate and the savings rate, Slovenia was most similar to Ireland and France over this period.

Figure 12: Average gross household saving rate and average real long-term interest rate, Euro Area countries, 2015–2019



Adapted from Eurostat (2021).

5 DEVELOPMENTS IN HOUSEHOLDS' SAVING BEHAVIOUR IN THE EURO AREA

Since the onset of the global financial crisis in 2008, Euro Area households have had to adjust their decisions to a challenging macroeconomic environment typified by high levels of financial and economic policy uncertainty and a significant decline in consumer confidence, which reflects people's expectations about the future (ECB, 2016c).

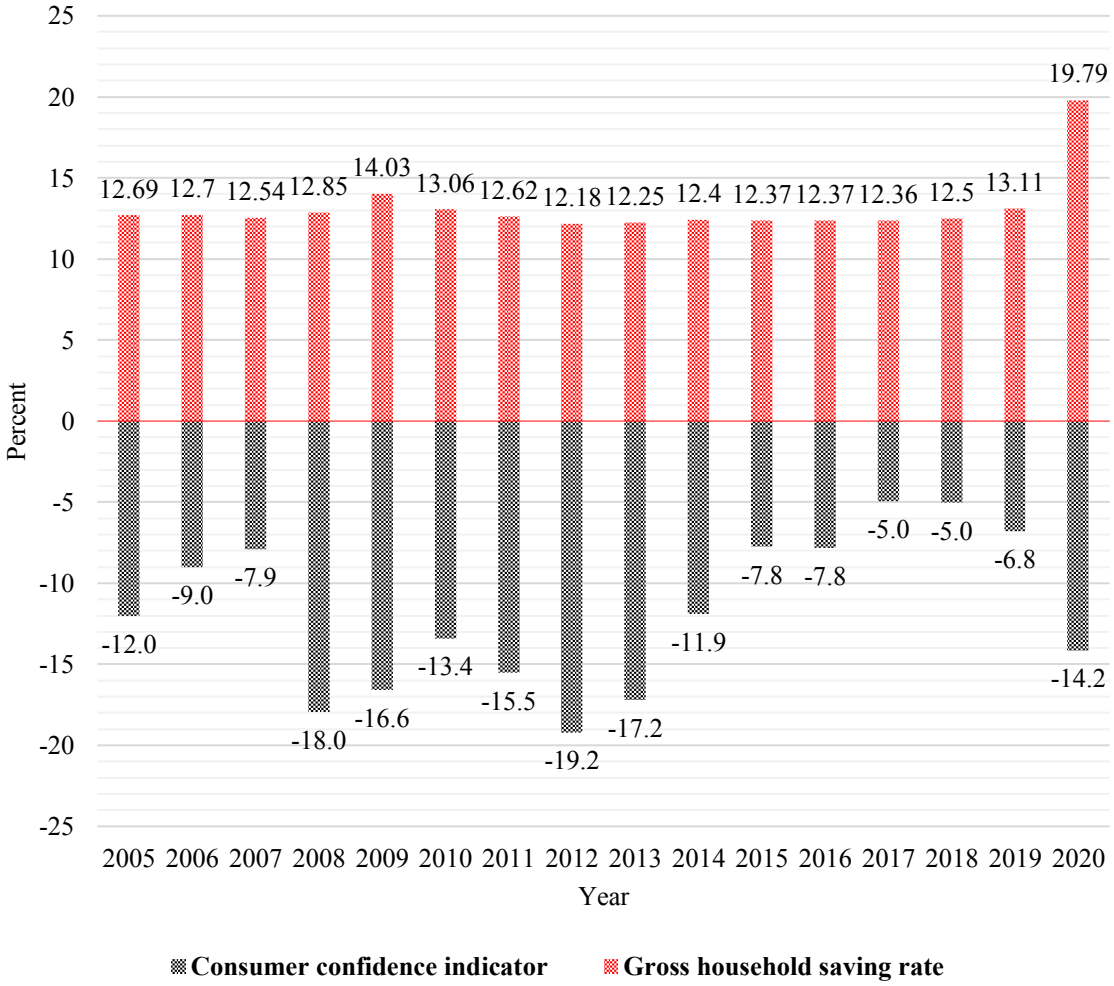
Consumer confidence is measured by the consumer confidence indicator. It includes consumers' perceptions of the current household financial situation, consumer's expectations for the next 12 months regarding the household financial situation, the economy in general, and major purchases in the next 12 months. A positive value indicates that consumers are optimistic about the economy, while a negative value indicates pessimism among consumers (Jevnikar, 2021).

The relationship between confidence indicators and economic activity is complex, although it can be particularly important during times of crisis. Changes in confidence during periods of normal economic activity may indicate misperceptions about the economy or may simply reflect true developments, so the information content of such measures may be limited. As a result, sentiment indicators may not be very well suited for forecasting. However, in times of crisis, a sharp decline in confidence may have some predictive power with respect to future economic developments. In such cases, sentiment indicators suggest a significant change in the behaviour of economic agents that is likely to have real consequences. If economic agents are worried about the economy or their future earnings, they may postpone purchases to hege and have extra money for future spending (ECB, 2013).

The evolution of the Euro Area consumer confidence indicator from 2005 to 2020 shows how economic shocks affect consumer confidence and saving behaviour. The Euro Area experienced two historical recessions during this period: the great recession following the global financial crisis of 2007–2008 and the ongoing recession caused by the COVID-19 pandemic.

Figure 13 shows the evolution of the consumer confidence indicator and the gross household saving rate in the Euro Area. The general economic trend is clear: we can see the initial drop in consumer confidence in 2008 (−18.0 points), which led to a 9.2 percent increase in the gross household saving rate the following year, the second slump in 2012, which led to only a small change in the gross household saving rate in 2013 and the recession last year. Consumers are pessimistic about the country's economy, comparable to the post-2008 situation, and consumers' perceptions of their current household financial situations have also worsened, although to a lesser extent than during the last recession (−14.2 points). However, the gross household savings rate has increased to 19.8 percent of disposable income (up 51 percent from 2019), indicating that households are increasing their precautionary savings.

Figure 13: Gross household saving rate and consumer confidence indicator[10], Euro Area, 2005–2020



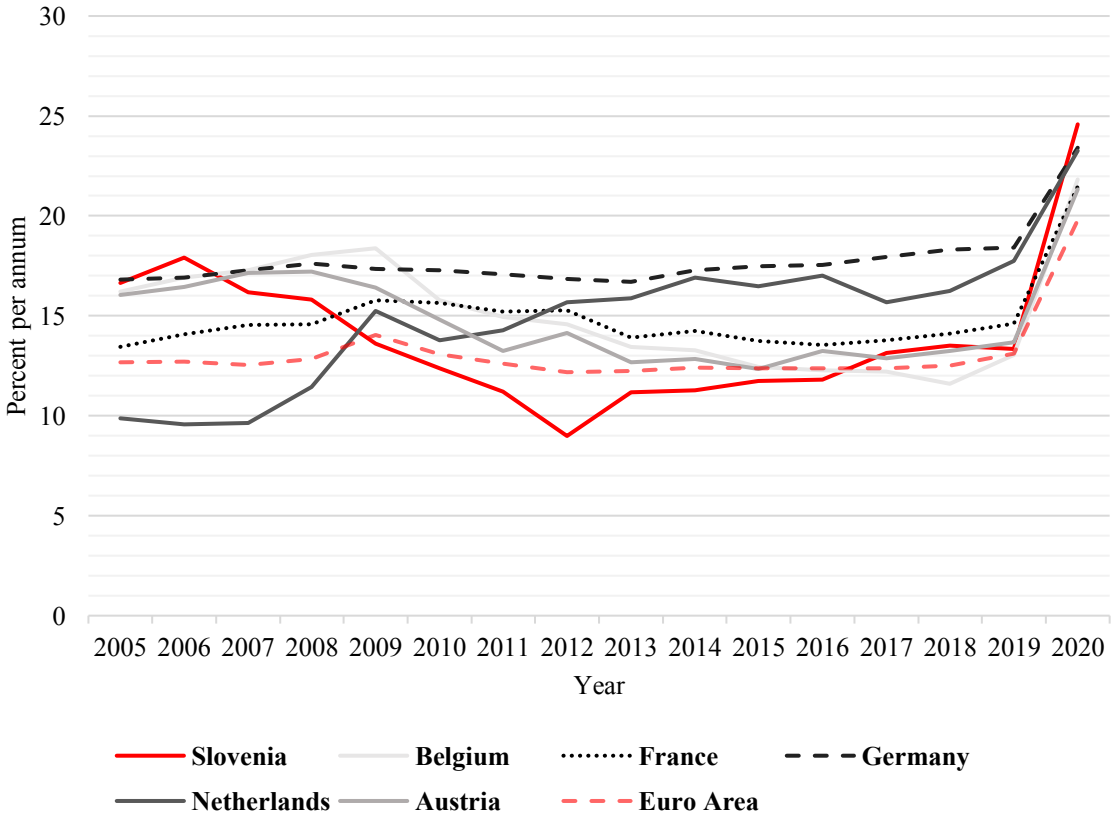
Adapted from Eurostat (2021).

Figure 14 shows the evolution of the gross household saving rates in Slovenia, Belgium, France, Germany, the Netherlands and Austria – or, in other words, in the countries from cluster 3 – and the Euro Area average. With the exception of 2020, the gross household saving rate in the Euro Area remained relatively stable over the studied period. Their average was 13.11 percent. Throughout the period under review, gross household saving rates in Germany, France, the Netherlands and Austria were above the Euro Area average. The gross household saving rate in Belgium was generally higher than in the Euro Area, with the

[10] The Consumer Confidence Indicator (CCI) is a survey that determines whether consumers are optimistic or pessimistic about their future financial situation. There are five questions, two of which relate to the current economic situation and three of which relate to future expectations. There are three response options for each question: positive, negative or neutral. After collecting the data, the relative value of each question is calculated and compared with the relative value of 1985, which was set at a base value of 100. For each question, this comparison of relative values results in an 'index value' (Ganti, 2020).

exception of the period from 2017 to 2019. The gross household saving rate in Slovenia was higher than the Euro Area average until 2009. Since 2006, the gross household saving rate in Slovenia has been declining and reached its low point in 2012 (8.99 percent of gross disposable income). Since then, the gross saving rate of Slovenian households has improved and exceeded the Euro Area average in 2016. Slovenian households saved a higher percentage of their disposable income in 2020 than the Euro Area average and even more than households in Germany.

Figure 14: Developments in households' savings rates across countries in Cluster 3 and Euro Area average, 2005–2020



Adapted from Eurostat (2021).

The level of gross household saving rates varies widely across Euro Area countries. The average level of gross household saving rates in the Euro Area has been analyzed in two different periods (Table 3). It can be observed that Luxembourg has the highest average gross household saving rate in both periods, followed by Germany and the Netherlands. In all three countries, households increased their savings in the second period. In addition to these countries, households in Estonia, Latvia, Slovenia and Slovakia also increased their savings. However, the average gross household saving rate decreased in most countries, namely Belgium, Ireland, Greece, Spain, France, Italy, Cyprus, Lithuania, Austria, Portugal and Finland. Belgium recorded the largest decrease from one period to another (-2.75 percentage points) and Latvia the largest increase from one period to another (3.68

percentage points). Slovenia ranks 7th among Euro Area countries in the first period, while it ranks 6th in the second period. The average gross household saving rate increased by 1.28 percentage points. Greece had negative average gross household saving rates in both periods.

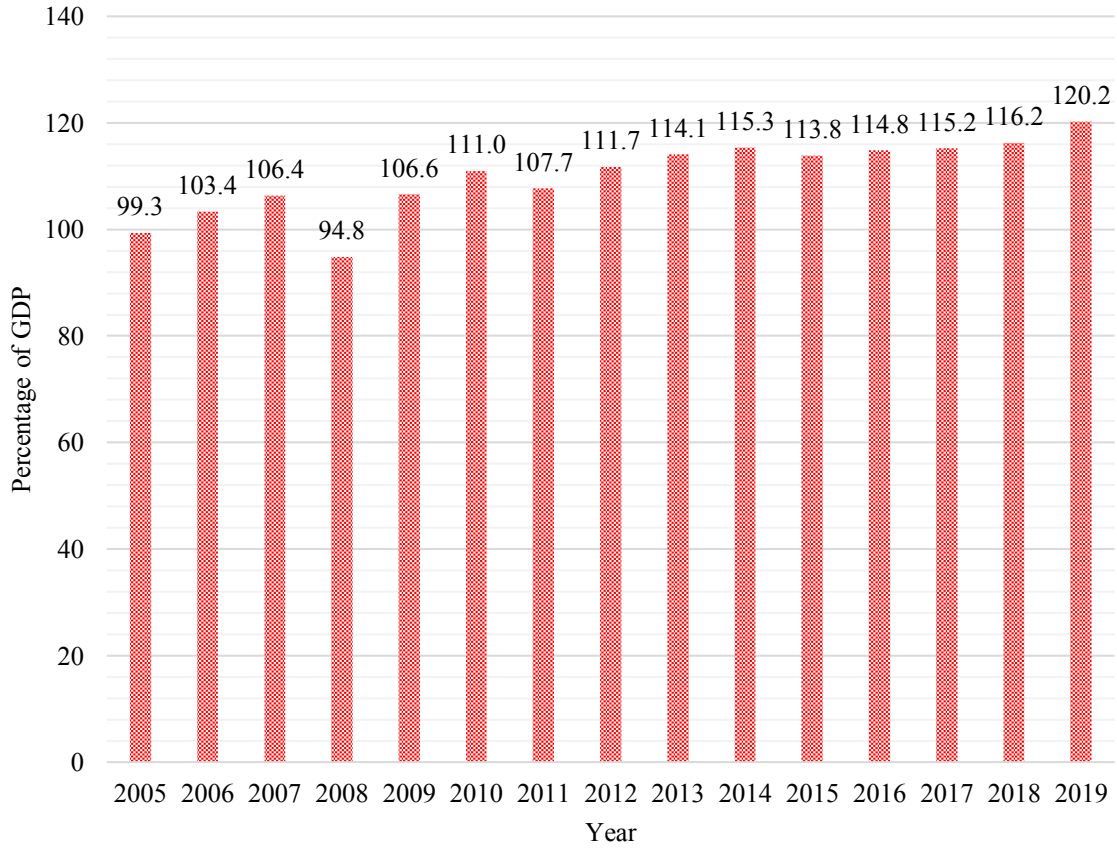
Table 3: Average gross household saving rates in Euro Area countries, levels in two different periods

	Average 2009–2014		**Average 2015–2019**
1. Luxembourg	19.98	1. Luxembourg	20.71
2. Germany	17.08	2. Germany	17.94
3. Netherlands	15.29	3. Netherlands	16.63
4. Belgium	15.05	4. France	13.96
5. France	15.01	5. Austria	13.07
6. Austria	14.02	**6. Slovenia**	**12.71**
7. Slovenia	**11.43**	7. Belgium	12.31
8. Ireland	11.42	8. Ireland	10.39
9. Italy	11.14	9. Italy	10.28
10. Portugal	9.25	10. Estonia	10.27
11. Estonia	9.07	11. Slovakia	9.29
12. Spain	8.63	12. Finland	7.24
13. Finland	8.59	13. Portugal	6.88
14. Slovakia	7.40	14. Spain	6.40
15. Lithuania	3.84	15. Latvia	5.99
16. Cyprus	3.1	16. Cyprus	1.94
17. Latvia	2.3	17. Lithuania	1.53
18. Greece	−1.95	18. Greece	−3.82

Adapted from Eurostat (2021).

Figure 15 shows the financial assets of households and NPISH as a percentage of GDP in the Euro Area. The financial assets of households are comprised from currency and deposits, debt securities, loans, equity and investment fund shares, insurance, pensions and standardised guarantees, financial derivatives and other accounts receivable/payable. The financial assets of households and NPISH are currently higher than before the global financial crisis (by 22.5 percentage points of GDP in 2019 compared to 2007), according to Euro Area-level data. Financial assets of households and NPISHs in the Euro Area recovered to 196.4 percent of GDP in 2009 after reaching a low in 2008. Thereafter, with the exception of 2011 and 2018, the ratio of financial assets to GDP grew in most years.

Figure 15: Financial assets of households and NPISH as % of GDP, Euro Area, 2005–2019

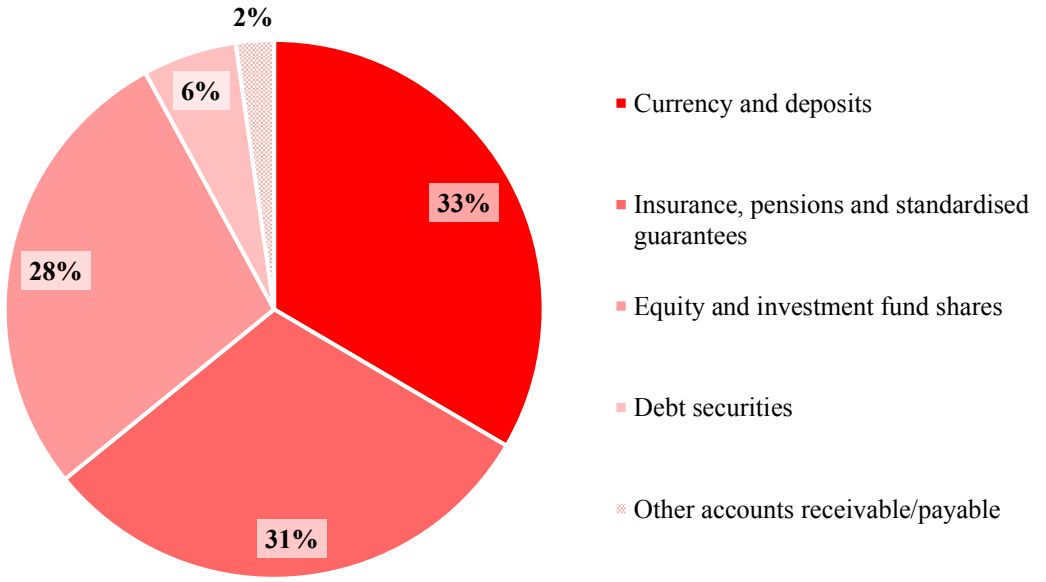


Adapted from Eurostat (2021).

Figure 16 illustrates the average structure of financial assets of households and NPISH in the Euro Area between 2005 and 2019. During the observed period, financial assets consisted mainly of three components; namely, currency and deposits (33.3 percent of total financial assets), insurance, pensions and standardised guarantees (30.6 percent of total financial assets), and equity and investment fund shares (27.8 percent of total financial assets). Debt securities accounted for 5.6 percent of total financial assets and other accounts receivable/payable accounted for 2.3 percent. Loans and financial derivatives and employee

stock options were not taken into account, as they include only a negligible share of total financial assets, 0.29 percent and 0.02 percent, respectively.

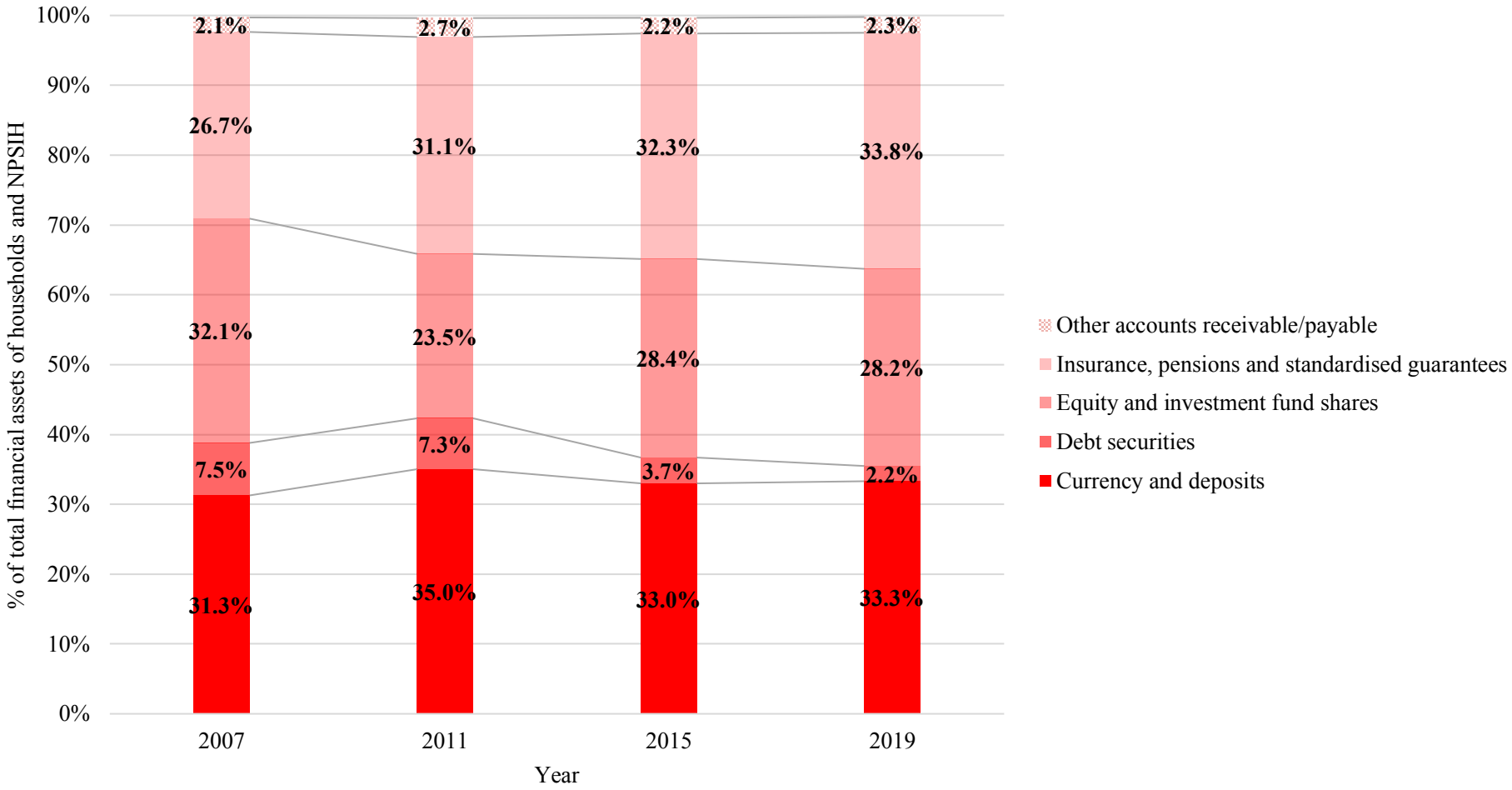
Figure 16: Financial assets of households and NPISH, structure by instrument, Euro Area, average 2005–2019



Adapted from Eurostat (2021).

Figure 17 illustrates the structure of total financial assets of households and NPISH in the Euro Area countries in 2007, 2011, 2015 and 2019. It is important to note that portfolio structures differ significantly across countries (Rupprecht, 2018). The purpose of this figure is to see if there is evidence of increased risk-taking among households. If risky assets are defined as the sum of debt securities, equity and loans, and other claims, the answer is no. We can see that currency and deposits represent the highest share in total financial assets and have remained relatively stable in all four years observed. Debt securities gradually declined after the global financial crisis. Equity and investment fund shares declined during the same period, then increased and remained at a stable level. Insurance, pensions and standardised guarantees are increasing in importance. Finally, other accounts receivable/payable also remained at a stable level.

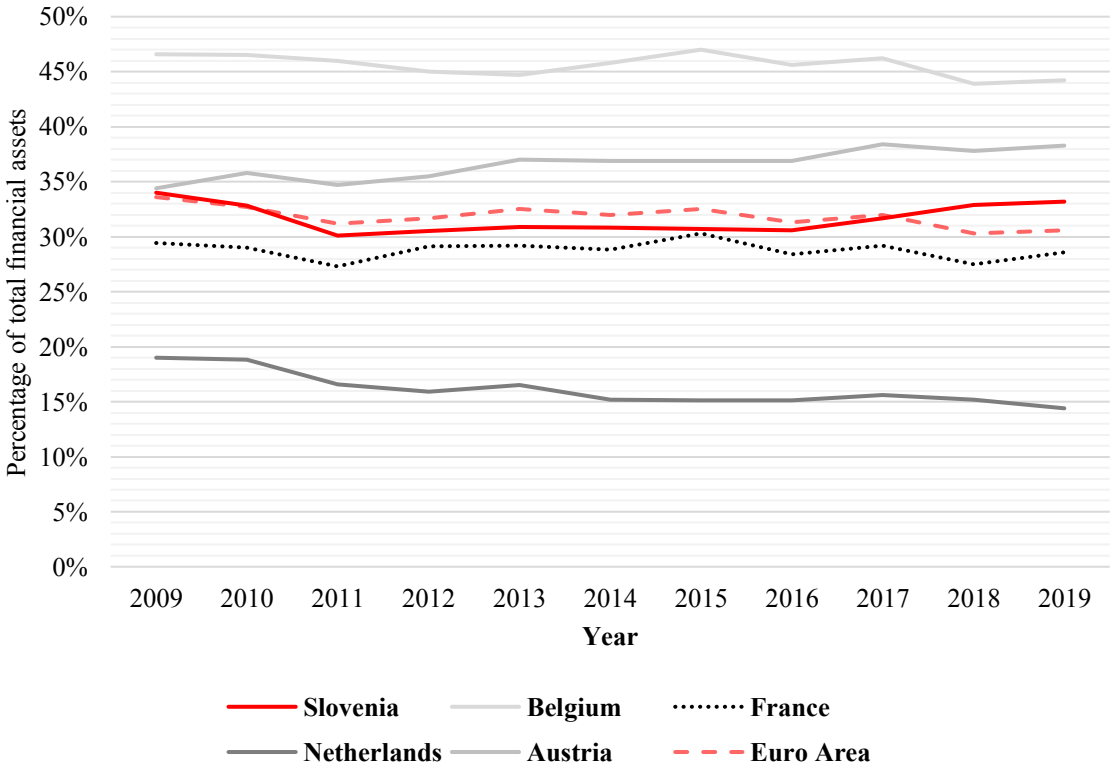
Figure 17: Structure of total financial assets of households and NPISH, Euro Area, 2007, 2011, 2015, 2019



Adapted from Eurostat (2021).

Figure 18 shows the evolution of risky assets as a share of total household financial assets in cluster 3 (Germany was excluded as data on loans volume were not available). The purpose of this figure is to make some assumptions about households' plans to change their portfolio structure, for example, by favoring riskier assets. We find that the share of risky assets in total household financial assets has neither increased nor decreased in most of the observed countries. However, we can observe a declining trend in the Netherlands. Slovenian households generally held a lower share of risky assets in their portfolio than Euro Area households, while Euro Area households started to favour safer assets in 2017. The results do not rule out the possibility that individual households increased their investment in riskier assets. This could be especially true for households with good financial literacy (Rupprecht, 2018). At the macro level, however, no such portfolio reallocation is evident.

Figure 18: Proportion of risky assets in total financial assets of households, countries in cluster 3, 2009–2019



Adapted from Eurostat (2021).

These trends indicate that interest rates or, more generally, the return on financial assets are not the most important consideration for households when deciding how to structure their portfolios. Other causes, such as households' liquidity preferences, the opportunity cost of certain assets and uncertainty about future developments, as well as more structural issues – described in Chapter 3 – appear to have a greater influence (Rupprecht, 2018). It is clear that the current low interest rate environment has not led households to invest in risky assets to any significant extent.

6 OVERALL FINANCIAL OPERATIONS OF HOUSEHOLDS IN SLOVENIA: TRENDS

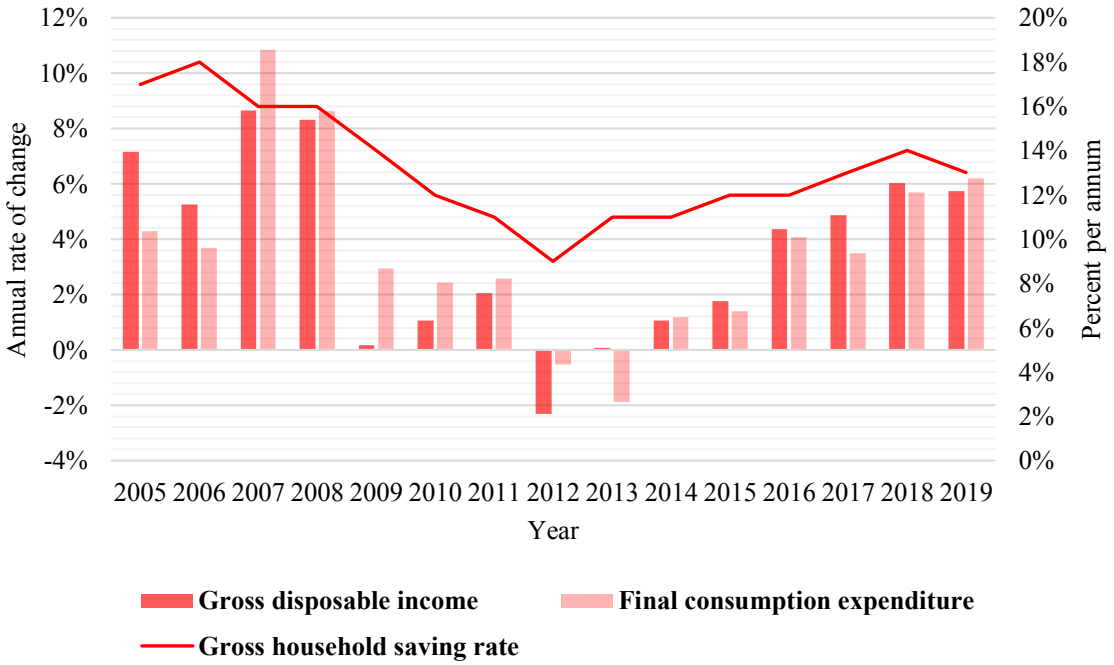
This chapter provides an overview of developments in saving behaviour and trends in the overall financial operations of households in Slovenia.

6.1 Gross savings

Figure 19 illustrates the evolution of the gross household saving rate, gross disposable income and final consumption expenditure between 2005 and 2019. Gross disposable income is primarily used for consumption and the rest is saved. In 2005 and 2006, household gross disposable income grew faster than consumption expenditure. In the following two years, 2007 and 2008, the situation changed, and consumption expenditure grew faster, resulting in a lower household gross saving rate. The slowdown in the growth of household disposable income and the consequent lower gross saving rate in 2009 to 2011 was mainly caused by the rise in unemployment and limited wage growth. This low growth was a factor in the low growth in final consumption (Bank of Slovenia, 2010). The continued unfavourable economic conditions significantly reduced household disposable income, consumption, and the household saving rate also in 2012 (Bank of Slovenia, 2013). The household saving rate increased in 2013 despite the stagnation of gross household disposable income as a result of the decline in consumption and also investment (Bank of Slovenia, 2014). In 2014 and 2015, the situation started to improve due to the increase in real gross wages and the decrease in unemployment. However, households remained cautious and reluctant to consume (Bank of Slovenia, 2015). From 2015 to 2018, disposable income started to grow faster than consumption expenditure again. However, in 2019, consumption expenditure grew faster, leading to a decline in the gross household saving rate.

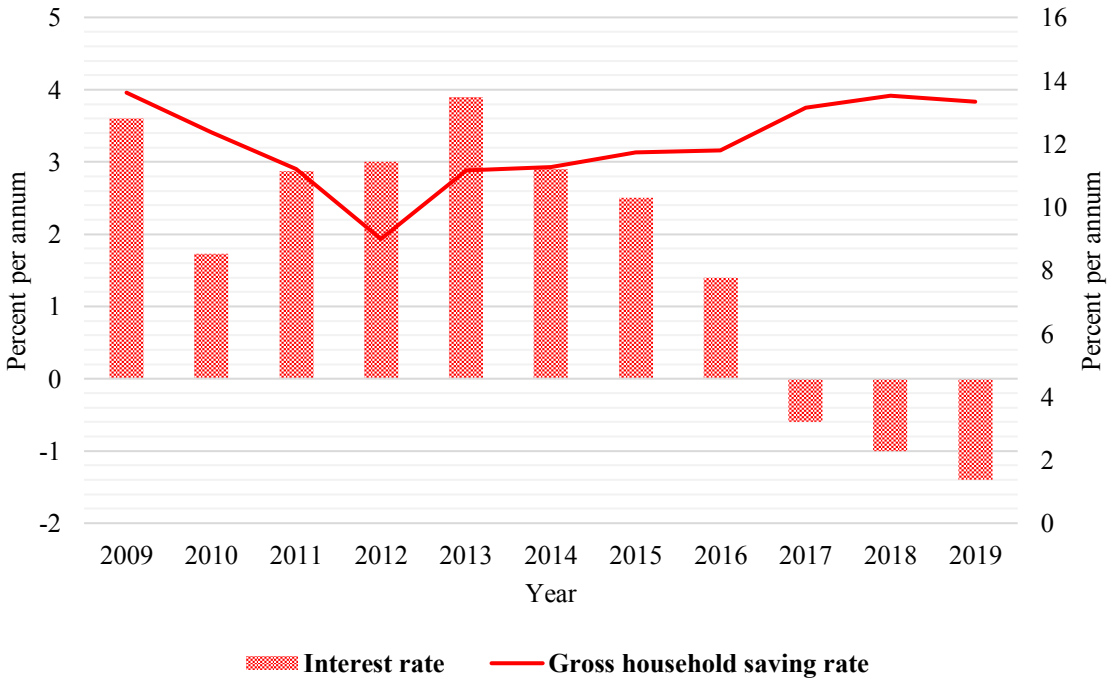
Figure 20 shows the real long-term interest rate and the gross household saving rate between 2009 and 2019. The real long-term interest rate fell by 1.87 percentage points from 2009 to 2010. At the same time, the gross household saving rate declined. From 2011 to 2013, real long-term interest rate increased, but the household saving rate plummeted in 2012 and began to improve in 2013. Since 2014, the real long-term interest rate has been declining, reaching negative territory in 2017. During this period, from 2014 on, a divergence between the real long-term interest rate and the household savings rate can be observed.

Figure 19: Evolution of the gross household saving rate (right axis), consumption (left axis) and disposable income (left axis), Slovenia, 2005–2019



Adapted from SURS (2021).

Figure 20: Real long-term interest rate and gross household saving rate, Slovenia, 2009–2019

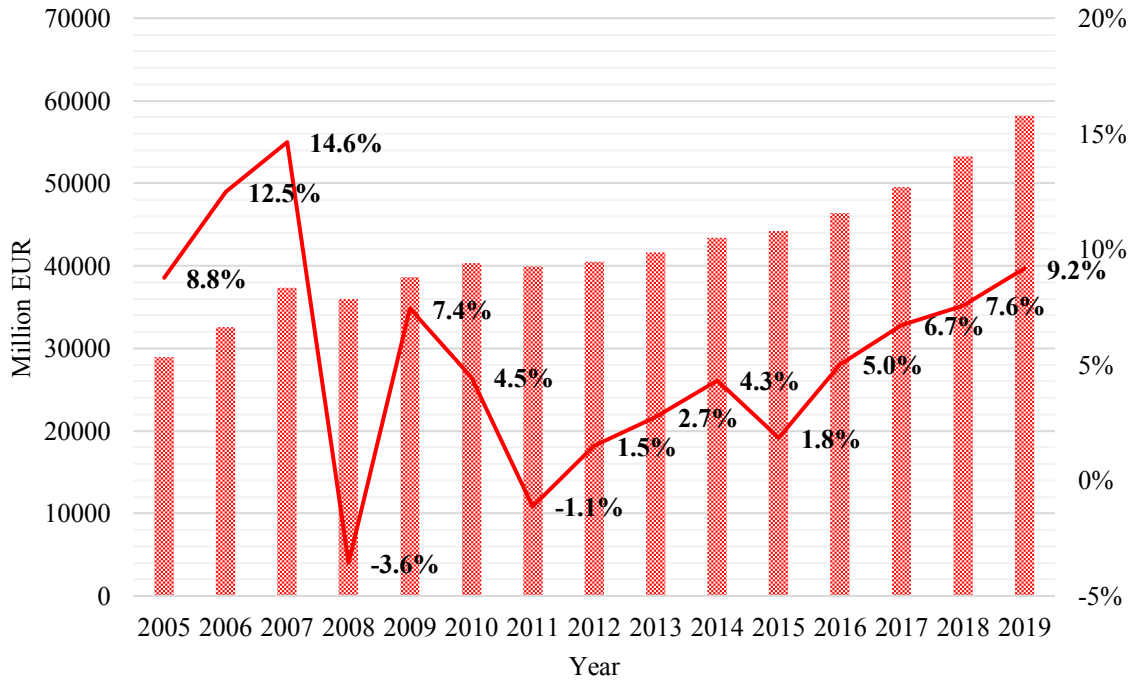


Adapted from Eurostat (2021).

6.2 Financial asset formation: breakdown by instrument

Figure 21 illustrates the volume and annual rate of financial asset changes among households and NPISHs in Slovenia between 2005 and 2019. In that period, the volume of financial assets increased dramatically, from 29,927 million EUR in 2005 to 58,171 million EUR in 2019, meaning that the volume almost doubled. Before the global financial crisis, the annual rate of change was growing rapidly: 8.8 percent in 2005, 12.5 percent in 2006 and 14.6 percent in 2007. In 2008, at the beginning of the crisis in Slovenia, the annual rate of change in financial assets was lower by 3.6 percent, which the Bank of Slovenia (2009) attributes to lower current household investments. Households' financial assets increased by 7.4 percent in 2009, mostly due to renewed growth in prices on the majority of world stock exchanges after March 2009 (Bank of Slovenia, 2010). The increase in households' financial assets in 2010 was less than in the previous year, primarily as a result of the adverse developments on the domestic capital market (Bank of Slovenia, 2011). In 2011, household financial assets fell by 1.1 percent as a result of capital losses and disinvestment (Bank of Slovenia, 2012). In 2012, households' financial assets again increased. The household financial assets increased by 2.7 percent in 2013 and by 4.3 percent in 2014, as a result of an increase in holdings of currency and, to a lesser extent, an increase in investments in mutual funds and pension funds, life insurance and equity, where valuation also played a significant role (Bank of Slovenia, 2014). The growth was a bit smaller in 2015 (1.8 percent), however, it started to increase at a growing pace from 2015 on due to the favourable macroeconomic conditions.

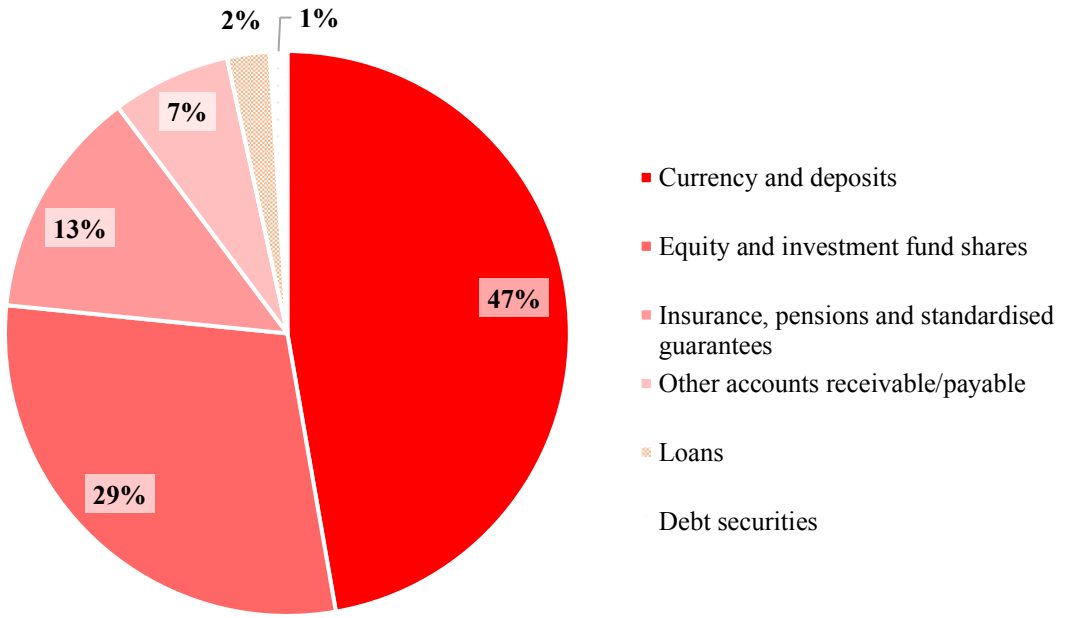
Figure 21: Financial assets of households and NPISH, volume and annual rate of change, Slovenia, 2005–2019



Adapted from Bank of Slovenia (2021).

Figure 22 illustrates the average structure of financial assets of households and NPISHs in Slovenia between 2005 and 2019. During the observed period, the bulk – about 50 percent – of Slovenian households' financial assets consisted of currency and deposits, about 30 percent of equity and investment fund shares, 13 percent of insurance, pensions, and standardised guarantees, 7 percent of other accounts receivable/payable and the remaining were loans, debt securities, and financial derivatives and employee stock options.

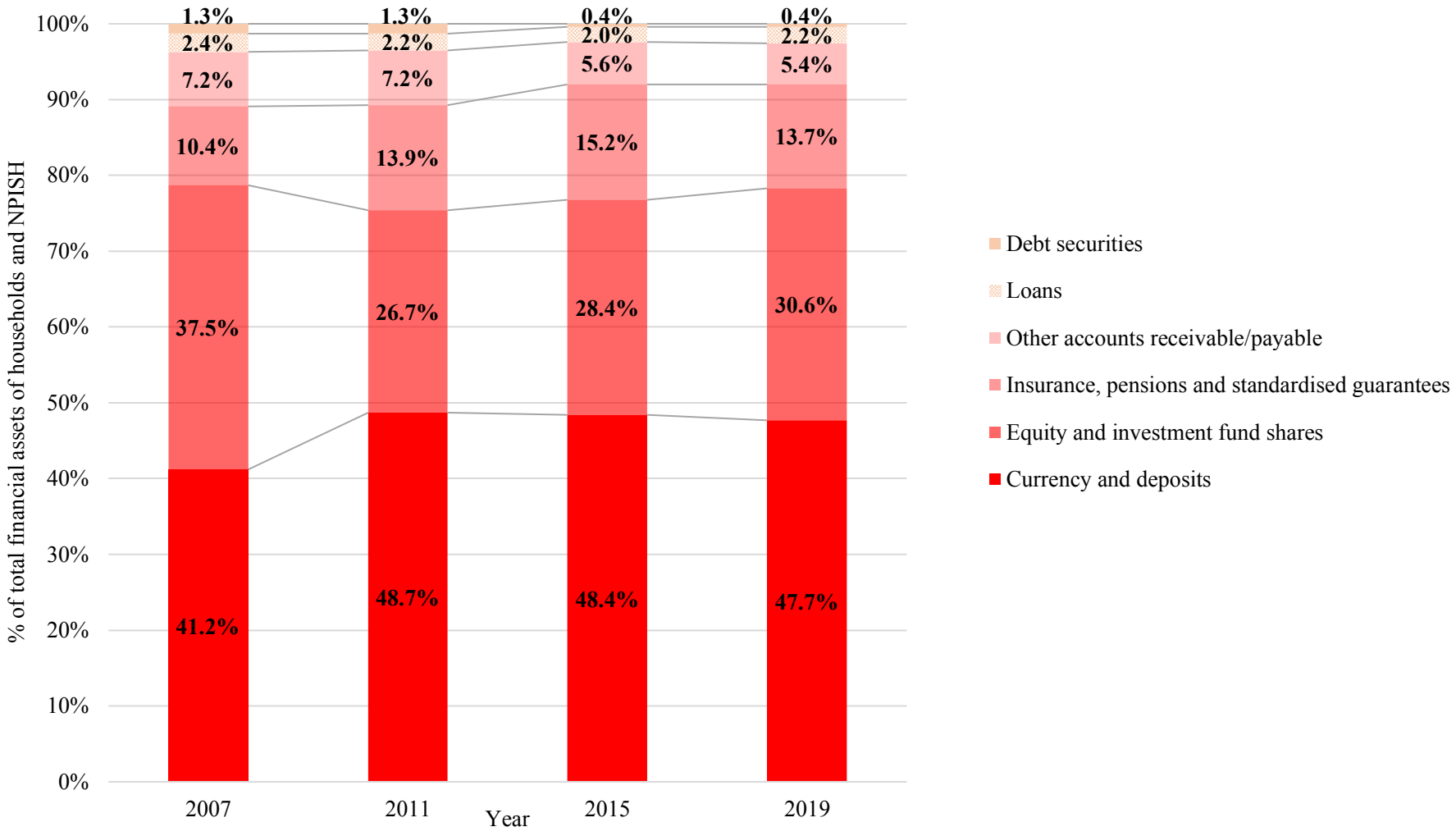
Figure 22: Financial assets of households and NPISH, structure by instrument, Slovenia, average 2005–2019



Adapted from Bank of Slovenia (2021).

Figure 23 illustrates the structure of total financial assets of households and NPISHs in Slovenia in 2007, 2011, 2015 and 2019. Again, the point is to see whether there is evidence of increased risk-taking by households. We can see that investments in risky assets decreased dramatically right after the global financial crisis and have slightly increased again recently. However, despite the low interest rate environment, Slovenian households mostly opt for traditional forms of saving in the form of deposits or cash kept at home (this form of saving increased by 7.5 percentage points in 2011 compared to 2007); other, riskier forms are used less frequently.

Figure 23: Structure of total financial assets of households and NPISH, Slovenia, 2007, 2011, 2015, and 2019



Adapted from Bank of Slovenia (2021).

The following subsections provide an overview of the movements of the three main forms of household financial assets in Slovenia; namely, currency and deposits, equity and investment fund shares and insurance, pensions and standardised guarantees. In addition, new volumes of overnight deposits, deposits with a maturity of up to one year, deposits with a maturity of one to two years, and deposits with a maturity of more than two years are examined, along with their respective deposit rates. The dispersion of deposit rates for overnight deposits and time deposits is presented, taking into account the deposit rates of the Euro Area countries. The analysis of the Bank of Slovenia on the stability of household deposits and its expectations regarding the development of deposit volumes when negative deposit rates are introduced is also summarised.

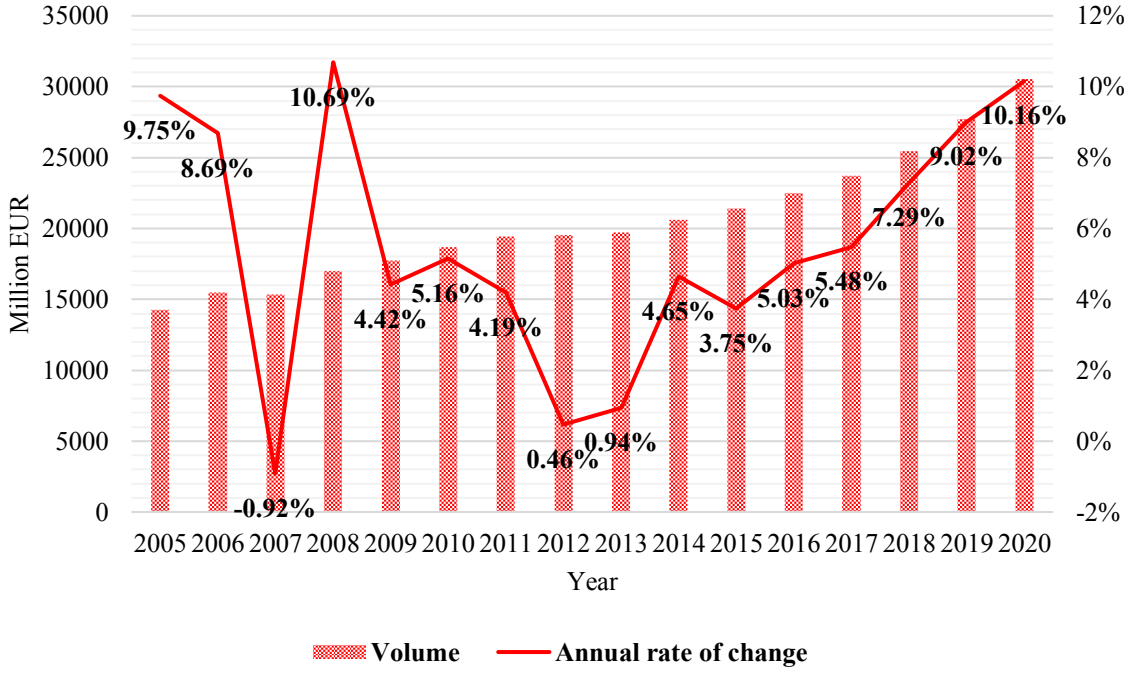
6.2.1 Currency and deposits

Figure 24 illustrates the volume of household deposits in 2005 and 2020. As mentioned earlier, currency and deposits account for about half of the financial assets of Slovenian households. Currency and deposits were increasing in 2005 and 2006, while they decreased in 2007, as households reallocated their financial assets to other, more profitable forms of investment. At the onset of the financial crisis in 2008, currency and deposits increased by 10.69 percent as households prefer more conservative forms of savings in uncertain times. The same was true in 2009. In 2010, the increase in interest rates led to an increase in deposits (Bank of Slovenia, 2011). The trend towards an increase in safer investments continued in 2011, although to a lesser extent than in the previous year (0.97 percentage points less). This was in line with lower wage growth, limited income from equities and the resulting lower disposable income of households (Bank of Slovenia, 2012). Household deposits grew at a much slower pace in 2012 and 2013, by only 0.47 percent and 0.94 percent, respectively. The slower growth of deposits was a result of high unemployment and the decline in net wages (Bank of Slovenia, 2013). In the following years, the growth of deposits increased due to the general economic improvements. The significant increase in deposits in 2019 has continued in 2020 despite the outbreak of the COVID-19 pandemic.

Figure 25 illustrates the new volume of overnight deposits of households and their deposit rates. We can see that between 2009 and 2013 this type of deposit experienced roughly the same growth each year. From 2014 onwards, this type of deposit grew at an increasing rate each year. Given that the deposit rate declined year over year (2011 being an exception), we cannot say that the deposit rate encouraged this type of deposit.

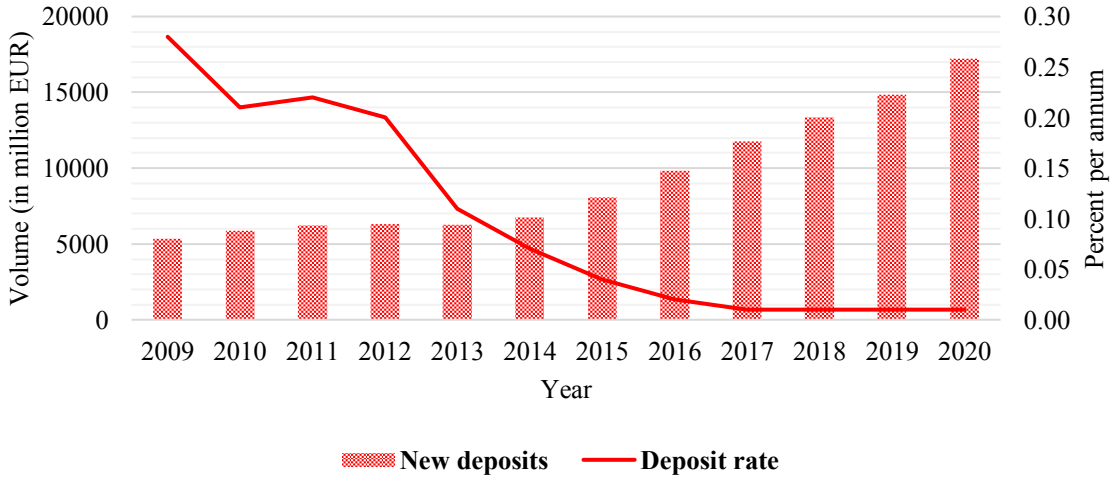
In Figure 26, we can observe a wide dispersion of overnight deposit rates across Euro Area countries. In the observed years, this dispersion has decreased drastically. Slovenia was among the countries with the lowest deposit rate for such deposits. It was lower than the Euro Area average throughout the observed period. The average spread during this period was 0.14 percentage points.

Figure 24: Volume of deposits owned by households and their annual rate of change, Slovenia, 2005–2020



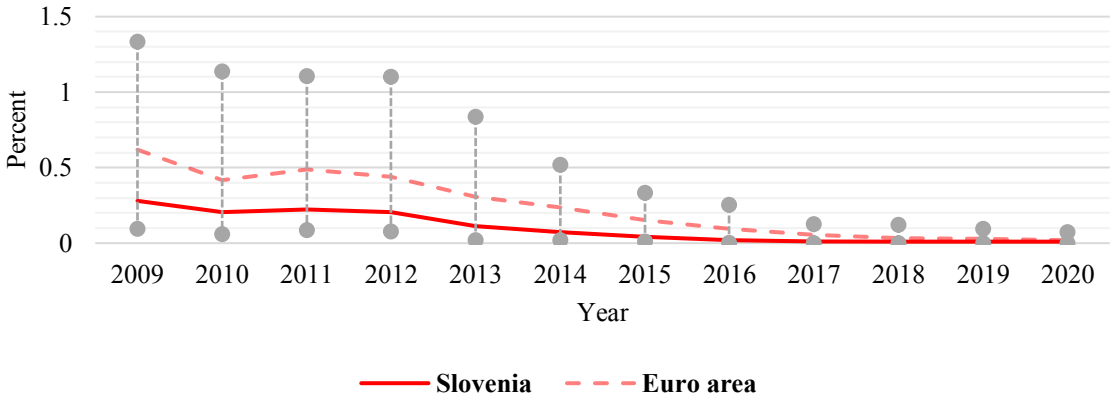
Adapted from Bank of Slovenia (2021).

Figure 25: New volume of overnight deposits (left axis) and deposit rate for overnight deposits (right axis), households, Slovenia, 2009–2020



Adapted from Bank of Slovenia (2021).

Figure 26: Dispersion of overnight deposit rate, Slovenia and Euro Area, 2009–2020

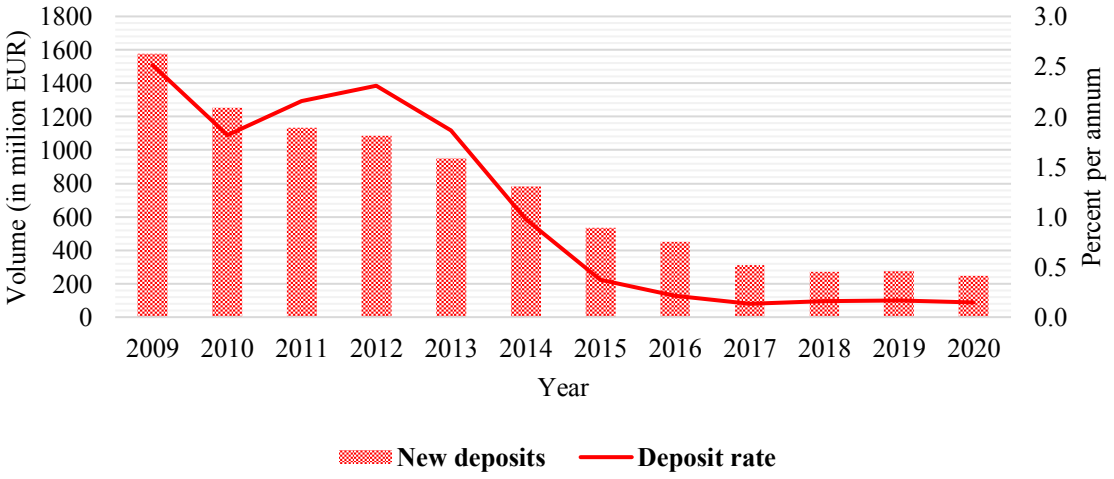


* Minimum represents the country with the lowest deposit rate among Euro Area countries and maximum represents the country with the highest deposit rate among Euro Area countries.

Adapted from Euro Area statistics (2021).

Figure 27 illustrates the new volume of household deposits with a maturity of up to one year and their deposit rate. We can see that this type of deposit has grown at a decreasing rate throughout the observation period. The higher deposit rate between 2010 and 2012 did not significantly boost the volume of new deposits.

Figure 27: New volume of deposits with a maturity of up to 1 year (left axis) and deposit rate for deposits with a maturity of up to 1 year (right axis), households, Slovenia, 2009–2020

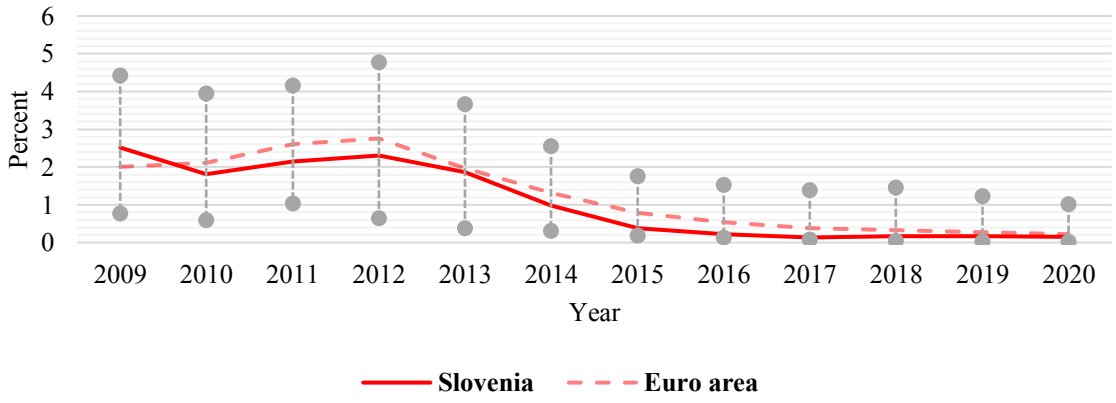


Adapted from Bank of Slovenia (2021).

As shown in Figure 28, the deposit rate for household deposits with a maturity of up to one year in Slovenia was above the Euro Area average only in 2009, and from then on it was

lower throughout the observation period. The average spread over this period was −0.45 percentage points.

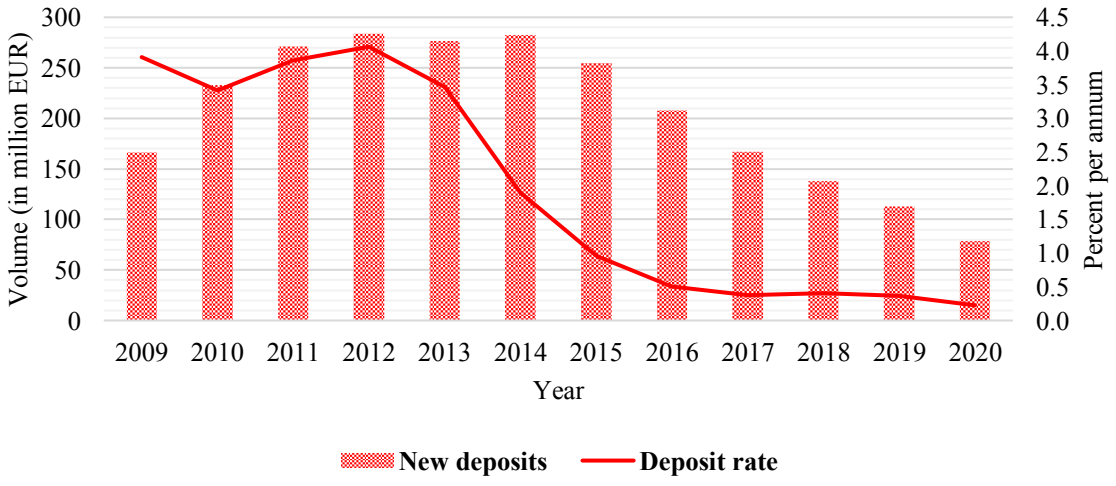
Figure 28: Dispersion of deposit rates for deposits with a maturity of up to 1 year, Slovenia and Euro Area, 2009–2020



Adapted from Euro Area statistics (2021).

Figure 29 illustrates the new volume of household deposits with a maturity of between one and two years and their deposit rate. The volume of new deposits grew at an increasing rate from 2009 to 2012. In 2013, the growth was slightly lower than in previous years. However, from 2014, the growth of this type of deposit has started to decline again. A higher deposit rate seems to encourage this type of deposit, and a falling deposit rate seems to discourage households from such investments.

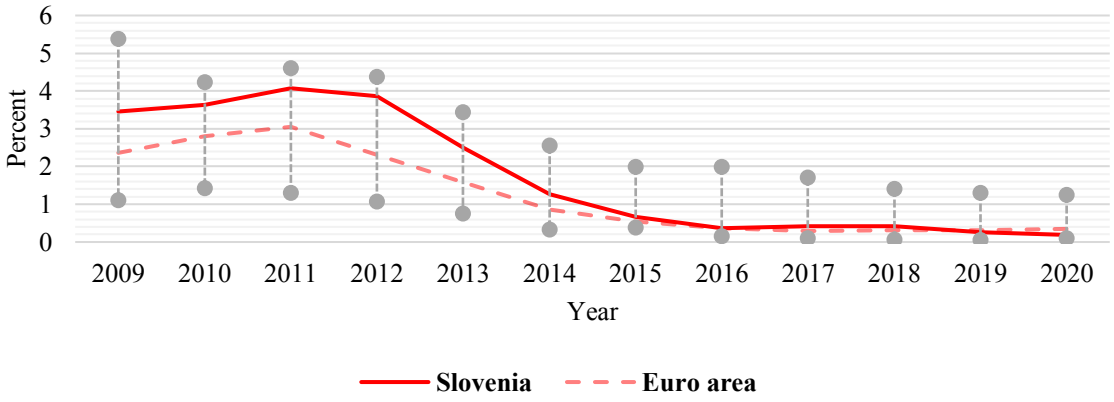
Figure 29: New volume of deposits with maturity between 1 and 2 years (left axis) and deposit rate for deposits with maturity between 1 and 2 years (right axis), Slovenia, households, 2009–2020



Adapted from Bank of Slovenia (2021).

In contrast to deposits with a shorter maturity, Figure 30 shows that the deposit rate for household deposits with a maturity of between one and two years was above the Euro Area average throughout the period under review, with the exception of 2019 and 2020. The average spread over this period was 0.5 percentage points.

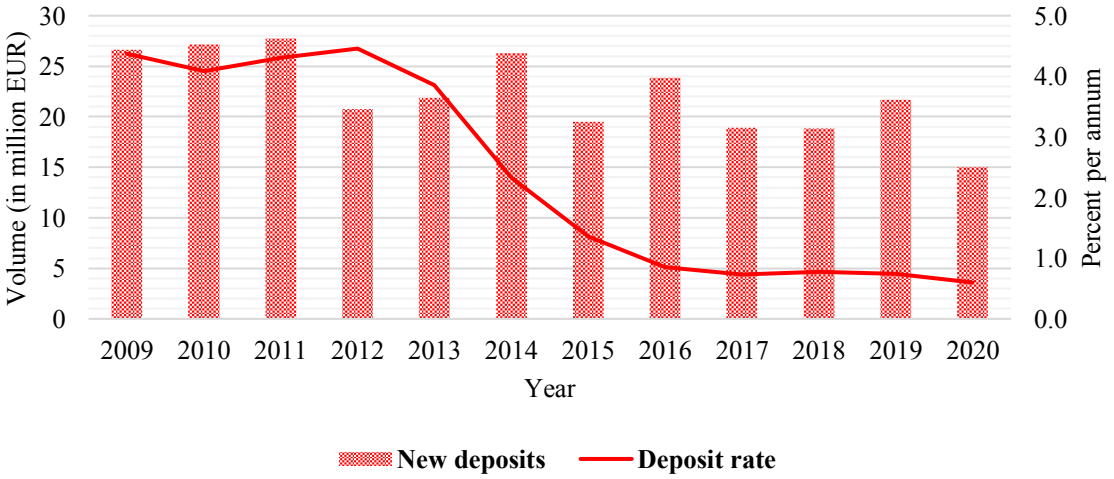
Figure 30: Dispersion of deposit rates for deposits with maturity between 1 and 2 years, Slovenia and Euro Area, 2009–2020



Adapted from Euro Area statistics (2021).

Figure 31 illustrates the new volume of household deposits with a maturity of more than two years. As we can see, these household deposits have increased at very different rates each year. No conclusion can be drawn, therefore, regarding the relationship between the deposit rate and the new volume of these deposits.

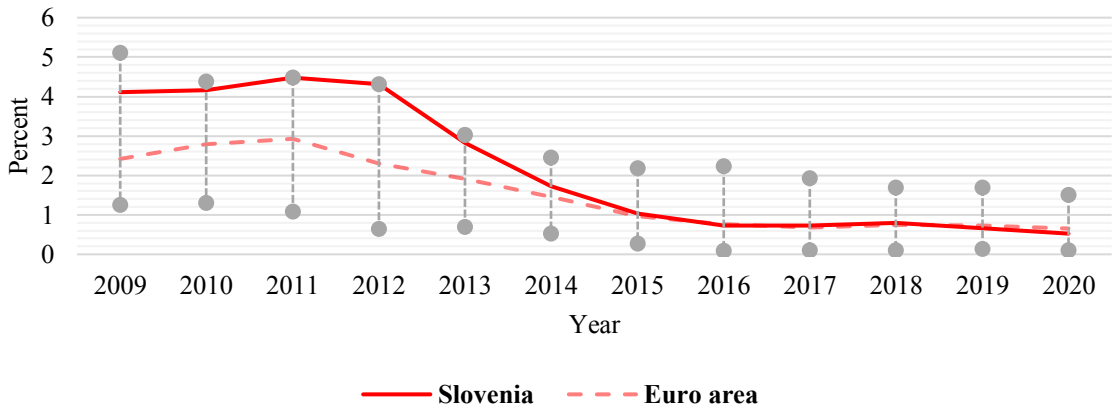
Figure 31: New volume of deposits with a maturity of over 2 years (left axis) and deposit rate for deposits with a maturity of over 2 years (right axis), households, Slovenia, 2009–2020



Adapted from Bank of Slovenia (2021).

Figure 32 shows that the deposit rate for deposits with a maturity of more than two years was above the Euro Area average between 2009 and 2015. In 2011 and 2012, Slovenia was even the country with the highest deposit rate for this type of deposit. After 2016, the deposit rate in Slovenia was below the Euro Area average, but the spread was positive during the observed period, averaging 0.32 percentage points.

Figure 32: Dispersion of deposit rates for deposits with a maturity of over 2 years, Slovenia and Euro Area, 2009–2020



Adapted from Euro Area statistics (2021).

Summary of the analysis of household deposit stability

As part of the Bank of Slovenia's analysis of deposit stability, the results of which are summarised in the Financial Stability Report of December 2018, two issues were raised. First, is the volume of deposits growing faster in the current low interest rate environment than would otherwise be the case? Second, is how sensitive deposits are to interest rate differentials between banks? The first question relates to the fact that households may find market-risk premia inadequate in the current low interest rate environment, which encourages deposit growth. If part of the recent deposit growth is not due to fundamental factors but to funds from alternative investment opportunities, then this share of deposits would likely be transferred from the banking system to alternative investment opportunities as market interest rates rise. The analysis shows that the observed trend in household deposits is mainly influenced by fundamental economic factors such as GDP, inflation and unemployment. Interest rates, on the other hand, mainly affect the term structure of deposits, implying that lower interest rates mainly contribute to the redistribution between different types of deposits. On this basis, they conclude that the normalisation of interest rates should mainly trigger a change in the term structure of deposits rather than an outflow of deposits or a diversion of these funds into other forms of investment. The second problem concerns the possibility that not all banks would be able to adjust deposit rates to the same extent. The risk associated with this scenario arises from the redistribution of deposits across banks, which could make some banks more vulnerable to liquidity risk. The results of the analysis

show that the sensitivity of deposits to interest rate differentials across banks is low. Therefore, the risk of reallocation of deposits between banks that could occur in the event of a change in interest rates is considered to be insignificant (Bank of Slovenia, 2020).

Expectations of movements in volume of deposits upon presentation of negative deposit rates

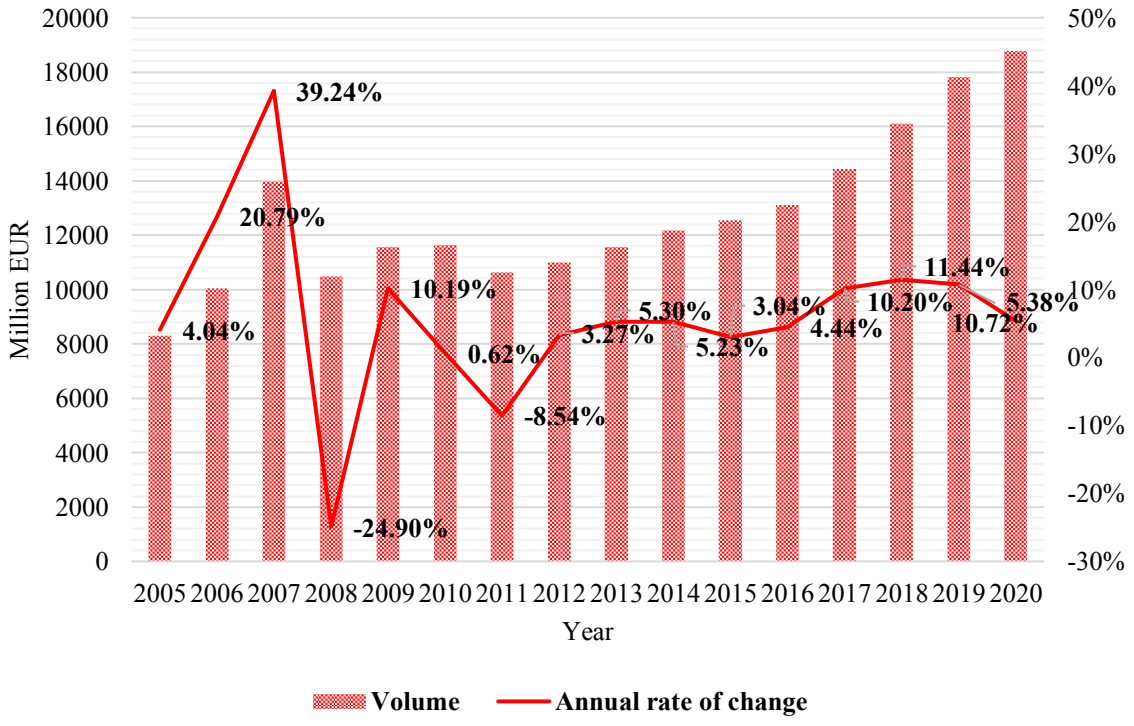
The scenario of negative deposit rates would be a feature unlike anything ever seen before and could change the strong preference of Slovenian households for deposits. Assessing the stability of deposits in a negative interest rate scenario using existing models would not be appropriate. Foreign banks that have already opted for negative deposit rates actually want the volume of deposits to fall. A careful assessment would include the assumption that customers will not accept negative interest rates and will divert their money to alternative investment opportunities. This, of course, requires certain considerations. Firstly, banks are unlikely to charge negative interest rates on relatively low-value deposits. Indeed, banks abroad that have charged negative deposit rates have, in most cases, limited this policy to high-value deposits. Secondly, it is still possible that some customers may be willing to accept negative interest rates, much like they accept negative effective interest rates as a result of a combination of commissions with very low positive interest rates. However, it is difficult or even impossible to determine the level of deposits that would not be affected by the application of negative interest rates. Nevertheless, it would be unwise to make assumptions in this regard. Most banks see a strong negative impact of the low interest rate environment on net interest income, while they do not perceive such an impact on non-interest income, or at most it is somewhat positive. Banks expect similar effects on individual segments of their business even if these conditions persist (Bank of Slovenia, 2020).

Banks have already introduced or intend to introduce negative interest rates or deposits for sight deposits for corporates, while no bank has decided to introduce them for households. Whether banks will introduce negative interest rates on sight deposits depends on how long the low interest rate environment will last and how other banks will react to the persistence of such an environment. Banks are also adjusting to the low interest rate environment by increasing non-interest income through the introduction of deposit fees or other charges. The vast majority of banks have already introduced deposit fees for sight deposits for corporates, while no bank has yet introduced them for households. In setting the fees, most banks would opt for a fee set as a percentage depending on the amount of the deposit. Most banks would link the amount of deposit or negative interest rates to the central bank's deposit rate or adjust it accordingly. Banks do not expect major liquidity outflows as a result of the introduction of negative interest rates or custody fees, as several of them believe that funds will be transferred to time deposits if they do not receive negative interest rates or custody fees. Most banks expect an outflow of a smaller proportion of deposits, and a possible uncontrolled outflow of demand deposits would be managed by more banks by raising interest rates on time deposits (Bank of Slovenia, 2020).

6.2.2 Equity and investment fund shares

Figure 33 illustrates the volume of equity and investment fund holdings of households in 2005 and 2020. In the years before the crisis, equities and mutual funds represented the fastest growing part of the financial assets of Slovenian households (Bank of Slovenia, 2007). In 2008, the volume of equity and investment fund shares owned by households decreased dramatically, by 24.9 percent. The money invested in equity and investment fund shares had a decisive impact on the low growth of household financial assets. Both current investments and the value of the existing portfolio had an impact on the decline of this part of wealth. Households withdrew from these investments on net due to the massive losses in the stock market, while the remaining assets lost value (Bank of Slovenia, 2009). The volume of equity and investment fund shares increased by 10.19 percent in 2009. The increase was primarily a result of positive changes in value, however, they were less likely to prefer this type of investment due to poor past experiences in the capital markets and uncertainty about future economic conditions (Bank of Slovenia, 2010). Household assets in the form of equity and investment fund units decreased by 8.54 percent in 2011 due to capital losses and disinvestment (Bank of Slovenia, 2012). After this slump, the volume of equity and mutual funds grows by 6.56 percent per year on average.

Figure 33: Volume of equity and investment fund shares owned by households and their annual rate of change, Slovenia, 2005–2020

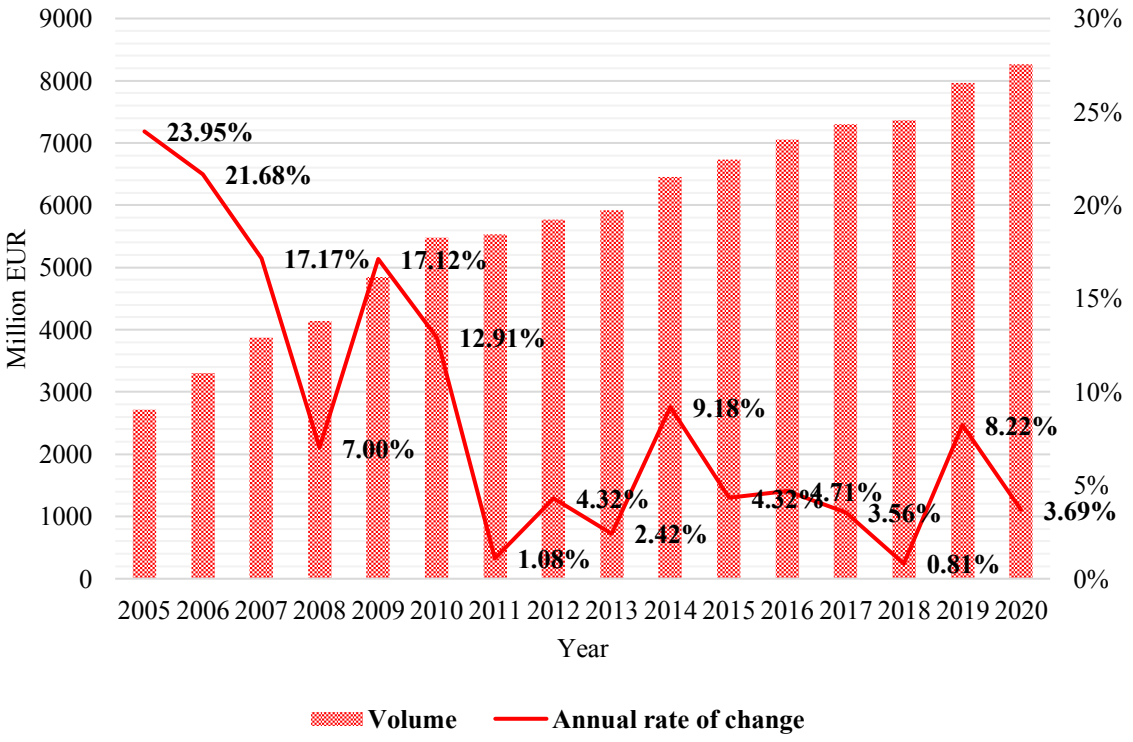


Adapted from Bank of Slovenia (2021).

6.2.3 Insurance, pensions and standardised guarantees

Figure 34 illustrates the volume of household insurance, pensions and standardised guarantees over the period 2005 to 2020. The general trend is obvious – the volume of insurance, pensions and standardised guarantees has increased throughout the period under review. However, although an increasing trend can be observed, the share of insurance, pensions and standardised guarantees in total household financial assets remains significantly lower than the Euro Area average (in the observed period, households in the Euro Area held on average 31 percent of total financial assets in the form of insurance, pensions and standardised guarantees, while in Slovenia this percentage is significantly lower, averaging only 13 percent).

Figure 34: Volume of insurance, pensions and standardised guarantees owned by households and their annual rate of change, Slovenia, 2005–2020



Adapted from Bank of Slovenia (2021).

CONCLUSION

The first chapter began with a description of the current macroeconomic environment and interest rate conditions. In advanced economies, the current macroeconomic climate is characterised by unusually low interest rates. The concept of equilibrium interest rate (r^*) and its underlying factors proves useful in examining the causes of low interest rates. Downward pressure on interest rates severely limits the options available to central banks.

Many central banks have adopted negative interest rate policies (NIRPs) against a background of low r^*. In analysing low or negative policy rates, one of the most important questions is how they affect other interest rates that matter in the economy. When policy rates are reduced below zero, there is a zero lower bound on retail deposit rates.

The second chapter emphasises the importance of returns (i.e. the interest rate) on household saving behaviour. The answer to the question of how the interest rate affects household saving behaviour is ambiguous. Interest rates can affect both the amount and structure of savings. A low interest rate environment may discourage saving because of the substitution effect, but it may also encourage saving because of the income effect, as households may try to compensate for the low interest rate by increasing their savings. In a low interest rate environment, households may be tempted to lengthen the term structure of their portfolios or shift assets into riskier, higher-yielding instruments. However, when considering household savings, it is important to remember that, while interest rates are an important factor, they are not the only factor.

The third chapter begins with the definition of household saving and also of the household saving rate. In examining household saving behaviour, it is important to examine what motivates households to save in the first place. Broadly speaking, the motives can be classified into two categories: to smooth the availability of financial resources over time in order to maintain a more stable consumption profile (life-cycle hypothesis and permanent income hypothesis) and to finance unexpected income losses (precautionary saving motive). In addition, chapter three examines other determinants that influence household saving behaviour besides the interest rate; namely, uncertainty, income and wealth, demographics, and fiscal policy.

Chapters four to six constitute the empirical part of this Master's thesis and help us to answer the fundamental research questions. The aim of the first research question was to find out whether there are differences between Euro Area countries in terms of the above determinants. For this purpose, the clustering technique was used. The following proxies for determinants were used for the analysis: government debt, inflation rate, interest rate, old-age-dependency ratio, and unemployment rate. The analysis revealed that there are differences between Euro Area countries in terms of the mentioned savings determinants. We formed 6 groups of countries; Luxembourg, Slovakia and Finland form cluster 1, Latvia and Lithuania form cluster 2, Slovenia, Belgium, France, Germany, the Netherlands and Austria form cluster 3, Ireland and Cyprus form cluster 4, Spain is alone in cluster 5, and Italy and Portugal form cluster 6. In order to isolate the interest rate from the other determinants and observe only the relationship between interest rate and savings rate, a bivariate analysis with scatter plots was performed. The analysis indicates a negative relationship between the average real long-term interest rate and the average gross household savings rate, implying that a higher average gross household saving rate is associated with a lower average real long-term interest rate and vice versa. Looking only at the relationship between the interest rate and the savings rate, Slovenia was closest to Spain and Italy in the

period from 2009 to 2014, while it was closest to Ireland and France in the period from 2015 to 2019.

The second question aimed to determine whether household risk-taking appetite increases in a low interest rate environment. Household financial assets in the Euro Area consists mainly of three components; namely, currency and deposits (33.3 percent of total financial assets), insurance, pensions and standardised guarantees (30.6 percent of total financial assets) and equity and investment fund shares (27.8 percent of total financial assets). It is important to note that portfolio structures vary considerably across countries. During the observed period, there is no evidence of increased risk-taking among households. However, the results do not rule out the possibility that individual households have increased their investments in riskier assets. This could be particularly true for households with good financial literacy. At the macro level, however, no such portfolio reallocation is evident.

The aim of the last question was to see how Slovenian households behave in a low interest rate environment. After the slump in 2012, the gross household saving rate of Slovenian households has gradually increased. In terms of forms of saving, households in Slovenia remained relatively conservative over the observed period, holding almost half of their financial assets in currency and deposits. The analysis conducted by the Bank of Slovenia shows that the observed trends in household deposits are mainly influenced by fundamental economic factors such as GDP, inflation and unemployment. Interest rates, on the other hand, mainly affect the term structure of deposits, implying that lower interest rates mainly contribute to the redistribution between different types of deposits. Hence, they conclude that the normalisation of interest rates should mainly trigger a change in the term structure of deposits rather than an outflow of deposits or a diversion of these funds to other forms of investment. Moreover, the same analysis also showed that the sensitivity of deposits to interest rate differentials across banks is low. This means that the risk of switching deposits between banks, which could occur in the event of a change in interest rates, is considered insignificant.

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APPENDICES

Appendix 1: Summary in Slovene

Zadnje desetletje bo zaradi svetovne finančne krize (2008–2009) nedvomno zaznamovano kot obdobje rekordno nizkih obrestnih mer. Čeprav se o razlogih za nizke obrestne mere še vedno razpravlja, se zdi vpliv na gospodinjstva povsem jasen: nizke, ničelne ali celo negativne obrestne mere naj bi gospodinjstva odvračale od varčevanja in jih spodbujale k naložbam v bolj tvegana sredstva. Namen tega magistrskega dela je analizirati razmerja med obrestnimi merami in varčevanjem, opazovati morebitne motnje in prekinitve v varčevalnem vedenju gospodinjstev zaradi vztrajno nizkih obrestnih mer ter preučiti vlogo obrestnih mer pri oblikovanju varčevalnih odločitev gospodinjstev v povezavi z drugimi dejavniki. Cilj tega magistrskega dela je izvesti celovito analizo gibanj varčevalnega in naložbenega vedenja slovenskih gospodinjstev v okolju nizkih obrestnih mer ter rezultate primerjati z drugimi državami evroobmočja.

Cilj magistrskega dela je odgovoriti na naslednja raziskovalna vprašanja:

- Ali med gospodinjstvi evroobmočja obstajajo razlike v varčevalnem vedenju?
- Ali se gospodinjstva v okolju nizkih obrestnih mer preusmerjajo k bolj tveganim naložbam?
- Kako se obnašajo slovenska gospodinjstva v okolju nizkih obrestnih mer?

Magistrsko delo je razdeljeno na naslednje sklope: prvo poglavje se začne z opisom trenutnega makroekonomskega okolja in obrestnih mer. Drugo poglavje poudarja pomen donosnosti (tj. vpliv obrestne mere na varčevalno vedenje gospodinjstev). Obrestne mere lahko vplivajo tako na višino kot tudi na strukturo varčevanja. Okolje nizkih obrestnih mer lahko odvrača od varčevanja zaradi učinka substitucije, lahko pa tudi spodbuja varčevanje zaradi učinka dohodka, saj lahko gospodinjstva skušajo nadomestiti nizko obrestno mero s povečanjem svojih prihrankov. V okolju nizkih obrestnih mer so gospodinjstva lahko v skušnjavi, da podaljšajo časovno strukturo svojih portfeljev ali prenesejo sredstva v bolj tvegane in bolj donosne instrumente. Pri obravnavi varčevanja gospodinjstev je treba upoštevati, da so obrestne mere sicer pomemben dejavnik, vendar ne edini. Tretje poglavje se začne z opredelitvijo varčevanja gospodinjstev in opredelitvijo stopnje varčevanja gospodinjstev. Pri proučevanju varčevalnega vedenja gospodinjstev je pomembno raziskati, kaj gospodinjstva sploh motivira za varčevanje. Na splošno lahko motive razdelimo v dve kategoriji: da bi sčasoma izravnali razpoložljivost finančnih virov in tako ohranili stabilnejši profil potrošnje (hipoteza življenjskega cikla in hipoteza o stalnem dohodku) ter da bi financirali nepričakovane izgube dohodka (motiv previdnostnega varčevanja). V tretjem poglavju so poleg obrestne mere obravnavane še druge determinante, ki vplivajo na varčevalno vedenje gospodinjstev, in sicer negotovost, dohodek in premoženje, demografija ter fiskalna politika.

Četrto, peto in šesto poglavje predstavljajo empirični del tega magistrskega dela in so pomagala odgovoriti na temeljna raziskovalna vprašanja. Cilj prvega raziskovalnega

vprašanja je bil ugotoviti, ali obstajajo razlike med državami evroobmočja glede na zgoraj navedene determinante. V ta namen je bila uporabljena metoda grozdenja. Za analizo so bili uporabljeni naslednji približki determinant: javni dolg, stopnja inflacije, obrestna mera, stopnja starostne odvisnosti in stopnja brezposelnosti. Analiza je pokazala, da med državami evroobmočja obstajajo razlike glede omenjenih dejavnikov varčevanja. Oblikovali smo šest skupin držav: Luksemburg, Slovaška in Finska tvorijo skupino 1, Latvija in Litva skupino 2, Slovenija, Belgija, Francija, Nemčija, Nizozemska in Avstrija skupino 3, Irska in Ciper skupino 4, Španija je sama v skupini 5, Italija in Portugalska pa v skupini 6. Da bi obrestno mero ločili od drugih determinant in opazovali samo povezavo med obrestno mero in stopnjo varčevanja, je bila izvedena bivariatna analiza z diagrami razpršitve. Analiza kaže negativno povezavo med povprečno realno dolgoročno obrestno mero in povprečno bruto stopnjo varčevanja gospodinjstev, kar pomeni, da je višja povprečna bruto stopnja varčevanja gospodinjstev povezana z nižjo povprečno realno dolgoročno obrestno mero in obratno.

Z drugim vprašanjem smo želeli ugotoviti, ali se v okolju nizkih obrestnih mer poveča nagnjenost gospodinjstev k prevzemanju tveganja. Finančno premoženje gospodinjstev v evroobmočju sestavljajo predvsem tri komponente, in sicer gotovina in vloge, zavarovanja, pokojnine in standardizirana jamstva ter delnice lastniških in investicijskih skladov. Pomembno je poudariti, da se strukture portfeljev med državami precej razlikujejo. V opazovanem obdobju ni dokazov o povečanem prevzemanju tveganja med gospodinjstvi.

Namen zadnjega vprašanja je bil ugotoviti, kako se slovenska gospodinjstva obnašajo v okolju nizkih obrestnih mer. Bruto stopnja varčevanja slovenskih gospodinjstev se je po recesiji v letu 2012 postopoma povečevala. Kar zadeva oblike varčevanja, so gospodinjstva v Sloveniji v opazovanem obdobju ostala razmeroma konzervativna, saj so skoraj polovico svojih finančnih sredstev hranila v gotovini in depozitih. Analiza, ki jo je opravila Banka Slovenije, kaže, da na opazovana gibanja depozitov gospodinjstev vplivajo predvsem temeljni gospodarski dejavniki, kot so BDP, inflacija in brezposelnost. Obrestne mere pa vplivajo predvsem na časovno strukturo depozitov, kar pomeni, da nižje obrestne mere prispevajo predvsem k prerazporeditvi med različnimi vrstami depozitov. Zato sklepajo, da bi morala normalizacija obrestnih mer povzročiti predvsem spremembo v časovni strukturi depozitov, ne pa odliv vlog ali preusmeritev teh sredstev v druge oblike naložb.

Appendix 2: Clustering – R code

Master's thesis - clustering

Hana Končan

8/31/2021

Libraries

```
#install.packages(ggplot2)
library(ggplot2)
#install.packages("ggfortify")
library(ggfortify)
#install.packages("ranger")
library(ranger)
#install.packages("dplyr")
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
## The following objects are masked from 'package:stats':
##
##     filter, lag
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
#install.packages("Hmisc")
library(Hmisc)
```

```
## Loading required package: lattice
## Loading required package: survival
## Loading required package: Formula
##
## Attaching package: 'Hmisc'
## The following objects are masked from 'package:dplyr':
##
##     src, summarize
## The following objects are masked from 'package:base':
##
##     format.pval, units
```

```
#install.packages("factoextra")
library(factoextra)
## Welcome! Want to learn more? See two factoextra-related books at https
://goo.gl/ve3WBa
#install.packages("cluster")
library(cluster)
#install.packages("magrittr")
library(magrittr)
#install.packages("NbClust")
library("NbClust")
```

Importing data

```
data <- read.table("~/Desktop/IMB/Master's thesis/Clustering/Clustering_d
ata.csv",
                   header=TRUE,
                   sep=",",
                   dec="." )
```

Description:

- Country: 1: Belgium, 2: Germany, 3: Ireland, 4: Greece, 5: Spain, 6:France, 7: Italy, 8: Cyprus, 9: Latvia, 10: Lithuania, 11: Luxembourg, 12: Netherlands, 13: Austria, 14: Portugal, 15: Slovenia, 16: Slovakia, 17: Finland

- Government_debt: General government gross debt as percentage of gross domestic product (GDP), annual data

- Inflation_rate: HICP inflation rate, annual average rate of change

- Interest_rate: Real long-term interest rate, percent per annum

- Old_age_dependency: Ratio between the number of persons aged 65 and over and the number of person aged between 15 and 64. The value is expressed per 100 persons of working age (15-64).

- Unemployment_rate: unemployment rate is shown as percentage of population in the labor force, in the age class from 15 to 75 years.

- Saving_rate: Gross household saving rate, percent per annum

Excluded countries: Estonia (no data of inflation rate and interest rate), Malta (no data of saving rate)

Excluded determinant: real GDP per capita (no volume data, only chain linked volumes)

Standardizing variables

```
data$Gov_debt_z <- scale(data$Government_debt)
data$Inflation_z   <- scale(data$Inflation_rate)
data$IR_z <- scale(data$Interest_rate)
data$Old_age_z <- scale(data$Old_age_dependency)
data$Unemployment_z <- scale(data$Unemployment_rate)
```

Correlation matrix

```
library(Hmisc)
rcorr(as.matrix(data[, c("Gov_debt_z", "Inflation_z", "IR_z", "Old_age_z"
, "Unemployment_z")]),
      type="pearson")
```

```
##                Gov_debt_z Inflation_z  IR_z Old_age_z Unemployment_z
## Gov_debt_z           1.00       -0.55  0.69      0.52           0.51
## Inflation_z         -0.55        1.00 -0.61      0.13          -0.43
## IR_z                 0.69       -0.61  1.00      0.23           0.76
## Old_age_z            0.52        0.13  0.23      1.00           0.18
## Unemployment_z       0.51       -0.43  0.76      0.18           1.00
##
## n= 17
##
##
## P
##                Gov_debt_z Inflation_z IR_z   Old_age_z Unemployment_z
## Gov_debt_z                0.0214      0.0022 0.0319    0.0383
## Inflation_z    0.0214                 0.0091 0.6084    0.0881
## IR_z           0.0022     0.0091             0.3797    0.0004
## Old_age_z      0.0319     0.6084      0.3797           0.4775
## Unemployment_z 0.0383     0.0881      0.0004 0.4775
```

Finding potential outliers - Euclidian distance

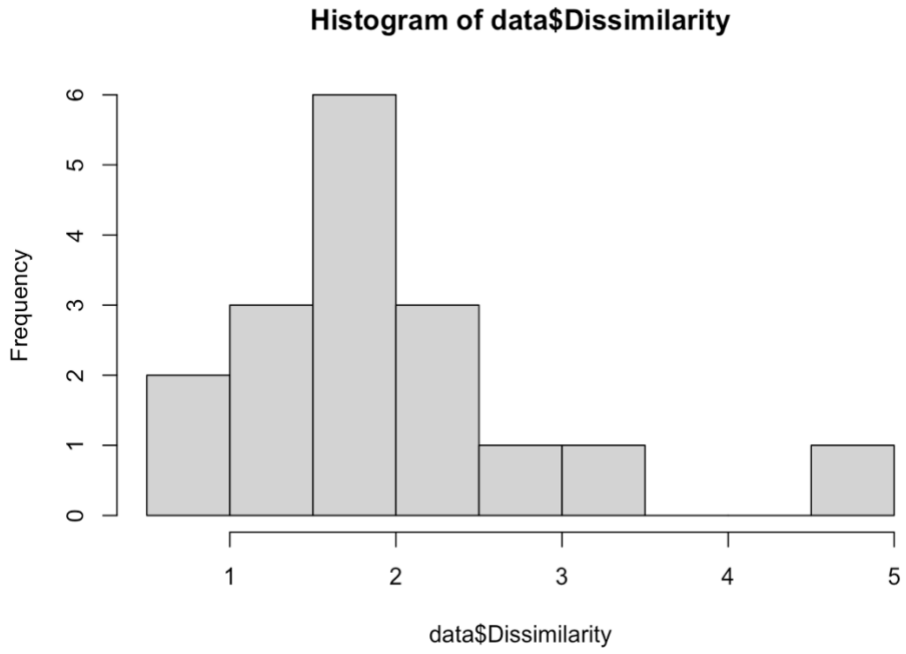
```
data$Dissimilarity = sqrt(data$Gov_debt_z^2 + data$Inflation_z^2 + data$I
R_z^2 + data$Old_age_z^2 + data$Unemployment_z^2)
```

Ordering data

```
head(data[order(-data$Dissimilarity), ], 10)
```

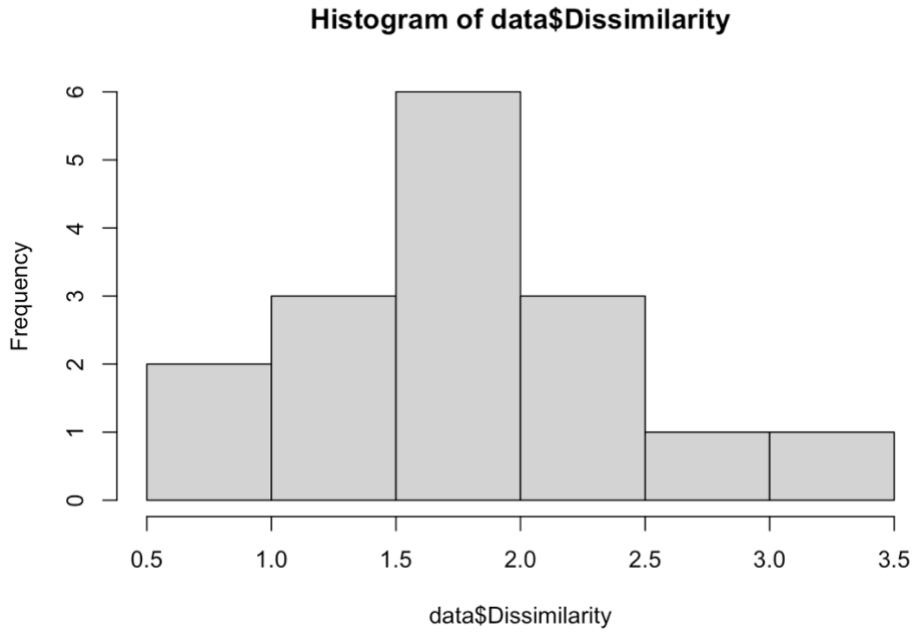
```
##       Country Government_debt Inflation_rate Interest_rate
## 4      Greece          170.33            0.8           8.3
## 3     Ireland           85.54            0.2           3.1
## 11 Luxembourg           21.01            1.6          -0.1
## 5       Spain           86.95            1.1           2.0
## 10  Lithuania           37.37            2.0           1.5
## 7       Italy          129.37            1.2           2.1
## 8      Cyprus           87.91            0.8           3.6
## 2     Germany           72.68            1.3          -0.1
## 14   Portugal          120.25            1.0           3.7
## 13    Austria           80.26            1.8          -0.1
##    Old_age_dependency Unemployment_rate Saving_rate  Gov_debt_z
## 4               31.46             20.48       -2.89  2.43082334
## 3               18.97             10.88       10.95  0.15561803
## 11              20.45              5.55       20.27 -1.57594229
## 5               26.97             20.26        7.62  0.19345314
## 10              27.79             10.86        2.79 -1.13694761
## 7               33.18             10.51       10.75  1.33172664
## 8               20.34             10.74        2.57  0.21921322
## 2               31.87              5.02       17.47 -0.18945970
## 14              30.35             11.47        8.17  1.08700589
## 13              26.99              5.20       13.59  0.01393759
##    Inflation_z       IR_z  Old_age_z Unemployment_z Dissimilarity
## 4  -1.14313491  3.0731190  1.1338191     2.27939051      4.810498
## 3  -2.53122729  0.6279010 -1.5515552     0.16180338      3.042876
## 11  0.70765494 -0.8768485 -1.2333523    -1.01389864      2.510454
## 5  -0.44908871  0.1106433  0.1684603     2.23086248      2.292700
## 10  1.63304987 -0.1244738  0.3447619     0.15739174      2.029440
## 7  -0.21773998  0.1576668  1.5036224     0.08018804      2.028072
## 8  -1.14313491  0.8630181 -1.2570025     0.13092190      1.922709
## 2   0.01360875 -0.8768485  1.2219699    -1.13080710      1.891264
## 14 -0.68043744  0.9100415  0.8951669     0.29194676      1.832842
## 13  1.17035240 -0.8768485  0.1727604    -1.09110234      1.832794
```

```
hist(data$Dissimilarity)
```



Deleting outliers

```
data <- data[-4, ]

hist(data$Dissimilarity)
```

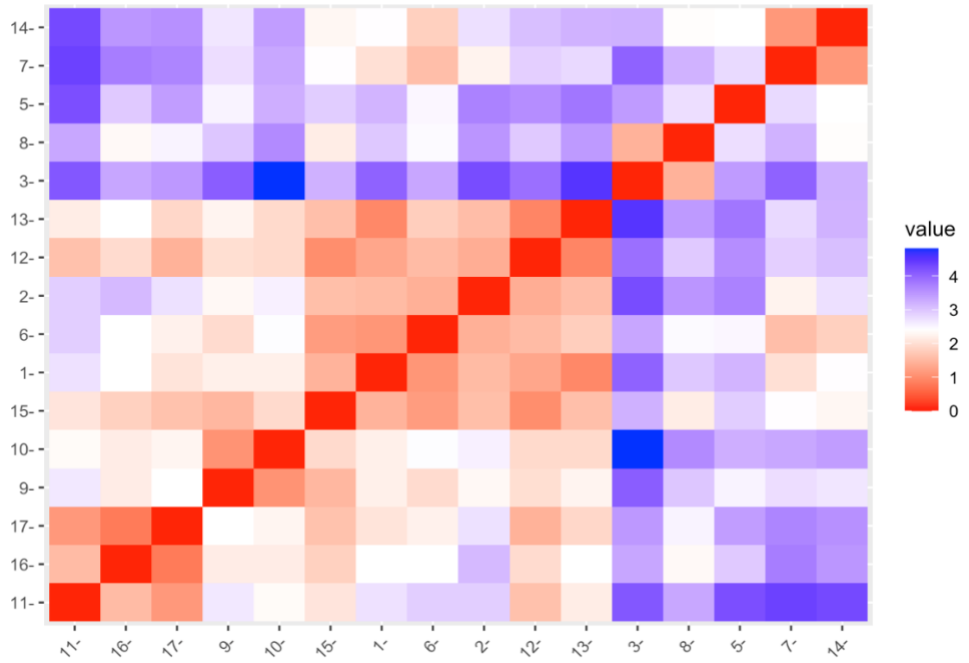


##

Dissimilarity matrix

```
library(factoextra)

distance <- get_dist(data[c("Gov_debt_z", "Inflation_z", "IR_z", "Old_age
_z", "Unemployment_z")],
```

```
                        method="euclidian")
fviz_dist(distance)
```



Hopkins statistics

```
get_clust_tendency(data[c("Gov_debt_z", "Inflation_z", "IR_z", "Old_age_z
", "Unemployment_z")],
                   n = 15,
                   graph = FALSE)
```

```
## $hopkins_stat
## [1] 0.5375423
##
## $plot
## NULL
```

We can perform clustering based on the chosen variables (H>0.5).

Hierarchical clustering with Ward's algorithm

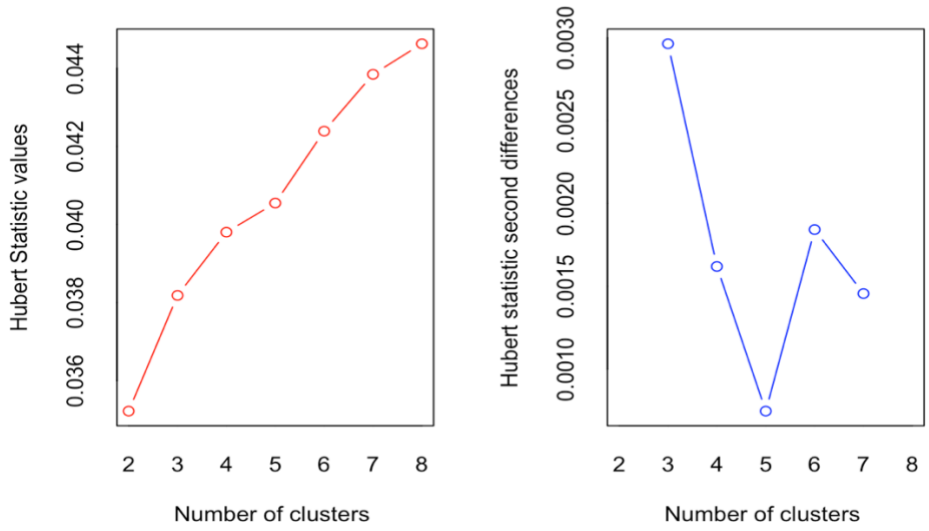
```
WARD <- data[c("Gov_debt_z", "Inflation_z", "IR_z", "Old_age_z", "Unemplo
yment_z")] %>%
  get_dist(method = "euclidean") %>%
  hclust(method = "ward.D2")


WARD
```

```
##
```

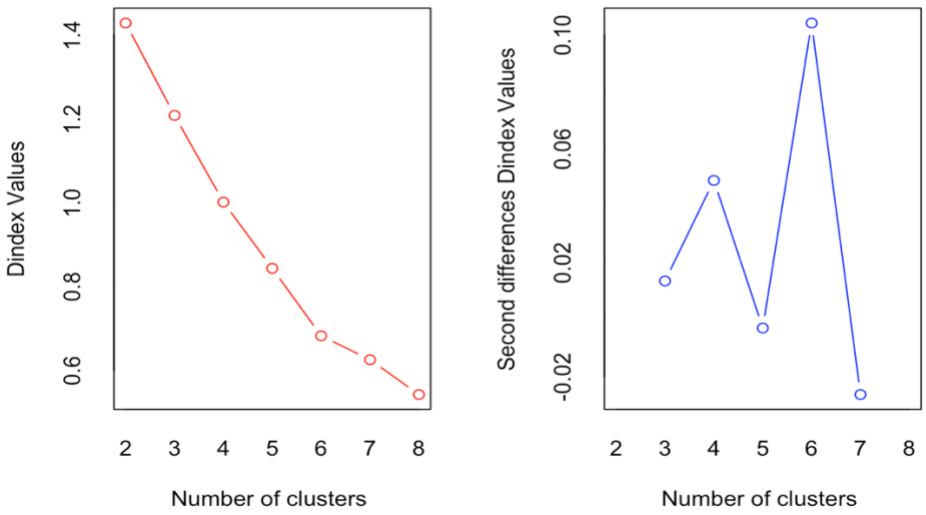
```
## Call:
## hclust(d = ., method = "ward.D2")
##
## Cluster method   : ward.D2
## Distance         : euclidean
## Number of objects: 16
```

Optimal nubmer of clusters

```
set.seed(1)
library(NbClust)
OptNumber <- data[c("Gov_debt_z", "Inflation_z", "IR_z", "Old_age_z", "Un
employment_z")] %>%
  NbClust(distance = "euclidean",
          min.nc = 2, max.nc = 8,
          method = "ward.D2",
          index ="all")
```

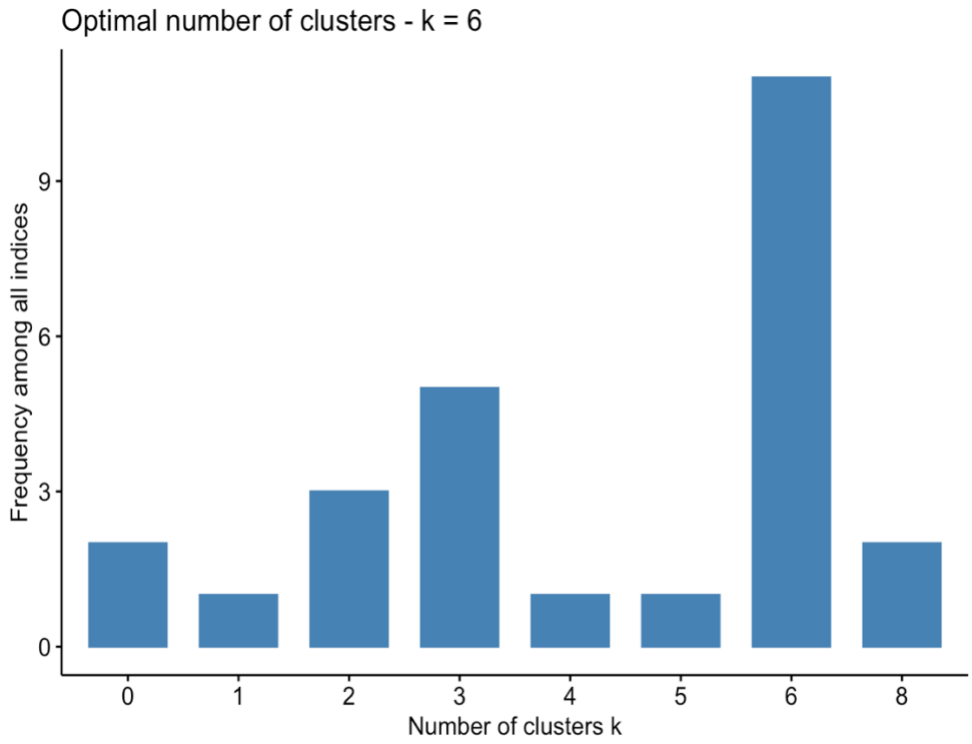



```
## *** : The Hubert index is a graphical method of determining the number
of clusters.
##                 In the plot of Hubert index, we seek a significant kne
e that corresponds to a
##                 significant increase of the value of the measure i.e t
he significant peak in Hubert
##                 index second differences plot.
##
```



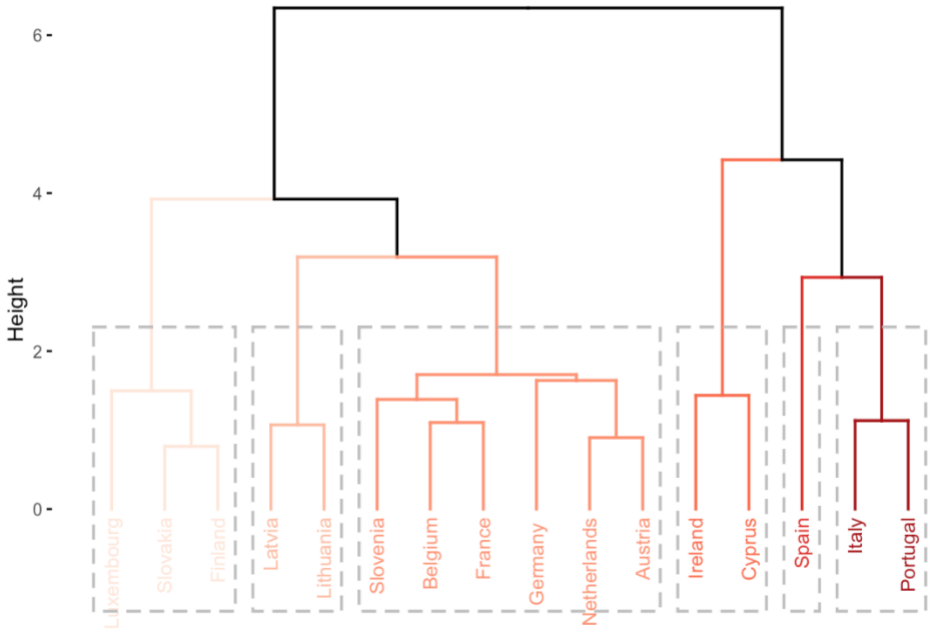

```
## *** : The D index is a graphical method of determining the number of c
lusters.
##                  In the plot of D index, we seek a significant knee (th
e significant peak in Dindex
##                  second differences plot) that corresponds to a signifi
cant increase of the value of
##                  the measure.
##
## *******************************************************************
## * Among all indices:
## * 3 proposed 2 as the best number of clusters
## * 5 proposed 3 as the best number of clusters
## * 1 proposed 4 as the best number of clusters
## * 1 proposed 5 as the best number of clusters
## * 11 proposed 6 as the best number of clusters
## * 2 proposed 8 as the best number of clusters
##
##                     ***** Conclusion *****
##
## * According to the majority rule, the best number of clusters is  6
##
##
## *******************************************************************
fviz_nbclust(OptNumber, ggtheme = theme_minimal())
## Warning in if (class(best_nc) == "numeric") print(best_nc) else if
```

```
## (class(best_nc) == : the condition has length > 1 and only the first
## element will be used
## Warning in if (class(best_nc) == "matrix") .viz_NbClust(x,
## print.summary, : the condition has length > 1 and only the first
## element will be used
## Warning in if (class(best_nc) == "numeric") print(best_nc) else if
## (class(best_nc) == : the condition has length > 1 and only the first
## element will be used
## Warning in if (class(best_nc) == "matrix") {: the condition has length
## > 1 and only the first element will be used
## Among all indices:
## ===================
## * 2 proposed  0 as the best number of clusters
## * 1 proposed  1 as the best number of clusters
## * 3 proposed  2 as the best number of clusters
## * 5 proposed  3 as the best number of clusters
## * 1 proposed  4 as the best number of clusters
## * 1 proposed  5 as the best number of clusters
## * 11 proposed  6 as the best number of clusters
## * 2 proposed  8 as the best number of clusters
##
## Conclusion
## =========================
## * According to the majority rule, the best number of clusters is  6 .
```



Dendrogram

```
library(factoextra)
WARD$labels <- data$Country
Dendrogram <- fviz_dend(WARD, k = 6,
          main = "",
          cex = 0.7,
          palette = c("Reds"),
          color_labels_by_k = TRUE,
          rect = TRUE,
          show_labels = TRUE)
plot(Dendrogram)
```



Cutting the tree

```
data$ClusterWard <- cutree(WARD,
                           k = 6)
head(data)
```

```
##    Country Government_debt Inflation_rate Interest_rate
## 1  Belgium          102.85            1.6           0.3
## 2 Germany           72.68            1.3          -0.1
## 3  Ireland           85.54            0.2           3.1
## 5    Spain           86.95            1.1           2.0
## 6   France           92.95            1.2           0.6
## 7    Italy          129.37            1.2           2.1
##   Old_age_dependency Unemployment_rate Saving_rate Gov_debt_z
## 1              27.45              7.52       13.81  0.6201045
## 2              31.87              5.02       17.47 -0.1894597
## 3              18.97             10.88       10.95  0.1556180
## 5              26.97             20.26        7.62  0.1934531
## 6              28.50              9.56       14.53  0.3544536
## 7              33.18             10.51       10.75  1.3317266
##   Inflation_z       IR_z  Old_age_z Unemployment_z Dissimilarity
## 1  0.70765494 -0.6887548  0.2716613    -0.57935212     1.3300891
## 2  0.01360875 -0.8768485  1.2219699    -1.13080710     1.8912638
```

```
## 3 -2.53122729  0.6279010 -1.5515552     0.16180338     3.0428756
## 5 -0.44908871  0.1106433  0.1684603     2.23086248     2.2926999
## 6 -0.21773998 -0.5476846  0.4974133    -0.12936485     0.8585812
## 7 -0.21773998  0.1576668  1.5036224     0.08018804     2.0280719
##   ClusterWard
## 1           1
## 2           1
## 3           2
## 5           3
## 6           1
## 7           4
```

Optimization with non-hierarchical clustering

```
InitialLeaders <- aggregate(data[, c("Gov_debt_z", "Inflation_z", "IR_z",
"Old_age_z", "Unemployment_z")],
                            by = list(data$ClusterWard),
                            FUN = mean)


InitialLeaders
##   Group.1  Gov_debt_z Inflation_z        IR_z  Old_age_z
## 1       1 -0.02769892   0.3606318 -0.63389419  0.3598121
## 2       2  0.18741562  -1.8371811  0.74545956 -1.4042789
## 3       3  0.19345314  -0.4490887  0.11064335  0.1684603
## 4       4  1.20936626  -0.4490887  0.53385416  1.1993947
## 5       5 -1.09830749   1.1703524  0.06361993  0.4683881
## 6       6 -1.01834391   0.5534225 -0.68875485 -1.3293865
##   Unemployment_z
## 1     -0.7558177
## 2      0.1463626
## 3      2.2308625
## 4      0.1860674
## 5      0.2908438
## 6     -0.4072982
```

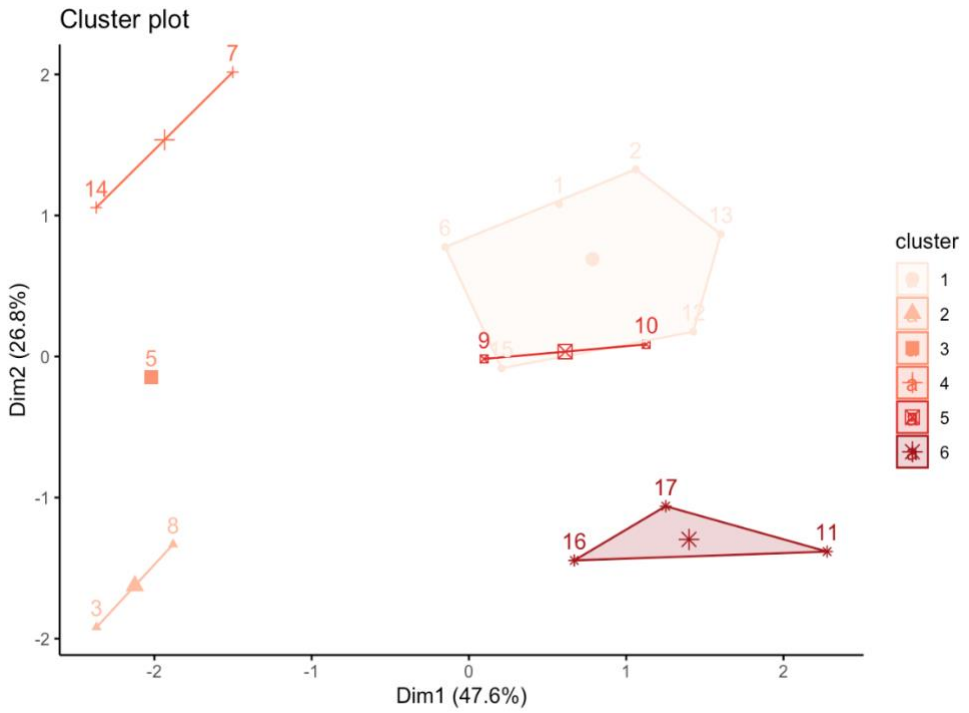
Running K_means cluster (non-hierarchical)

```
library(factoextra)
K_MEANS <- hkmeans(data[c("Gov_debt_z", "Inflation_z", "IR_z", "Old_age_z
", "Unemployment_z")],
                   k = 6,
                   hc.metric = "euclidean",
                   hc.method = "ward.D2")


K_MEANS
```

```
## Hierarchical K-means clustering with 6 clusters of sizes 6, 2, 1, 2, 2
, 3
##
## Cluster means:
##    Gov_debt_z Inflation_z        IR_z  Old_age_z Unemployment_z
## 1 -0.02769892   0.3606318 -0.63389419  0.3598121     -0.7558177
## 2  0.18741562  -1.8371811  0.74545956 -1.4042789      0.1463626
## 3  0.19345314  -0.4490887  0.11064335  0.1684603      2.2308625
## 4  1.20936626  -0.4490887  0.53385416  1.1993947      0.1860674
## 5 -1.09830749   1.1703524  0.06361993  0.4683881      0.2908438
## 6 -1.01834391   0.5534225 -0.68875485 -1.3293865     -0.4072982
##
## Clustering vector:
##  1  2  3  5  6  7  8  9 10 11 12 13 14 15 16 17
##  1  1  2  3  1  4  2  5  5  6  1  1  4  1  6  6
##
## Within cluster sum of squares by cluster:
## [1] 4.7490216 1.0369199 0.0000000 0.6275524 0.5681082 1.4364167
##  (between_SS / total_SS =  84.8 %)
##
## Available components:
##
##  [1] "cluster"      "centers"      "totss"        "withinss"
##  [5] "tot.withinss" "betweenss"    "size"         "iter"
##  [9] "ifault"       "data"         "hclust"
```

Cluster plot

```
fviz_cluster(K_MEANS,
             palette = "Reds",
             repel = FALSE,
             ggtheme = theme_classic())
```



Assigning the solution of k-means clustering to data frame

```
data$ClusteringK_MEANS <- K_MEANS$cluster
head(data)
```

```
##    Country Government_debt Inflation_rate Interest_rate
## 1  Belgium          102.85            1.6           0.3
## 2 Germany            72.68            1.3          -0.1
## 3  Ireland           85.54            0.2           3.1
## 5    Spain           86.95            1.1           2.0
## 6   France           92.95            1.2           0.6
## 7    Italy          129.37            1.2           2.1
##   Old_age_dependency Unemployment_rate Saving_rate Gov_debt_z
## 1              27.45              7.52       13.81  0.6201045
## 2              31.87              5.02       17.47 -0.1894597
## 3              18.97             10.88       10.95  0.1556180
## 5              26.97             20.26        7.62  0.1934531
```

```
## 6              28.50              9.56       14.53  0.3544536
## 7              33.18             10.51       10.75  1.3317266
##   Inflation_z       IR_z  Old_age_z Unemployment_z Dissimilarity
## 1  0.70765494 -0.6887548  0.2716613    -0.57935212     1.3300891
## 2  0.01360875 -0.8768485  1.2219699    -1.13080710     1.8912638
## 3 -2.53122729  0.6279010 -1.5515552     0.16180338     3.0428756
## 5 -0.44908871  0.1106433  0.1684603     2.23086248     2.2926999
## 6 -0.21773998 -0.5476846  0.4974133    -0.12936485     0.8585812
## 7 -0.21773998  0.1576668  1.5036224     0.08018804     2.0280719
##   ClusterWard ClusteringK_MEANS
## 1           1                 1
## 2           1                 1
## 3           2                 2
## 5           3                 3
## 6           1                 1
## 7           4                 4
```

Final centroids

```
Centroids <- K_MEANS$centers
Centroids
##    Gov_debt_z Inflation_z        IR_z  Old_age_z Unemployment_z
## 1 -0.02769892   0.3606318 -0.63389419  0.3598121     -0.7558177
## 2  0.18741562  -1.8371811  0.74545956 -1.4042789      0.1463626
## 3  0.19345314  -0.4490887  0.11064335  0.1684603      2.2308625
## 4  1.20936626  -0.4490887  0.53385416  1.1993947      0.1860674
## 5 -1.09830749   1.1703524  0.06361993  0.4683881      0.2908438
## 6 -1.01834391   0.5534225 -0.68875485 -1.3293865     -0.4072982
```

Showing where each object is under both classifications

```
table(data$ClusterWard)
##
## 1 2 3 4 5 6
## 6 2 1 2 2 3
table(data$ClusteringK_MEANS)
##
## 1 2 3 4 5 6
```

```
## 6 2 1 2 2 3
```

```
table(data$ClusterWard, data$ClusteringK_MEANS)
```

```
##
##      1 2 3 4 5 6
##    1 6 0 0 0 0 0
##    2 0 2 0 0 0 0
##    3 0 0 1 0 0 0
##    4 0 0 0 2 0 0
##    5 0 0 0 0 2 0
##    6 0 0 0 0 0 3
```

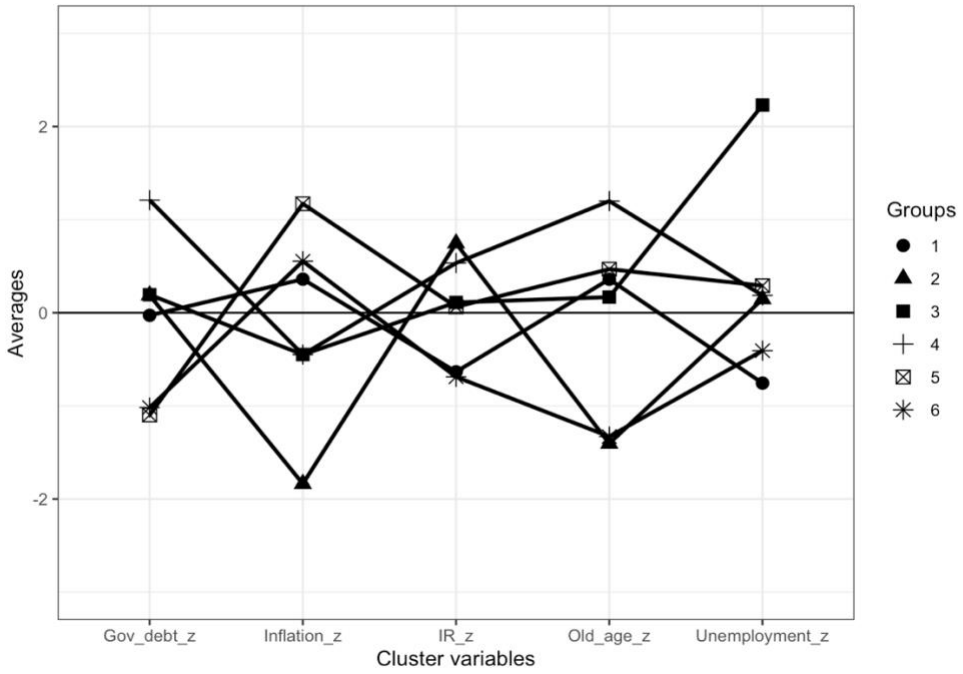
Eplanation of results

```
library(ggplot2)
library(tidyr)
```

```
##
## Attaching package: 'tidyr'
## The following object is masked from 'package:magrittr':
##
##     extract
```

```
Figure <- as.data.frame(Centroids)
Figure$id <- 1:nrow(Figure)
Figure <- pivot_longer(Figure, cols = c(Gov_debt_z, Inflation_z, IR_z, Old_age_z, Unemployment_z))


Figure$Groups <- factor(Figure$id,
                        levels = c(1, 2, 3, 4 , 5, 6),
                        labels = c("1", "2", "3", "4", "5", "6"))


Figure$nameFactor <- factor(Figure$name,
                            levels = c("Gov_debt_z", "Inflation_z", "IR_z", "Old_age_z", "Unemployment_z"),
                            labels = c("Gov_debt_z", "Inflation_z", "IR_z", "Old_age_z", "Unemployment_z"))


ggplot(Figure, aes(x = nameFactor, y = value)) +
  geom_hline(yintercept = 0) +
  theme_bw() +
  geom_point(aes(shape=Groups), size=3) +
```

```
  geom_line(aes(group = id), size=1) +
  ylab("Averages") +
  xlab("Cluster variables")+
  ylim(-3, 3)
```



Checking if all clustering variables discriminate between groups

```
fit <- manova(cbind(Gov_debt_z, Inflation_z, IR_z, Old_age_z, Unemploymen
t_z) ~ as.factor(ClusteringK_MEANS),
              data = data)


summary(fit)
```

```
##                               Df Pillai approx F num Df den Df
## as.factor(ClusteringK_MEANS)  5  3.485   4.6006     25     50
## Residuals                     10
##                                  Pr(>F)
## as.factor(ClusteringK_MEANS) 2.237e-06 ***
## Residuals
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
summary.aov(fit)
```

```
##  Response 1 :
##                               Df Sum Sq Mean Sq F value    Pr(>F)
## as.factor(ClusteringK_MEANS)  5 8.1917 1.63835  10.708 0.0009176 ***
```

```
## Residuals                    10 1.5301 0.15301
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##  Response 2 :
##                              Df  Sum Sq Mean Sq F value   Pr(>F)
## as.factor(ClusteringK_MEANS)  5 11.7124 2.34249    8.08 0.002752 **
## Residuals                    10  2.8991 0.28991
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##  Response 3 :
##                              Df Sum Sq Mean Sq F value   Pr(>F)
## as.factor(ClusteringK_MEANS)  5 4.9456 0.98912  9.6963 0.001362 **
## Residuals                    10 1.0201 0.10201
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##  Response 4 :
##                              Df  Sum Sq Mean Sq F value    Pr(>F)
## as.factor(ClusteringK_MEANS)  5 13.2865 2.65730  19.719 6.892e-05 ***
## Residuals                    10  1.3476 0.13476
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##  Response 5 :
##                              Df Sum Sq Mean Sq F value   Pr(>F)
## as.factor(ClusteringK_MEANS)  5 8.8585 1.77171  10.929 0.000845 ***
## Residuals                    10 1.6211 0.16211
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

All highly statistically significant (P<0.05). All variables discriminate between groups.

Statistics - gross household saving rate

```
library(psych)
##
## Attaching package: 'psych'
## The following object is masked from 'package:Hmisc':
##
##     describe
## The following objects are masked from 'package:ggplot2':
##
##     %+%, alpha
describeBy(data$Saving_rate, data$ClusteringK_MEANS)
##
##  Descriptive statistics by group
## group: 1
##    vars n  mean   sd median trimmed  mad   min   max range skew
## X1    1 6 14.55 1.91  14.17   14.55 1.71 12.01 17.47  5.46 0.23
##    kurtosis   se
## X1    -1.52 0.78
## ------------------------------------------------------
## group: 2
##    vars n mean   sd median trimmed  mad  min   max range skew
## X1    1 2 6.76 5.93   6.76    6.76 6.21 2.57 10.95  8.38    0
##    kurtosis   se
## X1    -2.75 4.19
## ------------------------------------------------------
## group: 3
##    vars n mean sd median trimmed mad  min  max range skew kurtosis se
## X1    1 1 7.62 NA   7.62    7.62   0 7.62 7.62     0   NA       NA NA
## ------------------------------------------------------
## group: 4
##    vars n mean   sd median trimmed  mad  min   max range skew
## X1    1 2 9.46 1.82   9.46    9.46 1.91 8.17 10.75  2.58    0
##    kurtosis   se
## X1    -2.75 1.29
## ------------------------------------------------------
## group: 5
```

```
##    vars n mean   sd median trimmed  mad  min  max range skew kurtosis
## X1    1 2 3.38 0.84   3.38    3.38 0.88 2.79 3.98  1.19    0    -2.75
##     se
## X1 0.6
## ------------------------------------------------------
## group: 6
##    vars n  mean   sd median trimmed  mad  min   max range skew
## X1    1 3 12.17 7.02   8.26   12.17 0.43 7.97 20.27  12.3 0.38
##    kurtosis   se
## X1    -2.33 4.05
```

Statistics - gross government debt as % of GDP

```
describeBy(data$Government_debt, data$ClusteringK_MEANS)
```

```
##
##  Descriptive statistics by group
## group: 1
##    vars n  mean    sd median trimmed   mad   min    max range skew
## X1    1 6 78.71 16.75  76.47   78.71 21.82 60.39 102.85 42.46 0.24
##    kurtosis   se
## X1    -1.83 6.84
## ------------------------------------------------------
## group: 2
##    vars n  mean   sd median trimmed  mad   min   max range skew
## X1    1 2 86.72 1.68  86.72   86.72 1.76 85.54 87.91  2.37    0
##    kurtosis   se
## X1    -2.75 1.18
## ------------------------------------------------------
## group: 3
##    vars n  mean sd median trimmed mad   min   max range skew kurtosis
## X1    1 1 86.95 NA  86.95   86.95   0 86.95 86.95     0   NA       NA
##    se
## X1 NA
## ------------------------------------------------------
## group: 4
##    vars n   mean   sd median trimmed  mad    min    max range skew
## X1    1 2 124.81 6.45 124.81  124.81 6.76 120.25 129.37  9.12    0
##    kurtosis   se
```

```
## X1    -2.75 4.56
## ------------------------------------------------------
## group: 5
##    vars n  mean   sd median trimmed  mad   min   max range skew
## X1    1 2 38.81 2.04  38.81   38.81 2.13 37.37 40.25  2.88    0
##    kurtosis   se
## X1    -2.75 1.44
## ------------------------------------------------------
## group: 6
##    vars n  mean    sd median trimmed   mad   min   max range  skew
## X1    1 3 41.79 18.35  48.59   41.79 10.65 21.01 55.77 34.76 -0.32
##    kurtosis    se
## X1    -2.33 10.59
```

Statistics - HICP inflation rate

```
describeBy(data$Inflation_rate, data$ClusteringK_MEANS)
##
##  Descriptive statistics by group
## group: 1
##    vars n mean   sd median trimmed  mad min max range skew kurtosis
## X1    1 6 1.45 0.23    1.4    1.45 0.22 1.2 1.8   0.6 0.35    -1.69
##      se
## X1 0.09
## ------------------------------------------------------
## group: 2
##    vars n mean   sd median trimmed  mad min max range skew kurtosis
## X1    1 2  0.5 0.42    0.5     0.5 0.44 0.2 0.8   0.6    0    -2.75
##     se
## X1 0.3
## ------------------------------------------------------
## group: 3
##    vars n mean sd median trimmed mad min max range skew kurtosis se
## X1    1 1  1.1 NA    1.1     1.1   0 1.1 1.1     0   NA       NA NA
## ------------------------------------------------------
## group: 4
##    vars n mean   sd median trimmed  mad min max range skew kurtosis
## X1    1 2  1.1 0.14    1.1     1.1 0.15   1 1.2   0.2    0    -2.75
```

```
##     se
## X1 0.1
## ------------------------------------------------------
## group: 5
##    vars n mean   sd median trimmed mad min max range skew kurtosis
## X1    1 2  1.8 0.28    1.8     1.8 0.3 1.6   2   0.4    0    -2.75
##     se
## X1 0.2
## ------------------------------------------------------
## group: 6
##    vars n mean   sd median trimmed mad min max range skew kurtosis
## X1    1 3 1.53 0.06    1.5    1.53   0 1.5 1.6   0.1 0.38    -2.33
##      se
## X1 0.03
```

Statistics - Real long-term interest rate

```
describeBy(data$Interest_rate, data$ClusteringK_MEANS)
```

```
##
##  Descriptive statistics by group
## group: 1
##    vars n mean   sd median trimmed  mad  min max range skew kurtosis
## X1    1 6 0.42 0.68    0.2    0.42 0.44 -0.1 1.7   1.8 0.95     -0.8
##      se
## X1 0.28
## ------------------------------------------------------
## group: 2
##    vars n mean   sd median trimmed  mad min max range skew kurtosis
## X1    1 2 3.35 0.35   3.35    3.35 0.37 3.1 3.6   0.5    0    -2.75
##      se
## X1 0.25
## ------------------------------------------------------
## group: 3
##    vars n mean sd median trimmed mad min max range skew kurtosis se
## X1    1 1    2 NA      2       2   0   2   2     0   NA       NA NA
## ------------------------------------------------------
## group: 4
##    vars n mean   sd median trimmed  mad min max range skew kurtosis
```

```
## X1    1 2  2.9 1.13    2.9     2.9 1.19 2.1 3.7   1.6    0    -2.75
##     se
## X1 0.8
## ------------------------------------------------------
## group: 5
##    vars n mean   sd median trimmed  mad min max range skew kurtosis
## X1    1 2  1.9 0.57    1.9     1.9 0.59 1.5 2.3   0.8    0    -2.75
##     se
## X1 0.4
## ------------------------------------------------------
## group: 6
##    vars n mean   sd median trimmed mad  min max range skew kurtosis
## X1    1 3  0.3 0.53    0.1     0.3 0.3 -0.1 0.9     1 0.32    -2.33
##      se
## X1 0.31
```

Statistics - Old-age-dependency ratio

```
describeBy(data$Old_age_dependency, data$ClusteringK_MEANS)
```

```
##
##  Descriptive statistics by group
## group: 1
##    vars n  mean   sd median trimmed  mad   min   max range skew
## X1    1 6 27.86 2.15  27.22   27.86 1.55 26.05 31.87  5.82 0.91
##    kurtosis   se
## X1    -0.85 0.88
## ------------------------------------------------------
## group: 2
##    vars n  mean   sd median trimmed  mad   min   max range skew
## X1    1 2 19.66 0.97  19.66   19.66 1.02 18.97 20.34  1.37    0
##    kurtosis   se
## X1    -2.75 0.69
## ------------------------------------------------------
## group: 3
##    vars n  mean sd median trimmed mad   min   max range skew kurtosis
## X1    1 1 26.97 NA  26.97   26.97   0 26.97 26.97     0   NA       NA
##    se
## X1 NA
```

```
## ------------------------------------------------
## group: 4
##    vars n  mean sd median trimmed mad   min   max range skew kurtosis
## X1    1 2 31.76  2  31.76   31.76 2.1 30.35 33.18  2.83    0    -2.75
##      se
## X1 1.41
## ------------------------------------------------
## group: 5
##    vars n  mean   sd median trimmed  mad   min   max range skew
## X1    1 2 28.37 0.81  28.37   28.37 0.85 27.79 28.94  1.15    0
##    kurtosis   se
## X1    -2.75 0.58
## ------------------------------------------------
## group: 6
##    vars n mean   sd median trimmed  mad   min   max range  skew
## X1    1 3   20 0.46  20.03      20 0.62 19.53 20.45  0.92 -0.06
##    kurtosis   se
## X1    -2.33 0.27
```

Statistics - Unemployment rate

```
describeBy(data$Unemployment_rate, data$ClusteringK_MEANS)
```

```
##
##  Descriptive statistics by group
## group: 1
##    vars n mean  sd median trimmed  mad  min  max range skew kurtosis
## X1    1 6 6.72 1.8   6.48    6.72 1.76 5.02 9.56  4.54 0.39     -1.7
##      se
## X1 0.74
## ------------------------------------------------
## group: 2
##    vars n  mean  sd median trimmed mad   min   max range skew
## X1    1 2 10.81 0.1  10.81   10.81 0.1 10.74 10.88  0.14    0
##    kurtosis   se
## X1    -2.75 0.07
## ------------------------------------------------
## group: 3
##    vars n  mean sd median trimmed mad   min   max range skew kurtosis
```

```
## X1    1 1 20.26 NA  20.26   20.26   0 20.26 20.26     0   NA       NA
##    se
## X1 NA
## ------------------------------------------------------
## group: 4
##    vars n  mean   sd median trimmed  mad   min   max range skew
## X1    1 2 10.99 0.68  10.99   10.99 0.71 10.51 11.47  0.96    0
##    kurtosis   se
## X1    -2.75 0.48
## ------------------------------------------------------
## group: 5
##    vars n  mean   sd median trimmed mad   min   max range skew
## X1    1 2 11.46 0.86  11.46   11.46 0.9 10.86 12.07  1.21    0
##    kurtosis   se
## X1    -2.75 0.61
## ------------------------------------------------------
## group: 6
##    vars n mean   sd median trimmed  mad  min   max range skew
## X1    1 3  8.3 2.82   8.17     8.3 3.88 5.55 11.18  5.63 0.05
##    kurtosis   se
## X1    -2.33 1.63
```