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OF ECONOMICS
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**“The effects of the sovereign bond in the
banking activity:
The case of Greece”**

by

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CERTIFICATION OF THESIS PREPARATION

“I hereby declare that this particular thesis has been written by me, in order to obtain the Postgraduate Degree in Accounting and Finance, and has not been submitted to or approved by any other postgraduate or undergraduate program in Greece or abroad. This thesis presents my personal views on the subject. All the sources I have used for the preparation of this particular thesis are mentioned explicitly with references being made either to their authors, or to the URL’s (if found on the internet).”

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Executive Summary

Much attention has been given to the recent surge in sovereign bond yields in the euro area. Greece is the country to present the higher spread. While the spread of ten-year bond yield against Germany averaged 25 basis points between the introduction of the euro in 2002 to 2007, it rose sharply during the financial crisis. Greek government bonds are now traded with spreads over the German Bund previously associated with emerging market debt.

In this thesis we seek to understand the fluctuations of the spread between the Greek and the German 10 year bonds and examine if the spread affects the activity of the banking sector. Although the financial crisis in the case of Greece was triggered by the sovereign deficit, the banking activity could not stay unharmed. We argue that banking and sovereign risk has become increasingly interconnected. The adoption of rescue packages for the financial sector highlights the relationship between them. The spread will allow us to gauge the pass through tensions.

Most people would agree that in good economic times the banking sector operates as a beneficial source of revenue for the government and a driver of economic growth. While the government faces fiscal deficits, the aggregate risk increases and banks are immediately absorbing the sovereign risk in several ways. The price channel, the balance sheet channel and the liquidity channel are the primarily channels to be affected by the sovereign spread tensions. Of course, the pass through tensions differ among the banks in response to the diversification, the business models and lending strategies they follow.

In the case of Greece, the omens for development and progress came to halt when the crisis showed the unstable fundamentals and the deficit of the economy reached its peak leading the country no other solution but to ask for rescue packages. A display of the main events since the entrance of Greece in the euro-zone and the outburst of the financial crisis helps us explain the main channels suggested for the transmission of government bond market in the Greek environment. We will explain them in an aggregate level. The reformulation of the banking sector does not allow us yet to investigate it among the Greek banks.

Econometrically, I use the 10-year spread of the Greek bonds vs their German counterparts as an explanatory variable on a wide array of bank lending and funding interest rates. Different time horizons of interest rates are exploited to assess to what extent the transmission of sovereign risk differ in relation with the investment horizon. Regarding the cost of loans, the sovereign spread significantly affects firms. In households the tensions are passed through only when we use a dummy to gauge for sovereign crisis. In the liability side, the spread has an effect in the deposit rates but slighter than its effect in the lending rates. Overall, the financial crisis affected the deposit interest rates by turning the effect of the spread negative. Surprisingly, the spread of overnight firms' deposits show positive impact during crisis.

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1. Introduction

The European sovereign debt crisis and its aftermath have renewed the debate on the role that sovereign risk plays on financial activity. The sovereign-bank nexus has received considerable attention in light of the sovereign distress wave that followed the 2007-2009 financial crisis. This attention was widely interpreted using the Greek bail out as a primarily event causing chain reactions among the interconnected by their common currency euro-zone countries.

To contribute to the current debate, this thesis analyzes the sovereign deficit implications on the banking sector focusing in the case of Greece. Greece is an especially good case for assessing the impacts of country risk on the lending and deposits interest rates. First, the high level of public debt led Greece to the hill of bankruptcy. The yield spread of the government bond rose to unprecedented levels. On April 23, 2010 the prime minister requested financial aid from the European Union (EU) and the International Monetary Fund (IMF). Greece was the first country to enter a bail-out program and continues to be under the third one until today. Second, the domestic banking sector was relatively healthy until the deterioration of government borrowing conditions. Afterwards substantial economic injections occurred from the government to support the banking sector, which had weakened substantially. Third, Greece is the only euro-country that activated capital controls as a measure to control the flows in the banking activity.

Governments create debt by issuing bonds. The difference between the bond prices in respectively finance instruments in the secondary market is the so-called yield spread. There is a consensus among researchers that there are four main factors driving the government yields (i) exchange rate risk, (ii) tax treatments and capital controls, (iii) liquidity and (iv) default risk. The European Monetary Union (EMU) eliminated once and for all the exchange rate risk within the new currency area. The effect of each characteristic of the bond yields is neither stable over time nor the same for euro area countries. The credit agencies grade the government bonds in response to their individual characteristics. The demand for sovereign bonds among euro-zone was thoroughly examined from the early '00s since member countries change their nature of sovereign debt in a fundamental way; that is, they cease to have control over the currency in which their debt is issued.

In the euro area the establishment of EMU in 1999 was a milestone on the road to more integrated financial markets. The financial crisis triggered in the middle of 2007 by the mortgage bubble in the United States was the first the EU had to cope since the introduction of the common monetary policy. Progressively credit condition was distorted leading to a raise in the interbank cost of funding. The European Central Bank conducted monetary policy with its main focus to rescue "Euro". The limited liquidity for interbank lending surged the need for safe instruments used as collaterals for the transactions. The sovereign bonds in developed countries are widely used as

collateral to interbank transactions. During the crisis, though, these instruments were prohibitive to use to some euro-zone countries, such as Greece, intensifying the lack of liquidity.

The financial institutions hold a multi-level agenda but their primary activity depends mainly in two categories, the deposits and the loans. The first one is the liabilities the bank has towards its depositors, to safeguard and repay the amount plus interest, and the latter one are the assets, to collect the amount borrowed plus its interest. The financial crisis has disrupted the upward trend that prevailed in both sectors since the entrance in the euro-zone.

When a country cannot repay its obligation towards its debt holders the sovereign risk increases and is also passed to the banking sector. The sovereign risk is transmitted to the banks via a number of different channels. There is a negative feedback loop among sovereign spreads, sovereign ratings and bank ratings. Besides a country's credit downgrade, the level of capitalization, the reliance on (un)stable funding sources, the quality of the loan portfolios are some balance sheet based characteristics to intensify the effect of the sovereign risk. Moreover, via liquidity factors the sovereign spreads pass their tensions to the banks.

In my econometric analysis I will estimate regression equations for the main banking activities, lending and interest rates on deposits. The 10 year spread between Greek and German bonds shows up as an additional explanatory variable next to the standard macroeconomic determinants identified in the literature. The yield spread with the German bund has been extensively used in the recent literature as a proxy to gauge the risk premium demanded by investors for holding government securities within the euro-zone. My main model includes two dummies to check for potential non-linear effects of the 10 year spread. The first dummy accounts since the entrance of Greece in the bail-out program and the second one since the implementation of the capital controls. The dataset is based on quarterly data from 2003 to 2016. The implementation of different time spans will add in explaining how the spread affected the interest rates in the short-term and in the long-term. To examine the impact of the yield spread on interest rates we employ an autoregressive distributed lags model (ARDL). This model has been extensively used to study the transmission of monetary policy shocks (Cottarelli and Kourelis 1994; Albetrazzi et al. 2012; Neri 2013).

My main results for the Greek banking system can be summarized as follows. The econometric analysis set out here shows that sovereign debt tensions have had an impact on banking activity lending rates. The results are in line with Neri (2013), who showed that the peripheral countries, which include Greece, absorbed the shock of the yield spreads. Regarding loans on firms, the spread is statistically significant for all the different time horizons. We find that the significant effect is stronger during the period of crisis in Greece as opposed to normal times. For the lending rates provided to households for house purchase the spread is not significant if we do not include the dummy time variables to gauge for the sovereign deficit and the capital controls.

When the dummies are incorporated in the regression the presence of non-linearity tensions between the interest rates and the spread becomes apparent. The capital controls seem to play a significant and negative role in the interest rates for house purchases.

Finally, for interest rates in deposits, we show that the overnight deposits of households are not affected by the spread. The spread affects positively though the firms overnight deposits. In the total interest rates the positive and significant effect of the spread turns negative when it interacts with the dummy counting for the financial crisis. The results are in line for both firms and households. The implementation of capital controls does not show any significant effect in the deposits interest rates overall.

The rest of the thesis is organized as follows. Section 2 reviews the growing literature and theoretical background by examining the sovereign crisis and its implications in the banking activity. Section 3 presents a timeline of the events from the entrance of Greece in the Eurozone until now. Section 4 describes our dataset, presents an empirical analysis in the case of Greece and then shows the methodology applied in the econometrical analysis. Section 5 provides the results for non-financial corporations and households and interprets them. Finally, section 6, draws some tentative conclusions and presents some thoughts for further research in the future.

2. Literature and theoretical background

The EMU signaled a new era for the economic and monetary life in the Eurozone. The Eurozone countries started sharing a common currency. Based only in the “strong” currency the first years of the union they charged the same risk premium in the sovereign bonds. The financial crisis erupted in the United States and the Lehman Brothers default triggered a domino of events worldwide. Europe was not an exception and the effects shook the fundamentals of the union.

There is a large literature on the behavior of euro area government bond yields. Beber et al. (2009) use data from pre-crisis euro-area sovereign bond markets. They find that credit quality matters for the valuation of bonds but that liquidity matters for investment decisions in periods of financial stress. Ehrmann et al. (2011a), argues that the early years of monetary union have been characterized by a strong convergence in yields, both in terms of their levels and their responsiveness to new information. Bai et al (2012) study the period since 2006 and find that, during the early part of the crisis, liquidity risk mattered for bond spreads but, during the later stages of the crisis, credit risk mattered. De Grauwe and Yi (2012) argue that government bonds in the euro area were mispriced. Beirne and Fratzscher, (2013); D’Agostino and Ehrmann (2014) with hindsight and using data following the global financial crisis, state that, prior to 2008, government bond markets were barely pricing credit default risk, and accordingly were largely unresponsive to a country’s fundamentals.

Over the last decade a strand of literature deals with market fragmentation and country’s fundamentals to explain the contagion of the crisis. Brutti and Saure(2015) assess the role of financial linkages for the transmission of sovereign risk in Euro crisis and their results indicate that cross-border financial exposures constitute important transmissions channels. Ehrmann and Fratzscher(2015) show that there was a substantial fragmentation across national sovereign bond markets since the beginning of the European sovereign debt crisis in 2010. Arghyrou and Kontonikas, (2012); Giordano et al., (2013) claim that countries with poor fundamentals faced a dangerously boost in their yields, a pattern that has been identified as “wake-up call” contagion. Bruha and Kocenda (2017), are in line with the “wake up call” hypothesis and their survey conclude to the most significant bank-specific variables associated with the increased sovereign risk. The size and the stability are significant but cannot overcome the importance of the level of the non-performing loans held by a bank.

The typical thought that government bonds are a safe investment held by a bank to minimize their exposure to adverse liquidity and asset price shocks was reassessed after the crisis. The European sovereign debt crisis has shown severe negative feedback loops between sovereign stress and risk in the banking sector. Neri and Ropele(2015) study the macroeconomic effects of the sovereign debt in the euro-area. They show that both core and peripheral countries faced significant effects in the cost

of new loans and a contraction in credit, which has affected particularly the latter ones. Buch, Koetter and Ohls (2013) analyze the effect of sovereign bond in bank risks in German banks. In Germany as they argue there has been no marked impact of sovereign bond hold on bank risk. Angeloni and Wolff (2012) analyze the impact of sovereign bond holdings on banks' share prices. They find that the effects of banks' sovereign debt holdings vary depending on the period: Greek sovereign debt affected banks' market values between July and October 2011 but not after October 2011. Albetrazzi et al.(2014) examine the implications of the sovereign debt tension on the Italian credit market. Their results show that there is evidence of transmission during the high level spreads of the sovereign bond both to the deposits and the loans of the banking system. They also analyze that the effect differs based on the size of the bank.

Inevitably the financial crisis revealed the need for an improved understanding on the linkages between sovereign risk and banking activity. The literature is broadly investigating the factors in the Euro-zone countries based in country specifics, in the fragmentation, the mispriced bond yields and the way tension were passed from one country to another. Greece was the first country to ask for a rescue package and more followed. Thus it is considered as the pioneer of the European crisis. To my knowledge though there is limited research for the effect of the sovereign bond to the Greek banking sector, which corresponds only to lending rates. My intention is to establish the conditions that prevailed during the period of crisis in Greece, explore the effects of the sovereign spread in lending rates including different maturities and furthermore in interest rates on deposits. This is the literature gap I would like to fulfill with my thesis.

3. The chronicle of the crisis

The housing bubble in mid-2007, the housing market correction and the subprime mortgage crisis that followed the next year resulted to the severe recession of the United States. Although the crisis started in the USA it was quickly transferred worldwide through the interconnected banking activity and came to our doorstep. Greece is the country which faced the harshest impact in the Eurozone of this crisis. But how is this possible if we consider that Greece is only a little pawn in the world board.

Greece joined the European Community in 1981 and joined the euro in 2001. From then Greek credit system is an integral part of the single European market for financial services and products. Membership required that candidates will have achieved stability to specific standards and have the ability to adhere the political, economic and monetary obligations of the union. The entrance in the EMU signaled a new stable macroeconomic environment for the country. The exchange risk was eliminated and short-term constraints on the financing both for public deficit and private borrowing were seize to exist. These were the main short-term benefits. The conditions for the economy to boom existed but it had to take into account the medium to long term dangers that were underlying.

At the beginning of 2009, many commentators viewed the single currency as major success. The bond yields among the EMU had converged in unprecedented levels. Strains on government securities markets became worrisome at the end of 2009. The scenery changed rapidly when the sovereign debt crisis erupted in early 2010. There was a diversification among the euro-countries the “core” and the “peripheral” ones. The latter one faced a widening of their sovereign spreads. The heterogeneity in fiscal, macroeconomic and financial imbalances existed prior to crisis but they surged to the surface only after.

Greece was the main concern. It had systemically concealed its budget situation by the official statistics. There was a questioning in the reliability of the financial data due to its repeated revisions. The banking system of the country was not directly hit by the global financial crisis. After the revision of the public deficit, the sovereign bond was downgraded. Fitch Ratings was the first to downgrade Greece’s credit rating on 22 October, followed by Standard & Poor’s and Moody’s on 16 and 22 December, respectively. In addition, a further downgrade was announced by Fitch on 9 April 2010. Because of the downgrade the banks immediately had to reassess the value of their portfolios In April 2010, Greece was the first country to ask for help and enter a bailout program. More countries followed Ireland, Portugal and Cyprus. The tensions in the financial market hit also Italy and Spain. The price for the external help was a biting austerity programme that prolonged a deep recession. A second Memorandum of Economic and Financial Policies was ratified on February 2012.

The stability of the banking system and the service of the public obligations were the first things to cover. Taking into account of the downgrade of the sovereign bond and the continuing increase of the non-performing loans, the liquidity crisis transformed into solvency one. Given the economic circumstances and the ensuing needs, the Greek banks had to be strengthened and recapitalized. The government, with the collaboration and assistance of European Central bank, has taken concrete and far-reaching measures to reform their financial institutions and markets. By using in their advantage the economies of scale, they formed four “core” banks Alpha Bank, Eurobank, National Bank of Greece and Piraeus. The core banks consist the 95% of the banking sector. Bank recapitalization procedures were completed during the first half of 2013 with both the participation of the private sector and the Hellenic Financial Stable Fund (HFSF). Beside the four systemic banks, intervention had to be made and to other institutions because they could not be in line with the law requirements and cope with the stress tests. The solutions provided differ in each case but it was always aiming to reestablish the certainty in the banking sector. Other factors that enhanced banking intermediation were the establishment of new prudential regulation and tighter supervision, an improvement of accounting and disclosure standards, the adoption of better techniques for risk evaluation and asset and liability management.

The continuously changing political scene led to delay in the enforcement of the measurements and to uncertainty in the sequence of the program. In the early 2015 a new party rose in power. The climate of uncertainty in the political scene had as a result a bank run. Between November 2014 and June 2015 the deposits of the non-financial institution and the households were declined 26%¹. In January 2015 the “core” banks required short term liquidity through the Emergency Liquidity assistance (ELA). On 29 June 2015, and in the shadow of the referendum, the government activated capital controls to secure the liquidity of the banks and we had a bank holiday. Capital controls are still active but looser.

In the following chapter, the analysis in the fluctuations in the yield of the sovereign spread empower the prevailing climate of uncertainty that was cultivated due to the political, macroeconomical and economic factors.

¹ Bank of Greece. (2016). Annual Report 2015.

4. Econometric Analysis

In this chapter, first I will mention the data used throughout the thesis in both theoretical and econometrical analysis. Moving on, there is a presentation for the case of Greece in the fluctuations of the interest rates and key banking variables. In the last subchapter, I introduce the methodology used for capturing the pass through tensions of the sovereign bond to the banking sector.

i) The Data

The indicator used here for capturing the tensions in the sovereign debt markets is the yield between the 10-year Greece government bond and the German Bund respectively. I will use this spread to explain the effects in the banking activity. The data for the bonds are monthly and quarterly capturing the period Greece has “euro” as its currency.

Regarding the main macroeconomic determinants of banking activity we closely follow previous studies (e.g. *Athanasoglou et al.*2008) and consider traditionally explanatory variables, such as : the monetary policy rate, money market interest rates, GDP growth, industrial production growth, unemployment rate, growth rate of housing prices and growth rate of stock market prices. The data are quarterly from 2002 to 2016 collected from Elstat.

Since my aim is to analyze the sovereign debt tensions over the banking activity I use lending and funding variables. The reformulation of the banking system creating the “core” banks in the Greek banking sector allows only examining the effect in an aggregate level. The aggregate information used is over the interest rates on loans and liabilities. In my research, I will use different time spans in the interest rates to examine whether they diversify in their statistical significance of the explanatory variables. These data were collected from January 2003 from ECB Data Warehouse. The monetary financial institutions interest rate cover all the interest rates that credit institutions apply to euro-denominated loans and deposits (outstanding amounts and new business) to non-financial corporations of all sizes and households and non-profit institutions serving households.

The lending variables are categorized among the new loans (excluding overdrafts) to firms and to households for house purchase. The interest rates of firms include total interest rate data and then we fragment them according to the duration of the loan, up to 1 year, from 1 to 5 years and finally from 5 years and above. For the interest rates to households the data are limited for different time horizons. I will provide estimations for loans over 1 year, from 1 to 5 years and finally from 5 years and

above. Total interest rate on lending for house purchase has not yet been defined since there are missing values in the data available.

On the liability side of the banking system are the deposit interest rates provided to the firms and households. For both categories the data include two annualized agreed rates from credit and other institutions in reporting sector in Greece. The first corresponds to outstanding amounts with total original maturity and the second one to deposits with original maturity up to 1 year. Furthermore, in the analysis the overnight deposit rates are examined to firms and households.

For a more integrated view in the Greek banking sector and its fluctuations over the period as a euro-zone member, some additional banking information is displayed in the Figures 1-4. The data are monthly collected from ECB Data Warehouse. More specifically, beside the interest rates, I include monthly data from 2003-2016 in the total and the overnight deposits for firms and households. For the same time horizon, transaction flows of deposits with maturity over 2 years are also presented and, finally, the annual growth rate of loans since 2004 to 2016.

In the Appendix sector the Table 1 summarizes the descriptive characteristics for the examined variables. Table 1i) shows the 10-year Greek and German bonds in monthly data from 2002 to 2016. The Greek bond has one observation less than the German one, because of the bank holiday in June 2016. Table 1ii) refers to the whole set of interest rates used.

ii) *Sovereign spreads and banking rates: The case study of Greece*

{Insert Figure 1 }

The relationship between sovereign risk and banking activity is discussed in a global and European level². One can identify three main channels for the transmission of government bond market tensions to bank funding and credit supply conditions. The so-called price channel operates when bank's borrowing cost or loan interest rise following an increase in the sovereign bond yield. The balance sheet channel is that a potential loss in the government bond portfolios may deteriorate the income and therefore capital of the bank, leading to a tightening of credit supply. And via the liquidity channel, the loss of value in the government bond portfolio reduces bank's ability to borrow in collateralized interbank transactions.

The intensity of each channel depends on the exposure of the banks to the government bonds and to the domestic sovereign debt. In the case of Greece, the mentioned channels have passed its tensions to the Greek banking activity following the

² See Committee on the Global Financial System (2011) and Trichet (2010)

fluctuations of the yield spreads of Greek government bonds vis-à-vis comparable German bonds. The GGB_10-Bund spread is the spread on 10-year Greek governments bond with respect to the corresponding German Bund. Figure 1 shows how the spread moved since Greece entered the European Union. The spread is used as an indicator of capturing the financial market tensions.

The spread started to increase when the crisis hit Europe but it spiked when the structural weaknesses and macroeconomic imbalances of the Greek government became apparent in the early 2010. For the 2001 to 2007 period the average spread was 25 basis points. The years of the global financial crisis the Greek spread had a slight increase mainly due to the Greek bond. A rise in the sovereign bond was followed until June 2012, and the 10- year Greek government bond yield reached its peak at 29,24 %. Afterwards the yield spread between the Greek and German 10-year sovereign bonds narrowed significantly until the third quarter of 2014. The decline in Greek sovereign bond yields came to a halt and conditions of high volatility prevailed. From September 2014 onwards, investor sentiment started to deteriorate and in 2015 the yield spread once again widened to over 1,000 basis points. This trend persisted until the first half of 2015. Afterwards, it slightly fluctuates between 700 to 1000 basis points.

The German bond the period examined was moving steadily in the same levels until the financial crisis hit. Then it started to smoothly decline and eventually reaching negative returns for the first time. From June until September 2016, the risk premium turned negative, with its minimum value at -0,15%. This phenomenon is called flight-to-quality. The investors move their capital away from riskier investments to safer possible one. This action is usually happening when financial uncertainty prevails in the international markets. German bonds are regarded as safe investment vehicle and allured the investors, which were pleased with even lower returns pushing down its yield. The lower levels the German bond was moving made even more apparent the lack of liquidity for the Greek bonds.

Empirically sovereign downgrades are generally followed by downgrades of domestic banks. Greece was not the exception. The publication of negative reports on the Greek economy by certain credit agencies, as already mentioned, had as a subsequent downgrade of Greece's credit rating and affected the ratings of domestic banks. Greece experienced 27 sovereign downgrades. Its four major banks, National Bank of Greece, Piraeus, Alpha Bank and Eurobank faced 18, 18, 20 and 21 respectively during the period examined. The downgrade raised the sovereign spread. The rise induced the ability of the country to repay its debt and consequently bank's balance sheet deteriorated.

{Insert Figure 2}

As the spread rose from late 2009 till 2012, the deposit rates were increasing, as shown in Figure 2. The increase in interest rate on new bank deposits indicates the

strong pressures on the liquidity need of Greek banks. This upward path reflects also banks' effort to stem the large outflows of deposits observed during the crisis and to reverse this phenomenon by offering high nominal returns on time deposits. The second half of 2012, a gradual return of deposits is observed leading to an easing of upward pressures on interest rates. The interest rates afterwards are following a steady decrease. The spike that hit the spread in 2015 did not cause a shift in the negative direction of the time deposit interest. Lending interest rates increased as well, reflecting the bank's effort to discourage demand for loans. The decline in the interest rates was recorded after 2011 especially after the declines in Eurosystem key interest rates were finally absorbed by the Greek banking system.

{Insert Figure 3}

In Figure 3, the negative trend in loan growth and the flows of deposits with maturity over 2 years confirm the suffocation of the financial sector. Deposit amounts are used as an indicator of banking solvency and stability. A Greek bankruptcy, the probability of Grexit (=exit of Greece from the Eurozone), a "haircut" in the deposits were some opinions heard at the early 2010 and even after the entrance in the bailout program. The outflows of deposits from the Greek banking system was stronger during months of heightened uncertainty, whereas in months of strengthened confidence, when it was believed that the debt crisis in Greece would be overcome, outstanding deposits increased, that is, an inflow of deposits into the Greek banking system was observed. Overall, the outflows of deposits are far superior to the inflows. Only in 3 year time period, the outstanding deposits from households and non-financial corporations decreased from €237 billion in June of 2009 to €150 billion in June 2012, a reduction equivalent to more than a third of the deposits of the system³. The fluctuation is far more obvious in the household transactions capturing the climate of fear, which was created in the country. The Greek banks lost a big share of their assets and became vulnerable. After June 2015, the bank holiday and the capital controls succeeded in containing the deposit outflows and the capital flight. The bank holiday and the imposition of restrictions on cash withdrawals, cross-border payments and capital movements and other bank transactions narrowed the fluctuations the deposits flows.

{Insert Figure 4}

As shown in Figure 4 the total amount of deposits has declined since the entrance in the Eurozone. The steady increase held until 2010 for both firms and households. After then the decrease is apparent reaching the levels of the beginning in 2003. For non-financial operations it even went below the started point. In 2016, around 80% and 56% of total deposits held in overnight deposits for firms and houses respectively. This fact eliminates the available sources for funding conditions from the perspective of the banking system.

³ Bank of Greece (2015) Statistical Database Online.

The deep economic recession, the prevailing uncertainty among depositors and the decrease in firms' and households' wealth had an impact on the loan repayment ability of households and enterprises, resulting in a rise of the non-performing loans ratio. From a share of 4,5% of total loans in 2007, non-performing loans reached 24,5% in 2012⁴ and continued their upward trend up to 43,6% by the end-September 2015⁵. On the supply side, between end-2009 and end-2012, the fact that Greek banks were shut out of markets and the shrinking of deposits contributed to a slowdown in credit expansion to the private (non-financial) sector of the economy and to households, which eventually turned negative (See Figure 3i).

The banking system posted losses on both individual and consolidated basis, during a period in which liquidity was under multiple pressures. In 2010 and the first months of 2011, the liquidity of Greek banks came under strong pressure, as the successive downgrades of Greece's sovereign debt since late 2009 inevitably affected the ratings of domestic banks too, virtually cutting them off from international money and capital markets. As a result, banks had difficulties in tapping into funding from the interbank market and refinancing their liabilities, thereby restricting the financing of the economy. Actually, banks faced a shortage of collateral (which is required to back central bank financing), as they saw the value of their sovereign debt holdings that were eligible collateral decline. Financial institutions could draw Emergency Liquidity Assistance (ELA) from the Bank of Greece, which however implies a higher cost of central bank refinancing. ELA was used from the Greek banking system to cope with illiquidity.

The widening of yield spreads of Greek sovereign bonds had a negative impact on banks' equity. Although Greek banks entered the crisis with satisfactory capital adequacy ratios, the heavy losses they suffered from 2010 and onwards resulted in most banks being faced with a capital shortage at end-2011. Following the bridge recapitalization of core banks in 2012 and the completion of the recapitalization process by mid-2013, the capital adequacy ratios of Greek banks have been restored. The Hellenic Financial Stability Fund (HFSF) is now the largest shareholder in each of Greece's four core banks. The deposit bank run in 2015 required once more recapitalization of the banking sector. After these turbulences the Greek banking system shows a steady course but the stability and the reassurance of its smooth operation has not yet been completely restored.

iii) The Methodology

In order to assess the effect of the sovereign debt crisis econometrically I employ an Autoregressive distributed lags (ARDL.). As thoroughly documented ARDL is able to

⁴ Bank of Greece (2013). Annual report 2012

⁵ Bank of Greece (2016). Summary of the Annual Report 2015

show if there is a long run relationship between the 10 year spread between Greek and German bonds and the banking activity. The ARDL model is the following:

$$i_t^b = a_0 + \sum_{j=1}^p a_j i_{t-j}^b + \sum_{j=0}^q \beta_j i_{t-j}^m + \sum_{j=0}^r \gamma_j x_{t-j} + \sum_{j=0}^s \delta_j spread_{t-j} + \bar{\mu} d_1 + \sum_{j=0}^s \mu_j d_1 spread_{t-j} + \bar{\eta} d_2 + \sum_{j=0}^s \eta_j d_2 spread_{t-j} + \varepsilon_t$$

where the dependent variable i_t^b is the bank interest rate (either funding or lending rate). In the explanatory side of the regression there is always a constant a_0 . The i_t^m is the monetary policy rate and x_t is a vector of macroeconomic variables which control for macroeconomic activity. The $spread_t$ is the GGB_10-Bund, the indicator of gauging the sovereign tensions. I have included in the regression two dummy variables to interact with the spread to test the presence of differentiated tensions in the effect of sovereign debt. In particular, d_1 takes value of 1 since the entrance of Greece in the first bailout program the second quarter of 2010 and forward, elsewhere is zero. The second dummy, d_2 takes the value of zero until the implementation of capital controls in the second quarter of 2015, where it takes the value 1, elsewhere is 0.

The model is estimated with quarterly data using the OLS procedure. The choice of the appropriate lag structure is based on the information criteria, the goodness to fit and the presence of autocorrelation in the residuals. I was conservative for the lags because of the limited sample size. Each interest rate is tested in 3 models. The first model includes no dummy, in the second model the dummy 1 is included and in the third model both dummies are incorporated in the regression.

5. Estimation Results

The Tables 2-6 present the estimation output of the regressions. Table 2 refers to the total lending interest rates offered by the banking system to the non-financial corporations, while Table 3 to the lending interest rates for different time horizon. Table 4 provides the results of the interest rates provided to households for house purchase in each time span. The Tables 5 and 6 show the estimated results for deposit interest rates for firms and households respectively. In each model, additional critical information is provided: Adjusted R^2 , the Akaike information criterion, LM test for serial correlation (p- value) and Heteroscedasticity Test (p-value).

i) Effects on bank lending rates

{Insert Tables 2, 3 & 4}

Table 2 reports the estimation results for the total interest rates provided to firms. Table 3 present the results for non-financial corporations covering different time horizon, while Table 4 shows the interest rates for new loans to households for house purchase. In each interest rate 3 regressions are provided, 3 models. The 3 models are used to capture the different tensions in the lending interest rates, when a time dummy variable is included in the regression

Regarding the non-financial corporations, we find that the coefficient of the 10-year spread is positive and significant in almost all regressions. In the specifications without dummy variables (Model 1) the estimated pass-through fluctuates between 3 to 2 basis points. When we consider the regression with dummy variable we find different results among the periods. First, the Dummy 1 (Model 2) is positively significant for all timespans. This indicates that “on average” the interests have increased during the crisis period. In the short term (up to 1 year and 1-5 years) the coefficient of the interacted terms impacts negatively and significantly the interest rates, while in the long term the spread of the previous lags affects the lending rates positively. When we add and the second dummy (Model 3), which counts for the capital control implementation, it is positive and significant only for the interest rates 1-5 years.

In the households lending rates for purchase of a house the results indicate the following: the spread is not significant outside the crisis period. During the crisis, however, the impact of the lagged value of the spread with the interacted term in the interest rates becomes positive and significant. This is true for all lending horizons. The implementation of capital controls has further improved significantly the impact of the spread on the lending rates. We observe, however, that the Dummy 2 is

negative and significant indicating a downward move on the “average” lending rate after the introduction of capital controls.

The results also show that the constant is statistically significant and positive in all the regressions. The one lagged dependent effects in a positive trend the interest rates. This implies that previous price of interest has an impact on the next. The lagged dependent two periods before affects only the total interest rate in firms in a negative trend. In the sub sizes of firms and of households, it is insignificant. The cost of credit is positively related to the monetary policy, the money market interest rate and the GDP growth, which control for the macroeconomic outlook and changes in borrower’s creditworthiness. The stock market growth is significant but has a small impact in the formation of the interest rates. Housing prices is another macroeconomic, which in the cost of lending to non-financial corporations is significant only in an aggregate level; while in the households it has slight positive significance at interest rates over 5 years. The unemployment rate in “normal times” influences positively and significantly the firms interest rates, while poses no effect in the households interest rates. The times dummies alter this effect over households affecting them in a significant negative way. In firms, though, the affect turns insignificant except for one time horizon, 1 to 5 years.

ii) Effects on bank deposit rates

{Insert Tables 5 & 6}

Table 5 and 6 reports the estimation results of the regressions for the interest rates on deposits for firms and households, respectively, based in three different time horizons. In each interest rate 3 regressions are provided, 3 models. The 3 models are used to capture the different tensions in the lending interest rates, when a time dummy variable is included in the regression. The amount of deposits in Greece, as it is mentioned above, has returned to pre-EU levels. The econometric analysis will show us if the high fluctuations in the yield of the sovereign bond has passed to the deposit rates.

The results show that the impact of the 10-year spread differs among the various interest rates based on their horizon. In particular, the spread does not exert any sizeable effect on the cost of overnight deposits held by households, with or without any time dummy variable included. This result can be rationalized considering the fact that overnight deposits are primarily held for transaction purposes and hence their remuneration is generally less reactive to changes in market returns. Moreover, as overnight deposits, they carry virtually no risk, therefore they offer no compensation. In compliance with the overnight households’ interest rates, the firms interest rate show no effect during “normal times”. The effect changes when Greece enters the bail-out program. The coefficient is positive and significant indicating that during the

financial crisis period the impact of the sovereign risk inclines its significance for the overnight deposit of non-financial corporations.

The presence of nonlinearity in the transmission of sovereign tensions is obvious and to other maturities. The total interest rates show 3,2 and 2,5 basis points movement in firms and households , accordingly. When the dummy counting for the financial crisis is added in the regression the coefficient of the spread with the dummy one quarter before is also significant but negative to 23 and 15 basis points. The interest rates up to 1 year are not affected by the sovereign tensions, when no dummy is included. When, however we add the financial crisis period dummy the effect of the spread positive and significant. The price one quarter before of the GGB_10-Bund spread influences positively the interest rates. In reaction with the dummy 1 its sign is negative. The implementations of capital controls did not alter the effect of the sovereign risk on deposit rates.

The lag dependent one quarter before is positive and significant for all regressions, indicating the strong relation of the explanatory variable with its previous price. Analyzing the macro economical outputs of the regressions regarding to the deposits the results differ. The money market rate and the monetary policy are significant and positive for the firms and the households as well. The stock market influences merely only the deposit rates of the firms in the time of the crisis. The growth in the industrial production affects negatively the short-term (up to 1 year) interest rates for households. In contrast with the lending interest rates, in the funding interest rates GDP growth affects only the households in an aggregate level pressuring a downward movement over the interest rates.

6. Conclusion

Almost a decade has passed since the U.S. financial crisis and Greece is still under rescue packages in order to comply with its obligations to its lenders and to the country economic demands.

In Greece, the international financial crisis soon evolved into a sovereign debt crisis. The slight difference in the spread between Greek and German bonds reflected the prosperous opportunities Greece had at first as member of the euro-zone. The dream transformed into a nightmare when the sovereign deficit could not yet be disguised. The first impact was the diversion among the bonds and respectively the rise in the spread. The markets, in a context of reassessment of credit risk that did not preclude a Greek default, imposed new, more onerous lending conditions, which gradually became prohibitive. Today Greece has seemingly stabilized its spread and is narrowing the difference, while it has successfully held its bond sale.

The sovereign debt crisis and the corresponding restrictions on lending conditions of the country had an impact on the smooth operation of the banking activity. The banks showed their deposit amount to decline significantly, the value of their portfolio to be reassessed based on the sovereign bond downgrade and limited entrance on the interbank funding. All these resulted to a long list of important actions to safeguard financial stability and support liquidity but also led to the restructuring of the banking sector.

Surprisingly enough, considering Greece pass through tensions to other euro-zone countries; the empirical analysis for the country is limited. The econometrical analysis, held in this thesis, confirms that the tensions of the 10-year spread were passed to the lending interest rate given to the non-financial firms in all the array of time horizons examined. In households, though, the tensions are incorporated in the interest rates if we use a dummy to gauge for the entrance of Greece to the bail-out program. Furthermore, we find that changes in the 10-year spread have a sizeable effect on the interest rates deposits hold by firms but no those of households. The dummy corresponding to the implementation of capital controls do not seem to effect significantly the interest rates, except the medium term lending rates to firms, the over 1 year lending rates to households and deposit rates up to 1 year for households.

Overall, the estimated coefficient of the GGB_10-Bund spread for the interest rates are significant but their impact is not as high as we would anticipate based on the widening of the spread and its high levels. In addition the effects of the capital controls in the banking sector may have not yet been totally revealed due to the short time passed since its implementation. Moreover, it could be that, the continuously deteriorating macroeconomic conditions that led to the deep recession absorbed some of its tensions.

Further research might explore the role of the macro determinants and how they involved in the Greek environment during the period of the crisis. Moreover, the reformulation of the banking sector presents a new environment for research in the balance sheet characteristics of the core banks. The total non-performing loans ratio, the government bond portfolio, the results of the stress test, the Tier 1 buffet are only few of the elements worth to examine in the future so as to gain a more clarified view of the Greek banking system.

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8. Appendices

Figure 1: The 10-year Greek Government bond (GGB 10) and the corresponding in maturity German Bond (Bund). The spread is the difference between them (Monthly data, %). *Source:* Bank of Greece

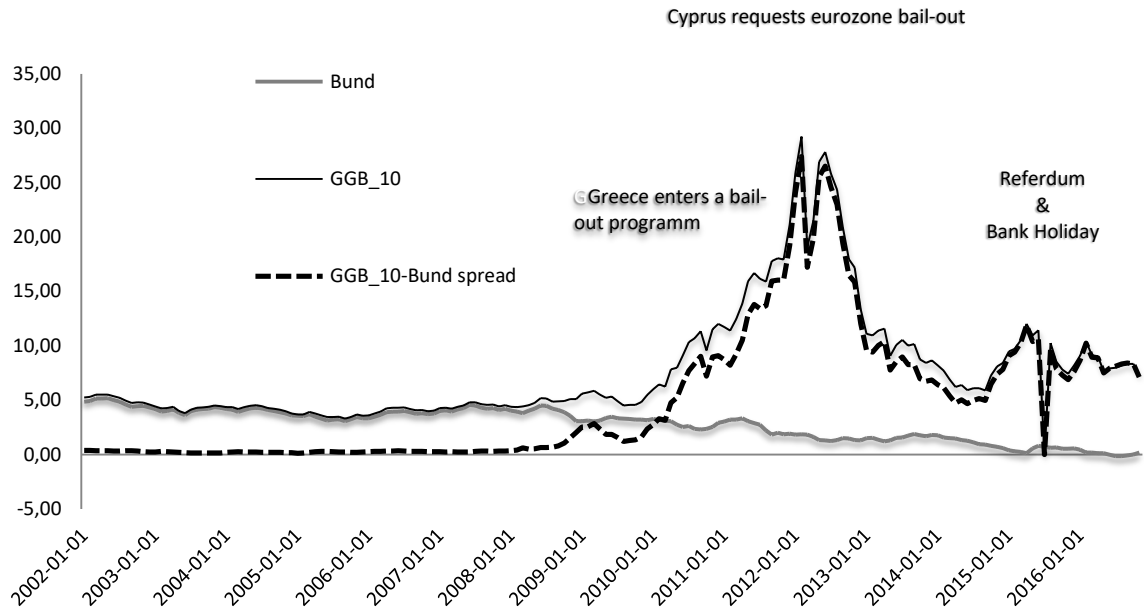
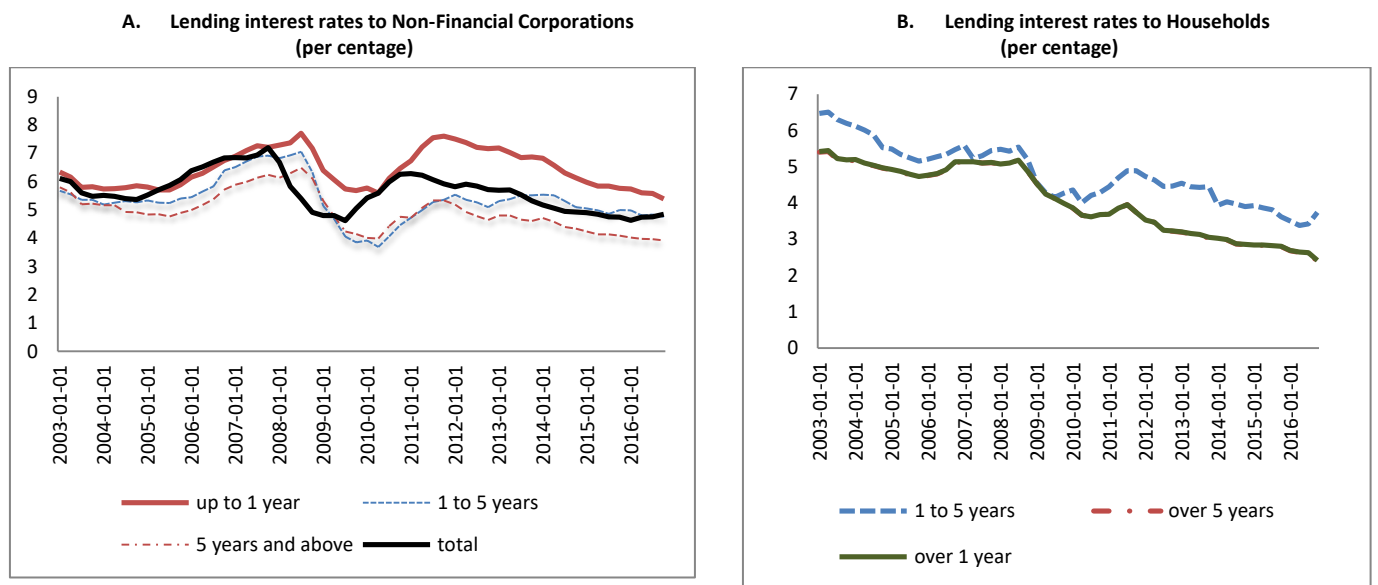
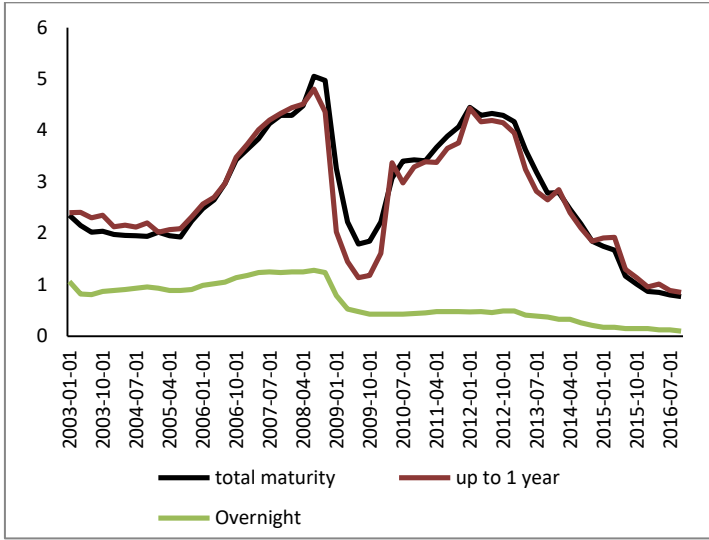


Figure 2: Diagrams with the interest rates in Greece. *Source:* ECB



C. Deposit Interest rates to Non-Financial Corporations (per percentage)



D. Deposit Interest rates to Households (per percentage)

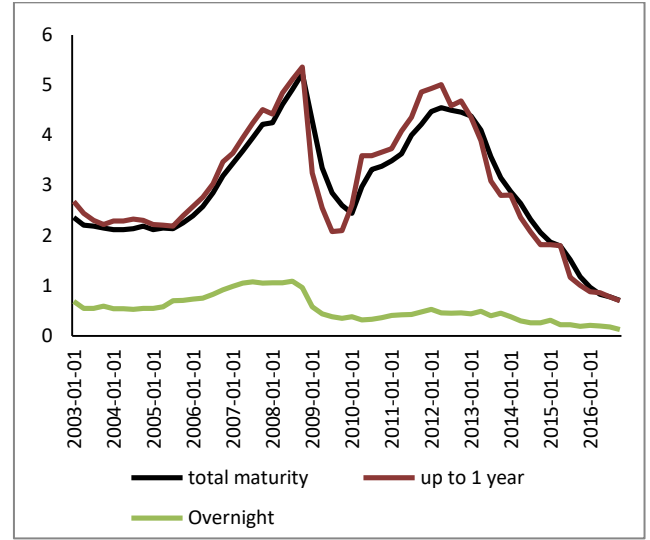
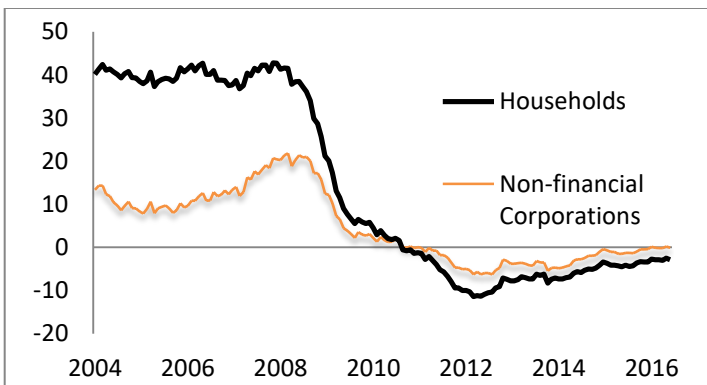


Figure 3: Banking activity information. Source: ECB

i) Annual growth rate of loans % change



ii) The financial transactions (flows) of deposits for Non-financial corporations and Households with maturity over 2 years (EUR millions)

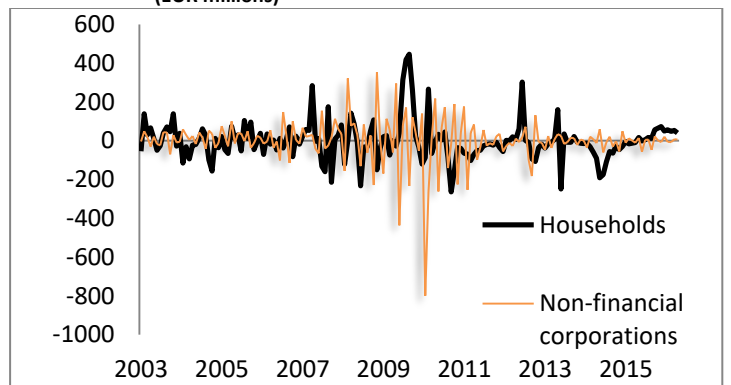


Figure 4: Deposits Total Deposit Liabilities, total maturity, and Overnight Deposits for Households and Non-Financial Firms in Greece(EUR millions)

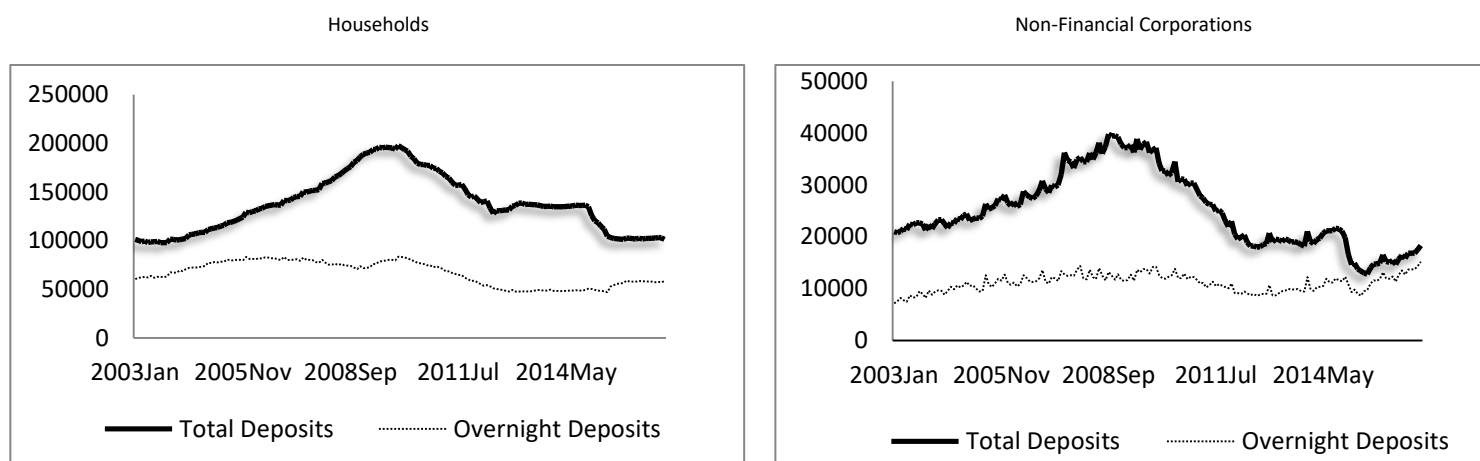


Table 1: Descriptive Statistics

i. For 10-year Greek and German bonds, monthly data 2002:2016

	Mean	Median	Max	Min	Std. Dev.
Greek	7,87	5,49	29,24	3,30	5,33
German	2,78	3,12	5,17	-0,15	1,44

ii. For the interest rates, quarterly data 2003:2016

Lending rates to Firms	<i>Total</i>	5,64	5,59	7,20	4,62	0,68
	<i>Up to 1 year</i>	6,42	6,30	7,71	5,39	0,67
	<i>1-5 years</i>	5,34	5,31	7,05	3,69	0,76
	<i>Above 5 years</i>	4,94	4,84	6,49	3,92	0,68
Lending rates to Households	<i>Over 1 year</i>	4,06	3,97	5,45	2,42	0,96
	<i>1-5 years</i>	4,80	4,66	6,51	3,38	0,81
	<i>Over 5</i>	4,05	3,96	5,42	2,39	0,95
Deposit Rates to Firms	<i>Total</i>	2,79	2,56	5,05	0,77	1,15
	<i>Up to 1 year</i>	2,72	2,49	4,80	0,85	1,10
	<i>Overnight</i>	0,65	0,48	1,28	0,10	0,37
Deposit rates to Households	<i>Total</i>	2,94	2,85	5,23	0,71	1,13
	<i>Up to 1 year</i>	2,99	2,72	5,36	0,70	1,24
	<i>Overnight</i>	0,53	0,47	1,09	0,13	0,26

Table 2: Estimated coefficients for total interest rates in firms. (per centage)

Explanatory variables	Total interest rates		
	Model 1	Model 2	Model 3
Constant	1,1316***	2,1004***	2,2588 ***
Lagged dependent (t-1)	1,4753***	1,4178***	1,4054***
Lagged dependent (t-2)	-0,8180***	-0,9729***	-0,9802***
Monetary policy rate	0,0426	0,0491	0,0266
Monetary policy rate (t-1)	0,2604***	0,4260***	0,4060***
GDP	-0,0247	0,0093	0,0115
GDP (t-1)	-0,0068	0,0239	0,0266
GDP(t-2)	0,0572***	0,0672***	0,0676***
Unemployment rate	0,0196*	0,0065	0,0012
Stock Market growth	0,0042*	0,0054***	0,0056**
Stock Market growth(t-1)	0,0045**	0,0421**	0,0052**
Housing prices	0,0533***	0,0421**	0,0411*
Industrial Production	0,0086	0,0064	0,0061
Money Market rate	0,2099**	0,3771***	0,3685***
10-year spread	0,0388**	0,0652	0,0906
10-year spread (t-1)	-0,0209	-0,1160**	-0,1199**
Dummy 1	-	0,4187**	0,5199*
GGB_10-Bund spread * D1	-	-0,0269	-0,0536
GGB_10-Bund spread(t-1)* D1	-	0,0989*	0,1064**
Dummy 2	-	-	-0,0788
GGB_10-Bund spread * D2	-	-	0,0014
Adj R^2	0,9581	0,9631	0,961
Akaike information critetion	-0,834	-0,9318	-0,869
LM test for serial correlation (p- value)	0,1192	0,1668	0,2039
Heteroscedasticity Test (p-value)	0,1960	0,2148	0,3448

***, **, * indicate significance at the 1%, 5% and 10% respectively.

Table 3: Estimated coefficients for interest rates in firms in different time horizon. (per centage)

Explanatory variables	Interest rates up to 1 year			Interest rates more than 1 and up to 5 years			Interest rates more than 5 years		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Constant	1,8986***	1,6095***	1,7614***	1,2754***	1,2840***	1,2146***	1,6788***	1,7180***	1,7110***
Lagged dependent (t-1)	0,6472***	0,6571***	0,6921***	0,3498***	0,3590***	0,2350*	0,5097***	0,3501**	0,3502**
Lagged dependent (t-2)	-0,2751**	-0,1885	-0,2046	0,0260	0,0258	0,0724	-0,1022	0,0847	0,0848
Monetary policy rate	0,1262	0,0624	-0,0046	-0,0076	-0,0435	0,0331	0,0885*	0,1024*	0,1044*
Monetary policy rate (t-1)	0,3499***	0,2910***	0,2118**	0,0192	-0,0134	0,0553	0,0983*	0,1571**	0,1598**
GDP	0,0064	0,0185	0,0217	0,0033	0,0097	0,0044	-0,0100	0,0095	0,0094
GDP (t-1)	-0,0359**	-0,0144	-0,0097	-0,0205	-0,0130	-0,0155	-0,0267	-0,0106	-0,0109
GDP(t-2)	-0,0259*	-0,0144	-0,0137	-0,0236*	-0,0203*	-0,0250**	0,0002*	0,0053	0,0054
Unemployment rate	0,0693***	0,0367	0,0212	0,0772***	0,0625***	0,0893***	0,0320***	0,0165	0,0169
Stock Market growth	0,0021	0,0036	0,0025	0,0022	0,0036**	0,0044***	0,0017	0,0007	0,0007
Stock Market growth(t-1)	0,0052***	0,0062***	0,0055***	-0,0002	0,0036**	0,0007	0,0024*	0,0021	0,0021
Housing prices	-0,0042	0,0055	0,0032	0,0198	0,0006	0,0178	-0,0103	-0,0134	-0,0132
Industrial Production	0,0040	-0,0039	-0,0046	0,0050	0,0055	0,0028	0,0096	0,0105*	0,0108
Money Market rate	0,5308***	0,4915***	0,4429***	0,6040***	0,6110***	0,7162***	0,4521***	0,4424***	0,4433***
10-year spread	0,0293**	0,1849**	0,2465***	0,0204*	0,1889***	0,1163*	0,0212**	0,0190	0,0171
10-year spread (t-1)	-0,0123	-0,602	-0,0671	-0,0216*	-0,0938**	-0,0825**	-0,0174*	-	-
Dummy 1	-	0,5339**	0,7186***	-	0,3240**	0,0460	-	0,2501	0,2456
GGB_10-Bund spread * D1	-	-0,1536**	-0,2212**	-	0,1637***	-0,0825	-	-0,008	-0,0063
GGB_10-Bund spread(t-1)* D1	-	0,0494	0,0654	-	0,0706**	0,0470	-	0,1110***	0,1107***
Dummy 2	-	-	-0,2033	-	-	0,5975*	-	-	-0,0237
GGB_10-Bund spread * D2	-	-	0,0057	-	-	-0,0484	-	-	0,0033
Adj R ²	0,9613	0,9643	0,964	0,9821	0,9853	0,987	0,9770	0,9819	0,980
Akaike information critetion	-0,923	-0,974	-0,974	-1,447	-1,618	-1,739	-1,463	-1,674	-1,600
LM test for serial correlation (p-value)	0,1251	0,0187	0,0329	0,7071	0,9891	0,1452	0,1086	0,1340	0,1423
Heteroscedasticity Test (p-value)	0,1921	0,1899	0,5294	0,8166	0,3037	0,4735	0,4135	0,0402	0,0868

***, **, * indicate significance at the 1%, 5% and 10% respectively.

Table 4: Estimated coefficients for interest rates in households for house purchase in different time horizon. (per centage)

Explanatory variables	Interest rates over 1 year			Interest rates more than 1 and up to 5 years			Interest rates over 5 years		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Constant	0,5373**	0,9125**	1,1969**	0,6587*	0,9612*	1,4524**	0,5284**	0,8956*	1,1758**
Lagged dependent (t-1)	1,1413***	0,9333***	0,9366***	1,0097***	0,9246***	0,8953***	1,1485***	0,9293***	0,9316***
Lagged dependent (t-2)	-0,2798*	-0,1257	-0,1591	-0,1779	0,1067	-0,1182	-0,0284*	-0,1190	-0,1505
Monetary policy rate	-0,0661	-0,0309	-0,0561	-0,0273	-0,0176	-0,0794	-0,0697*	-0,0333	-0,0584
Monetary policy rate (t-1)	0,0601	0,1341**	0,1001*	0,0182	0,0771	-0,0059	0,0624	0,1372**	0,1029*
GDP	0,0104	0,0245*	0,0256**	-0,0273	-0,0049	-0,0011	0,0113	0,1372	0,0264**
GDP (t-1)	-0,0087	0,0025	0,0015	0,0031	0,0167	0,0223	-0,0091	0,0254	0,0013
GDP(t-2)	-0,0056	-0,0014	0,0000	0,0000	0,0057	0,0063	-0,0065	0,0025	-0,0004
Unemployment rate	-0,0069	-0,0128*	-0,0210**	-0,0023	0,0172	-0,0315*	-0,0070	-0,0021	-0,0210**
Stock Market growth	0,0001	-0,0009	-0,0014	0,0019	0,0013	0,0006	-0,0070	-0,0127*	-0,0016
Stock Market growth(t-1)	0,0031***	0,0023**	0,0017*	0,0043**	0,0038*	0,0026	-0,0001	-0,0011	0,0018*
Housing prices	0,0049	-0,0028	-0,0040	0,0269	0,0124	0,0041	0,0032***	0,0023**	-0,0037
Industrial Production	0,0006	-0,0002	0,0029	0,0049	0,0124	0,0000	0,0007	-0,0001	0,0034
Money Market rate	0,0677**	0,0640**	0,0453*	0,0729*	0,0517	0,0097	0,0668***	0,0645**	0,0458*
10-year spread	0,0074	-0,0769	-0,0511	0,0205	0,0301	0,0635	0,0070	-0,0805	-0,0610
10-year spread (t-1)	-0,0039	-0,0614**	-0,0637**	-0,0081	0,1306**	-0,1413**	-0,0035	-0,0580*	-0,0603**
Dummy 1	-	-0,0744	-0,0254**	-	0,1255	0,2201	-	-0,0727	-0,0181
GGB_10-Bund spread * D1	-	0,0755	0,0511	-	-0,0182	-0,0576	-	0,0785	0,0522
GGB_10-Bund spread(t-1)* D1	-	0,0620**	0,0724**	-	0,1274**	0,1490**	-	0,0591**	0,0698***
Dummy 2	-	-	-0,5243**	-	-	-0,1317	-	-	-0,5728**
GGB_10-Bund spread * D2	-	-	0,0494*	-	-	-0,0086	-	-	0,0550*
Adj R ²	0,9918	0,9931	0,9937	0,9523	0,9549	0,9559	0,9917	0,9929	0,9936
Akaike information critetion	-1,8581	-1,9936	-2,078	-0,4977	-0,5266	-0,5324	-1,8377	-1,9639	-2,0666
LM test for serial correlation (p-value)	0,4651	0,2119	0,2064	0,5183	0,4409	0,3718	0,4396	0,2018	0,2122
Heteroscedasticity Test (p-value)	0,7834	0,6683	0,3394	0,9295	0,8507	0,9118	0,8308	0,7541	0,4381

***, **, * indicate significance at the 1%, 5% and 10% respectively.

Table 5: Estimated coefficients for deposit rates provided to firms in different time horizon.
(per centage)

Explanatory variables	Total interest rates			Interest rates up to 1 year			Overnight deposit rates		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Constant	0,3016	-0,2478	-0,0526	-0,0251	-0,5979	0,0034	0,1166***	0,1713***	0,2461***
Lagged dependent (t-1)	1,0403***	1,1336***	0,9718***	0,5134***	0,6884***	0,3991**	1,0173***	0,8904***	0,8564***
Lagged dependent (t-2)	-0,1871*	0,3304***	0,2984***	0,0287	-0,0863	-0,1078	-0,1263*	-0,1432**	-0,1873**
Monetary policy rate	0,3496***	0,3682***	0,2845**	0,5585***	0,4978***	0,2643*	0,0536***	0,0726***	0,0533***
Monetary policy rate (t-1)	-0,2728*	-0,2658*	-0,3489*	-0,2753	-0,2771	-0,4660**	0,0804***	-0,0484**	0,0618***
GDP	-0,0141	-0,0268	-0,0202	-0,0380	-0,0306	-0,0178	0,0049	0,0029	0,0037
GDP (t-1)	-0,0085	0,0186	-0,0151	-0,0400	-0,0356	-0,0323	0,0082**	0,0049	0,0054
Unemployment rate	-0,0133	0,0186	0,0006	0,0173	0,0380	-0,0060	0,0057***	-0,0006	-0,0036
Stock Market growth	0,0034	-0,0015*	0,0051*	0,0081*	0,0070*	0,0060*	0,0004	0,0001	0,0001
Stock Market growth(t-1)	-0,0030	-0,0015	-0,0006	-0,0030	-0,0012	0,0015	0,000	-0,0003	-0,0005
Housing prices	-0,0447*	-0,0248	-0,0323	-0,0824*	-0,0314	-0,0459	-0,0053	-0,0059*	-0,0052
Industrial Production	-0,0119	-0,0124	-0,020*	-0,0067	-0,0078	-0,0125	-0,0027	-0,0031*	0,00412**
Money Market rate	0,9491***	0,9888***	0,8947***	1,4664***	1,2887***	1,0087***	0,1604***	0,1676***	0,1424***
Money Market rate(t-1)	0,8226***	0,7564***	0,5547***	0,9827***	0,7832***	-0,2603	0,1432***	0,1257***	0,0903***
10-year spread	0,0329*	0,0001	0,1641	0,0474	-0,1906	0,1306	0,0037	0,0541***	-0,0402**
10-year spread (t-1)	-0,0107	0,2134***	0,2141***	-0,0081	0,4333***	0,3785***	0,0024	0,0079	-0,0045
Dummy 1	-	-0,1482	0,4513	-	-0,0336	1,3108***	-	-0,1439**	-0,1043*
GGB_10-Bund spread * D1	-	0,0450	-0,1265	-	0,2470*	-0,1068	-	0,0539***	0,0402**
GGB_10-Bund spread(t-1)* D1	-	0,2303***	0,2074***	-	0,4446***	0,3237***	-	-0,0035	0,0045
Dummy 2	-	-	0,0123	-	-	-1,466*	-	-	-0,0088
GGB_10-Bund spread * D2	-	-	-0,0484	-	-	0,0699	-	-	-0,0045
Adj R ²	0,9724	0,9777	0,9813	0,9196	0,9469	0,9642	0,9948	0,9948	0,9962
Akaike information critetion	-0,1991	-0,3808	-0,5437	0,7946	0,4074	0,0297	-4,1556	-4,1556	-4,4168
LM test for serial correlation (p-value)	0,6489	0,722	0,2974	0,7323	0,4789	0,7320	0,7858	0,5086	0,4730
Heteroscedasticity Test (p-value)	0,3594	0,6602	0,4698	0,2386	0,0108	0,0043	0,7842	0,0759	0,0315

***, **, * indicate significance at the 1%, 5% and 10% respectively.

Table 6: Estimated coefficients for deposit rates provided to households in different time horizon. (per centage)

Explanatory variables	Total interest rates			Interest rates up to 1 year			Overnight deposit rates		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Constant	0,0698	-0,0921	0,0310	0,2613	-0,3239	0,0951	-0,0146	-0,0614	-0,0228
Lagged dependent (t-1)	1,0743***	1,2257***	1,1215***	0,7353***	0,7895***	0,6276***	0,6133***	0,5700***	0,5831***
Lagged dependent (t-2)	-0,1853	0,3468***	-0,3107**	0,0277	-0,0958	-0,1084	0,0080	-0,0611	-0,0721
Monetary policy rate	0,3191***	0,3434***	0,2993***	0,5355***	0,5989***	0,4624***	0,0375	0,0498**	0,0350
Monetary policy rate (t-1)	-0,2583**	-0,2244**	0,2582***	-0,3235*	-0,2803	-0,3966**	-0,0047	-0,119	-0,0262
GDP	-0,0426**	-0,0333*	-0,02989*	-0,0211	-0,0333	-0,0271	0,0013	-0,0050	-0,0040
GDP (t-1)	-0,0073	-0,0014	-0,0024	-0,0160	-0,0346	-0,0311	0,0005	-0,0048	-0,0036
Unemployment rate	-0,0061	0,0067	-0,0015	-0,0160	0,0266	-0,0008	0,0037	0,0105**	0,0074
Stock Market growth	0,0022	0,0021	0,0019	0,0014	0,0024	0,0022	0,0009	0,0012*	0,0011
Stock Market growth(t-1)	-0,0014	-0,0006	-0,0002	-0,0024	-0,0009	0,0003	0,0000	-0,0003	-0,0003
Housing prices	-0,0242	-0,0162	-0,01836	-0,0473	-0,0240	-0,0360	0,0011	0,0005	0,0004
Industrial Production	-0,0004	-0,0031	0,0033	-0,0267*	-0,0288*	-0,0364**	0,0013	0,0020	0,0016
Money Market rate	0,5986***	0,5360***	0,4835***	1,1699***	1,2127***	1,0368***	0,1866***	0,2270***	0,2098***
Money Market rate(t-1)	0,4476***	0,3737***	0,2768***	0,9273***	0,8411***	0,5492***	-0,0892**	-0,1046**	-0,0929*
10-year spread	0,0250*	-0,1120*	-0,0262	0,0358	-0,0986	0,1084	0,0444	0,0130	0,0270
10-year spread (t-1)	-0,0045	0,1497***	0,1551***	0,0007	0,2757***	0,2879***	-0,0016	0,0094	0,0087
Dummy 1	-	-0,0979	0,1738	-	-0,2546	0,4863	-	-0,0931	-0,0451
GGB_10-Bund spread * D1	-	0,1370**	0,0440	-	0,1407	-0,0768	-	-0,0077	-0,0221
GGB_10-Bund spread(t-1)* D1	-	0,1558***	0,1465***	-	0,2736***	0,2493***	-	-0,0119	-0,0097
Dummy 2	-	-	-0,4015	-	-	-0,3823	-	-	-0,0087
GGB_10-Bund spread * D2	-	-	0,0216	-	-	-0,0255	-	-	-0,0025
Adj R ²	0,9881	0,9909	0,9916	0,9643	0,9705	0,9774	0,9731	0,9744	0,9735
Akaike information critetion	-1,0717	-1,3113	-1,3853	0,2107	0,0488	-0,2047	-3,1546	-3,1762	-3,125
LM test for serial correlation (p-value)	0,8205	0,9125	0,5748	0,6109	0,9637	0,3157	0,6330	0,7038	0,900
Heteroscedasticity Test (p-value)	0,4636	0,7815	0,3877		0,6478	0,1656	0,6709	0,7027	0,6702

***, **, * indicate significance at the 1%, 5% and 10% respectively.