SOVEREIGN DEFAULT RISK AND DEPOSITOR BEHAVIOR.
THE CASE OF GREECE*

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ABSTRACT

This paper studies the effect of the Greek macroeconomic crisis on depositors' behavior. It tests the main hypothesis during that period depositors react more to sovereign risk than to the idiosyncratic indicators of bank health. Using a quarterly panel dataset of Greek banks from June 2005 to September 2012, this paper finds that the withdrawal of deposits at the outbreak of the crisis can be mainly explained by the country risk variable, represented by sovereign spreads, controlling for bank-specific characteristics. Market discipline is also present, especially pre-crisis. Results are consistent with the existing literature and robust to different estimation methods.
Keywords: Greece, Crisis, Depositors, Sovereign Risk, Banks.

RESUMEN

Este trabajo estudia el efecto de la crisis Griega sobre el comportamiento de los depositantes. Utilizando datos trimestrales de panel desde Junio 2005 hasta Septiembre 2012, el trabajo concluye que el retiro de depósitos al inicio de la crisis se explica principalmente por la variable de riesgo macroeconómico -el spread de tasas de interés del bono soberano Griego a largo plazo-, controlando por los indicadores individuales de los bancos. La disciplina de mercado también se encuentra presente, particularmente en el período pre-crisis. Los resultados son consistentes con la literatura existente, y robustos a distintos métodos de estimación.
Palabras claves: Grecia, Crisis, Depositantes, Riesgo Soberano, Bancos.

I. Introduction

The Greek economy has been experiencing a deep crisis since the end of 2009. Persistent fiscal and external imbalances were the main source of the crisis. Greece has been exhibiting high fiscal deficits and high rates of inflation -exceeding the Eurozone average- since joining the Euro. The resulting heavy public debt (roughly 100% of Gross Domestic Product -GDP- from 2001 to 2008) and loss of competitiveness placed the Greek economy in a delicate situation that unraveled with the global financial crisis of 2008/09.

When the crisis became evident, depositors withdrew their money from Greek banks. At the beginning of the crisis, however, the banking system did not show liquidity or solvency problems. This suggests that depositors' decision to withdraw their funds was not directly related to bank-specific characteristics, as suggested in the market discipline literature. Market discipline is defined as a situation in which market participants monitor and react to bank risk in a way that impose "*strong incentives on banks to conduct their business in a safe, sound and efficient manner*" (Basel Committee on Banking Supervision's, 1999; Bliss and Flannery, 2001). Withdrawing the investments when a financial firm is becoming increasingly risky is one of the mechanisms by which market discipline can be detected (Flannery and Nikolova, 2004).

This paper investigates the effect of the Greek macroeconomic crisis on depositors' behavior. In particular, this study focuses on the impact of sovereign default risk. Using a panel dataset consisting of quarterly observations for Greek banks from June 2005 to September 2012, the results show that the fall of deposits during the Greek financial crisis can be mainly explained by sovereign default risk, controlling for bank-specific attributes. When the whole economy seemed at risk, depositors withdrew their money with no concern for the individual characteristics of banks. Before the crisis, however, depositors' behavior primarily depended on microeconomic variables as stated by the market discipline literature.

This case study provides new evidence regarding the importance of macroeconomic risk on banks deposits, contributing to the literature by showing that this effect is present not only in emerging markets but also in countries considered to be more "developed" as Greece. This is an in-

teresting case because: 1) it highlights the connections between sovereign debt crisis and banking crisis and 2) it raises the issue that these crises may arise not only because of the country risk itself but because of the *perception* of this risk and that this *perception* is what frequently defines a country's degree of development. Although the aim of this paper is not to investigate this last issue, it could give a future line of research as Greece became the first sovereign to find itself in the middle of a confidence crisis despite the fact that the fiscal situation in 2009 worsened throughout Europe and the rest of the world, in many countries much more than in Greece (Alogoskoufis, 2012). Moreover, in June 2013 Greece became the first developed country to be downgraded to emerging market status after being classified as a developed country in 2001 by the Russell Indexes and MSCI. Ultimately, all this suggests that investors, consumers, lenders make their decisions based on their confidence in a country and what is critical to them is "not the *ability* to repay the debt but the *willingness* to repay" [1] it. In the beginning of 2012, with the Private Sector Involvement program, Greece effectively defaulted on half of its debt becoming the first developed nation to default since 1946.

This sovereign default risk, the perception that the country is not willing (and/or able) to repay its debt, not only can affect international markets but specially can negatively influence the domestic economy and, in particular, it's banking system. This paper empirically assess that Greek's depositors indeed reacted more to sovereign risk than to bank-specific characteristics, putting additional pressure on liquidity and capitalization of the banking system.

The paper finds similar evidence for Greece as that found by Levy-Yeyati, Martínez Peria and Schmukler (2010). Using data on the 2000–02 bank runs in Argentina and Uruguay, they show that the macroeconomic shocks affected deposits despite the relative "good" indicators of the banks. Their conclusion is that depositors' behavior during macroeconomic crisis periods mainly responds to macroeconomic risks. They also show

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1. This phrase was stated by the senior vice president and director of Research of the St. Louis Fed, Dr. Christopher Waller during the first "Dialogue with the Fed"- "Sovereign Debt: A Modern Greek Tragedy" in May 2012.

that in the pre-crisis period deposits respond to bank-specific attributes. Results are also consistent with the findings of Burdisso, Cohen Sabban and D´Amato (2003) that show that the crisis suffered by Argentina in 2000-01 was unleashed by deterioration in the macro fundamentals rather than a bank run caused by excessive risk taking by financial institutions.

Much of the empirical research on market discipline focuses on the US and how risks assumed by banks influence on debt prices. Early work investigated the relationship between bank risk indicators and subordinated debt yields or large deposit rates, and a number of recent studies follow this same approach (Alton Gilbert, 1990; Flannery and Nikolova, 2004).

A number of papers also investigate how bank risk influences deposit quantities. In a recent paper, Berger and Turk-Ariss (2010) find significant depositor discipline in both the US and the EU over the period 1997-2007, even though they show stronger effects in the US than in the EU. They show that deposit growth rates react more consistently to equity ratios than to measures of loan portfolio performance. Their conclusion is that significant depositor discipline exists, or at least did exist prior to the recent global financial crisis.

Martínez Peria and Schmukler (2001) also find evidence of market discipline in Argentina, Chile and Mexico during the 1980s and 1990s. They show that deposits respond to bank risk taking; in the three countries, bank risk characteristics jointly affect the behavior of deposits. Their results also suggest that depositors monitor banks by following a few variables and that the relative importance of those variables may differ by country. For instance, the coefficient of the nonperforming loans ratio has different effect on deposits (not only in terms of significance but also in signs) according to the regression specification and the country under study. For Argentina, Calomiris and Powell (2000) conduct a panel regression analysis for private banks during the 1990s and find that lower capital ratio and higher asset risk are associated with depositors discipline in the form of greater deposits withdrawal, although not all measures of assets risk have the expected impact.

As already mentioned, the present study investigates if the behavior of Greek deposits from June 2005 to September 2012 can be explained as

a result of the bank-specific characteristics and/or the sovereign default risk represented in the government debt spreads. The main hypothesis is that during the crisis depositors react more to the sovereign risk than to the idiosyncratic indicators of bank health and that this effect was not present before the crisis. The regressions results indeed show that this was the case: the variable "spread" does not exert significant effect in the pre-crisis period but becomes significant in explaining the behavior of deposits at the outbreak of the crisis. Market discipline is also present, especially through assets and equity ratios but not so much through performance of loans, consistent with the already mentioned literature. In the robustness check Section the variable spread is replaced by the debt-to-GDP ratio and results again show that macroeconomic risk has a negative and significantly effect on deposits during the crisis; in fact, Greek depositors did not react to the high debt ratio until the crisis outbreak in the end of 2009.

The reminder of this essay is structured as follows. Section II describes the development of the Greek crisis and how it was transmitted to the banking sector. Section III describes the data and empirical methodology used in this study and presents the evolution of the main variables. Section IV provides and discusses the empirical results. Section V presents robustness checks and section VI concludes.

II. The Greek Crisis

When Greece joined the Euro in January 2001 its economy expanded quickly. The growth lasted from 2001 through 2008 and was a direct result of the benefits associated with euro-area entry: lower inflation expectations, lower interest rates, elimination of exchange-rates fluctuations and longer investment horizons. In particular, the initial fall in interest rates and long-term growth expectations increased consumption and investment, generating positives growth rates and keeping interest rates low until 2008.

The financial crisis that started in the US subprime mortgage market and followed with the collapse of Lehman Brothers in September 2008, produced a negative impact on the financial markets all over the world. In the euro-area, Greece was the country with the larger increased in spreads relative to German long-term government debt as financial markets and

credit rating agencies started to pay more attention to the country's fiscal and external imbalances. The outbreak of the crisis occurred at the end of 2009 when a mix of internal and external factors ended with a larger jump in spreads and an even higher percent of government debt to GDP.

Gibson, Hall and Tavlas (2011) argue that during the whole period 2001-2009 the Greek economy was already characterized by growing, unsustainable fiscal and external imbalances and that the low-levels of interest rate spreads that Greece reached in the mid-2000s were not justified by economic fundamentals. With the euro-area entry, Greece started to exhibit low interest rates but also continued to display high fiscal deficits, inflation and loss in competitiveness. Figure Nr. 1 shows that the ratio of public debt to GDP remained above 100% for every year (except for some quarters around 2003-2004) even during economic growth and low spreads periods. This high indebtedness was a logic consequence of persistent fiscal and current account deficits and the impossibility to issue local currency (Euro) to finance them.

Figure No. 1: Greek Debt to GDP and Spreads (vs. Germany) 2001-2012.
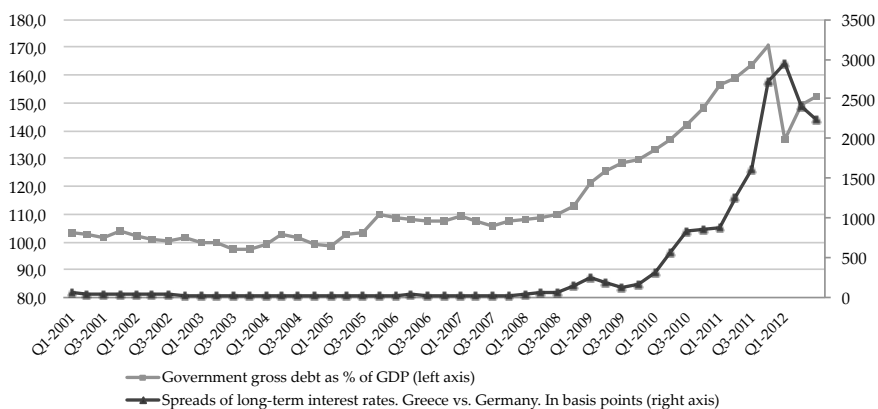
Sources: Eurostat, OECD.Stat and Thomson Reuters

Figure Nr. 1 shows that by the end of 2008 the interest rate spread started to increase. However, the outbreak of the crisis took place at the end of 2009 when various factors came together to provoke a jump in spreads

and a bigger increase in the debt to GDP ratio. Gibson, Hall and Tavlas (2011) remark two main reasons for this market sentiment deterioration: first, the newly-elected Greek government[2] disclosed that fiscal data were misreported, correcting the public-debt-to-GDP ratio and announcing a fiscal deficit of around 12.7% when the previous government had projected 6%; and second, the Dubai government announced the restructuring of the investment company Dubai World´s debt, which had a negatively impact on the world financial markets. Alogoskoufis (2012) adds a third reason for this spread's eruption: the failure of the new government to present a credible plan of fiscal consolidation.

As a result of all these events, in December 2009 international credit rating agencies decided to downgrade the ratings of Greek sovereign bonds: Fitch reduce it from A to BBB+; Moody´s from A+ to A and Standard & Poor's from A- to BBB+. Since then, Greece's long-term debt ratings began a downward path, reaching by the beginning of 2012 a rating of "C" for Fitch and Moody's and of "Selective Default" for Standard and Poor's.

By the end of 2009, thus, market sentiment towards Greece started a steep downward trend. To strengthen market confidence and Greece´s fiscal and financial position, the Greek government requested the International Monetary Fund support for a multi-year program under a Stand-By Arrangement (SBA). On May 9th 2010, the Executive Board of the IMF approved the SBA requested by Greece in an amount equivalent to SDR[3] 26.4 billion. In the executive summary of the agreement, the Greek economy was described by the IMF as:[4]

- Heavy public debt and loss of market access;
- Weak competitiveness (inflation has consistently out-paced the euro average);

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2. *Because of the worsening economic conditions and growing public discontent, the Greek Prime Minister Kostas Karamanlis announced on September 2009 that he would ask President Karolos Papoulias to dissolve the parliament and call early elections. Parliament was dissolved on September 9th 2009 and elections were formally set for October 4th 2009. After almost six years of conservative administration by New Democracy (ND), the Panhellenic Socialist Party (PASOK) returned to power and George Papandreou became the Prime Minister of Greece on October 6th 2009.*

3. *Special Drawing Rights*

4. *The information regarding the SBA and the development of the Greek economy under the revisions of the SBA were extracted from the publications section of the IMF website: www.imf.org.*

- Need of very large fiscal adjustments and simultaneously internal devaluation but bound to limit growth for a protracted period;
- A banking system with sound liquidity and solvency indicators at the beginning of the crisis, but under distress caused by sovereign downgrading, recession and uncertainty.

The reforms that the IMF program involved, such as tax reforms and privatizations, caused deep divisions within Greece political parties and society. At a global scale, Greece lost market access and although it started to adjust in macroeconomic terms, the continued economic recession and the apparent need to extend financial aid to Greece generated strong confrontation within European countries. Moreover, expectations of Greece´s debt restructuring emerged and market confidence suffered a new shock, falling sharply by mid-2011. This worsening market sentiment can be observed in Figure Nr. 2, which shows the evolution of daily spreads between Greece and Germany over 10 year bonds for the years 2011 and 2012.

**Figure Nr. 2: Daily Spreads of long-term interest rates.
Greece vs. Germany 2011-2012.**
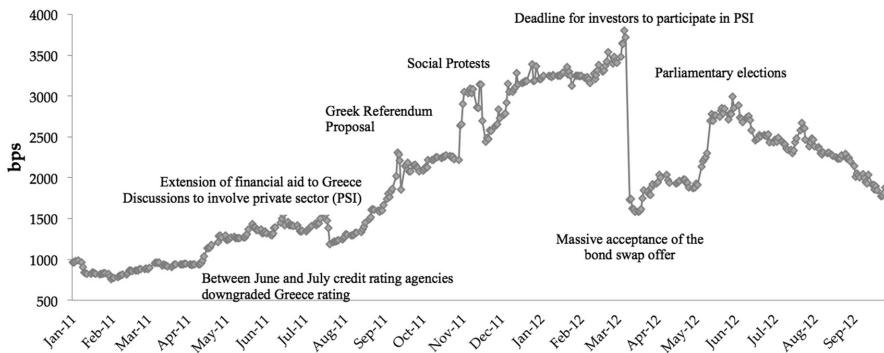
Source: Thomson Reuters, credit rating agencies and international news reports.

It could be considered that around July 2011 the Greek crisis reached a new stage where spreads changed their upward trend (Figures Nr. 1 and 2), peaking more than 3500 basis points in the beginning of 2012. This

marked deterioration in the market's reaction took form while the need for restructuring the Greek sovereign debt became more and more evident and as the political and social situation of the country grew weaker. Figure Nr. 2 notes the main events that occurred between mid-2011 and 2012, which are summarized below.

In July 2011 European leaders reached the required consensus to continue their financial support to Greece with the aim to restore its market access, but with the condition that their program be implemented. The debate about extending financial aid to Greece also involved public discussions about options for a Private Sector Involvement program (PSI). After an initial proposal of the PSI and subsequent revisions by Eurogroup members, bank representatives from the IIF (a group representing the world's largest banks) and the IMF staff as observers, European partners agreed on the key targets of the PSI operation. In October 2011 a modified PSI was adopted –envisaging a significant reduction in the face value of the Greek sovereign debt– together with an ambitious program of structural reforms for the Greek economy, aimed at bringing down the Greek debt-to-GDP ratio to 120% by 2020. The PSI was successfully completed in April 2012 with a participation rate that surprisingly reached 96.9% of the total out-standing amount of eligible bonds. The PSI program ultimately meant a default on Greek debt; investors "voluntary" accepted to take 50% cut in the face value of their bonds.

The weak economic situation went hand-in-hand with social and political unrest. Social protests and strikes became frequent as the new austerity measures and structural reforms for growth recovery were expanding. On October 31st 2011, the Prime Minister of Greece, Mr. Papandreou, proposed a referendum to openly approve the additional financial aid that the Eurozone agreed to offer Greece. Faced with a storm of criticism over the referendum, Papandreou had to withdraw it and announced his resignation. As a result of this political conflict, a national unity government was formed by the beginning of November 2011. In November 17th, under the commemoration of the revolutionary organization, at least fifty thousand Greeks joined a protest that represented the first public test of the new national unity government. In May 2012, the first early parliamentary elec-

tions took place but the three top-ranking parties failed to form a working coalition and President Papoulias called new elections for June 17th, 2012. The parliamentary elections of June boosted New Democracy, albeit leaving it without a majority. Finally, leader Antonis Samaras became the new Prime Minister of Greece and assembled a coalition with third-placed PASOK and smaller groups to pursue the austerity program.

Banking Sector´s behavior

The economic crisis affected the banking sector via many channels, the more important being the cut-off from international financial markets; the outflow of deposits; the deterioration of asset quality as a result of worsening economic conditions; and the restructuring of the Greek sovereign debt through the Private Sector Involvement (PSI) program.

In particular, the process of restructuring the Greek sovereign debt entailed the exchange of Greek Government Bonds (GGBs) with a series of new bonds, at a significant price discount. In the context of the PSI, Greek banks exchanged GGBs and state-related loans of a total face amount of €48.6 billion, for New Bonds issued by the Hellenic Republic and PSI Payment Notes issued by the European Financial Stability Facility (EFSF)[5]. For the Greek banking sector, the losses in net present value amounted to €37.7 billion, out of which €5.8 billion had already been recorded on the June 2011 financial statements. Before the massive acceptance of the bond swap, in December 2011 the aggregate capital of the credit institutions amounted €53,067 millions. Considering these values, the losses derived from the PSI exchange program represented more than 70% of the system's equity.

Banks´ financial profiles were severely affected by the pressure on liquidity and capital put by these factors. To respond to these pressures, the Bank of Greece took a prominent role in providing emergency liquidity assistance (ELA) and a process of recapitalizing and restructuring of the banking system is already underway. Regarding capitalization, the strategy followed by the Bank of Greece was to identify four "core banks",

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5. *Bank of Greece, Report on the Recapitalisation and Restructuring of the Greek Banking Sector, December 2012.*

namely National Bank of Greece, Eurobank, Alpha Bank and Piraeus Bank, which were eligible for recapitalization using public funds, and "non-core banks" needed to be recapitalized by the private sector or, otherwise, to be resolved.

At the time of writing, some commercial banks in Greece had already been merged with or acquired by core banks, and other are in the process of being resolved. Between 2011 and the beginning of 2013: the largest public bank ATE was resolved through an acquisition by Piraeus Bank; two smaller banks were acquired by two core banks (Emporiki and GE-NIKI by Alpha Bank and Piraeus Bank, respectively); another small bank was resolved with state financial aid (Proton Bank) and the Hellenic Post-bank was resolved as a new bank capitalized by the Hellenic Financial Stability Fund (see Table A.1 in the Appendix). After this crisis, clearly, the structure of the banking sector will not be the same.

The next section is dedicated to the description of the empirical methodology we employ to test the main hypothesis and to describe in more detail the banking sector's behavior. The evolution of the main variables identified in this section, the database and the regressions specifications are described in the next section in order to answer the following key questions:

- How did the crisis affect banks' indicators?
- Was the decision of depositors to withdraw their funds made before or after the deterioration of these indicators?
- Did depositors react more to the sovereign risk (represented by the long-term debt spreads) than to specific-bank characteristics when the crisis started?
- If they responded to "liquidity and solvency" indicators before the crisis, did they also respond at the time of the crisis?

III. Data and Methodology
III.1. Sample
The bank-level database in this study includes 12 commercial banks operating in Greece which represent approximately 80% of the banking system. The decision to include these banks relies on their importance within the

system and data availability. At the end of 2011 only five of these banks had a total of € 283 billion in assets, accounting for 60% of total credit institutions assets. In December 2010 (before the PSI), these five banks held 61% of the Government Securities held by credit institutions, other than shares and derivatives. For these banks, on average, the ratio of these government securities to assets was 10% and to equity was 222%[6]. For the aggregate of credit institutions these Government Securities –other than shares and derivatives – accounted for 10% of total assets and 104% of capital and reserves. Appendix Table A.1 shows the banks included in the sample.

Data come directly from banks' balance sheets and income statements. The database is quarterly as available public information is released every three months. The period covers 30 quarters from June 2005 to September 2012 in order to include the pre-crisis and the crisis period.

The data also include ownership information from the statements reports and Bankscope dataset to control for mergers and acquisitions (M&A) that occurred during the whole period. The bank-quarter observations in which M&A were concluded are treated as missing points[7]. The main changes in ownership and the mergers deals of the period are also presented in the Appendix Table A.1.

Given the main focus of how sovereign risk affects deposits, regressions also include macroeconomic data as independent variables. The core measure of country risk is the spread on Greek sovereign bonds over German comparable bonds provided by Thomson Reuters dataset and OECD. Stat. To consistently merge with the bank quarterly database, spreads are calculated as the quarter average of the daily difference between the 10-year sovereign bonds yields of Germany and Greece.

The rest of the macroeconomic variables were collected from Eurostat and OECD.Stat. The information about the whole financial system of

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6. *If the fifth largest bank –Agricultural bank of Greece-, which was publicly owned until 2012, is not taken into account, the average ratio of government securities (other than shares and derivatives) to equity drops to 154%.*

7. *In particular, the observation treated as missing points were: Piraeus Bank in September 2012 as in July 2012 it absorbed Agricultural Bank of Greece, thus, since September it represents a "new" bank; and Proton Bank in September 2006 as it was the result of a merger between Proton Investment Bank, Omega Bank and Proton Securities. The banks that were acquired by other banks remain in the database with observations until the last publicly available financial statement.*

Greece, including the recapitalization and restructuring of the banking system, was obtained from the website of the Bank of Greece.

III.2. Empirical Methodology

The main hypothesis of this study is that during the Greek crisis depositors react more to sovereign risk than to bank-level indicators. To test it, the following panel specification is estimated:

$$D_{i,t} = \alpha_i + \beta * SPREAD_t + \delta * BANK_{i,t-1} + \varepsilon_{i,t} \qquad (1)$$
$$\varepsilon_{i,t} \sim N(0, \sigma^2_{i,t})$$

Where D is the log of time deposits, each observation corresponding to total customer deposits that bank i has at quarter t; the variable $SPEAD$ is the country risk that changes over time but not across banks; and $BANK$ is a vector of bank-specific characteristics that changes over banks and time. The sovereign default risk is usually measured as the spread of interest rates. Thus, in the baseline estimations, this risk is measured by the variable $SPEAD$: the interest-rate spread between 10-year Greek and German government bonds. For robustness check, other regressions replace $SPREAD$ with the debt-to-GDP ratio and a dummy variable that takes into account the completion of the PSI program, as spreads are expected to be influenced by fundamentals and the probability of default. The vector $BANK$ includes a number of bank-level variables and ratios that are mainly derived from the CAMEL rating system of banks and controls for size, capital adequacy, assets quality, earnings and liquidity. Description and averages of these variables' pre-crisis and during crisis values are reported on Table Nr. 1.

It is worth mentioning that for asset quality the typical ratio of non-performing loans (NPLs) is not used here because of data availability. Many of the public available financial statements are not presented in much detail so it was not possible to obtain the amount of impairment on loans for all the banks. In the Bankscope dataset there are also very few observations for the variable NPLs for the banks and years considered in this sample. Instead, this paper uses a more comprehensive ratio regarding the quality of assets as "Impairment charges for credit losses" includes not only the charges from

non-performing loans but also the losses derived from holding government securities after the outbreak of the crisis. The ratio divides the impairment charges over total assets instead of over total loans as the government debt is computed in other assets than loans, such as investments.

Table Nr. 1: Variable definition and Descriptive Statistics

Variables	Definition	Pre-crisis Q2-2005 –Q2-2009		Crisis Q3-2009 –Q3-2012	
		Average	Std Dev	Average	Std Dev
Assets	Log of total assets	16.542	1.307	16.902	1.211
Equity_assets	Equity to total assets ratio (%)	6.955	5.904	5.635	3.232
Impair_assets	Impairment charges for credit losses to total assets (%)	0.599	0.396	2.479	2.653
ROAA (Return on assets ratio)	Ratio of net interest income to total assets (%)	2.408	0.519	2.073	0.590
Liquid_assets	Liquid assets - cash and balances with central banks - to total assets ratio (%)	3.200	1.332	2.667	1.289

In equation (1) bank-specific variables are lagged one period to account for the fact that depositors have access to financial information with certain delay. The estimation of (1) includes fixed effects to consistently estimate the parameters if α_i were correlated with ε_{it}. In this way, this estimation assumes that the unobserved heterogeneity of the individual banks is constant over time and can be correlated with the independent variables. The decision to estimate under a fixed effects model is related to the post-estimation analysis. Estimating Eq. (1) with different control sets and with fixed effects (FE) gives roughly the same results than estimating the same specifications with random effects (RE).[8] Even so, after estimating both models, a Hausman test was applied and the null hypothesis was rejected with high significance level. Thus, it seemed preferable to estimate with FE since RE could give inconsistent estimators.

The equation is also estimated by dividing the sample in two periods: pre crisis and crisis and, as robustness check, by using other variables than

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8. The only variable that changes signs between FE and RE estimations was ROAA.

"spread" to control for the sovereign risk and also by accounting for types of ownership (foreign and no foreign banks). All these results are presented in sections IV and V.

III.3. Evolution of key variables

Before the empirical estimation of Eq. (1) it is important to take a closer look at the key variables included in that equation. The dependent variable is the log of deposits and the independent variable of main interest is the spread of yields on Greek over German long-term bonds, which represents the country risk. Figure Nr. 3 shows the inverse relation between these two variables.

Figure Nr. 3: Deposits vs. Spreads 2005-2012.
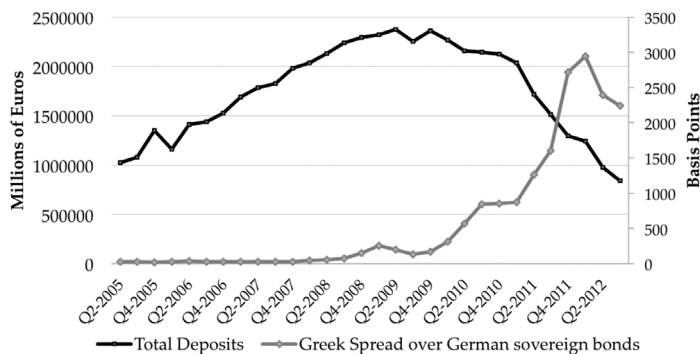
Source: OECD. Stats, Thomson Reuters and Banks Financial Statements.

The variable "Total Deposits" is the sum of the twelve banks costumer deposits. It shows a downward trend since end of 2009 that accelerates by mid-2011. Between March 2010 and March 2011, depositors withdrew their funds at an average monthly rate of approximately 1%, representing a 12-month percentage change of -11%. By the end of 2011 the annual withdrawal rate reached 18% and in July 2012 climbed to 22%.

In turn, Figure Nr. 3 shows that the spread of Greek over German long-term bond started its upward trend by the end of 2009 and presented its maximum quarter average value in March 2012 when it reached 2941 basis points. It also stresses a very close inverse relationship between the

spreads and depositors' behavior; their correlation coefficient is -0.427, which is significant at the 5% level. Moreover, as shown in Figure Nr. 1, spreads move in close relation with public debt, with a highly significant correlation coefficient of 0.813 for the whole period 2001-2012. Thus, this may be a first sign that depositors do react to sovereign risk.

It is also important to plot total deposits versus the mean of the bank-level variables to see if a direct relationship like deposits vs. spreads may also be observed between deposits and bank ratios. Figures Nr. 4 to 8 indicate that the connection is not as clear between deposits and banking indicators as in the case of spreads. Most of the variables show a volatile behavior and a deterioration of their values some months after the bank run started at the beginning of 2010.

Figure Nr. 4: Deposits vs. Assets 2005-2012
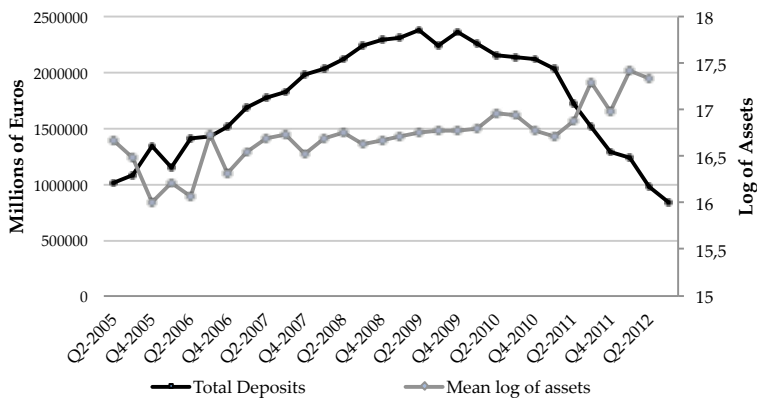
Source: Banks Financial Statements.

The deterioration in bank-level indicators is related to the way the crisis developed and impacted on the banking sector, described in the previous section. With the discussions of Private Sector Involvement, since approximately the second quarter of 2011, banks were forced to recognize large losses on bonds and consequently their impairment-charges-for-credit-losses ratio sharply increased and their profitability became under strong pressure (Figures Nr. 6 and 7). With the acceptance of the PSI and the exchange of GGBs in the first quarter of 2012, banks proceeded to the full

derecognizing[9] of the old securities and loans and the recognition of the new securities received from the exchange, which generated a decrease in the impairment ratio.

Figure Nr. 5: Deposits vs. Equity/Assets 2005-2012.

Figure Nr. 6: Deposits vs. Impairment/Assets 2005-2012.
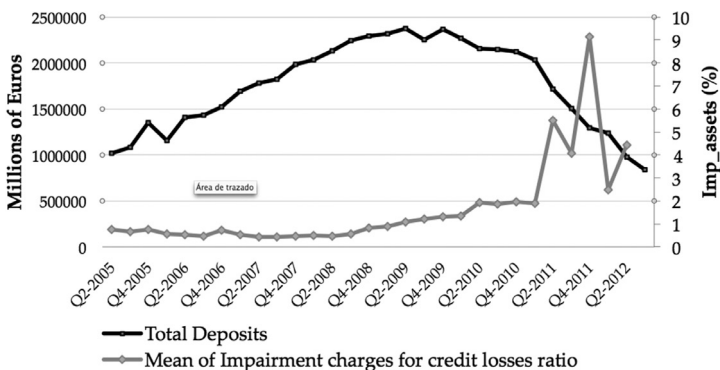
9. In April 2012, the IFRS Interpretations Committee received a request for guidance on the accounting for several aspects of the restructuring of Greek Government Bonds. Regarding the derecognition of the financial assets, the Committee concluded that the transaction would result in derecognition, as established in the International Accounting Standard 39. "Derecognition" is defined by the IAS 39 as the removal of a previously recognised financial asset or financial liability from an entity's statement of financial position. After this derecognition, the Greek banking sector had to absorb losses that amounted to €37.7 billion in net present value.

Figure Nr. 7: Deposits vs ROAA 2005-2012.
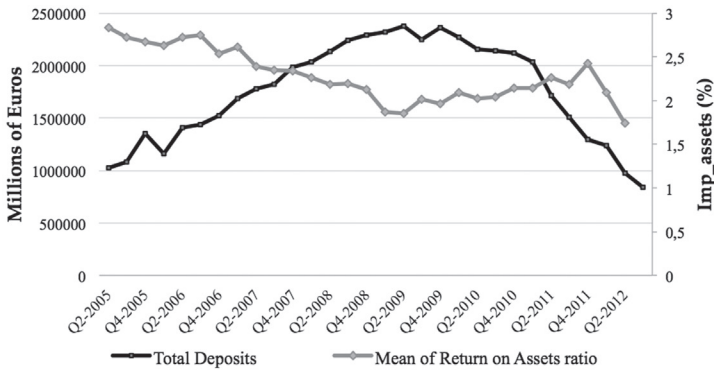
Source: Banks Financial Statements.

Figure Nr. 8: Deposits vs. Liquid Assets ratio 2005-1012.
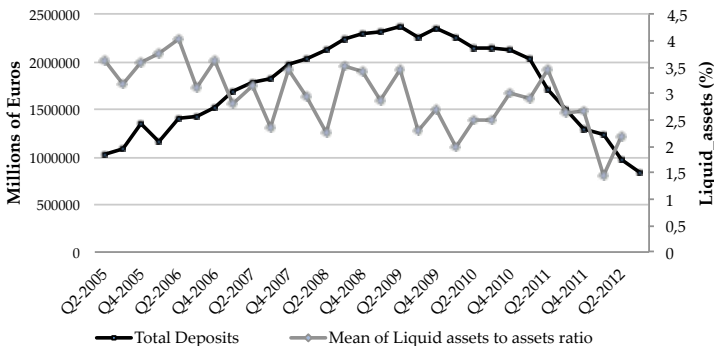
Source: Banks Financial Statements.

The losses absorbed by banks as a result of their heavy exposure to Greek government bonds produced drastic drops in the ROAA and Equity ratios since the end of 2011. As can be seen in Figures Nr. 5 and 7, these declines started after the beginning of deposits withdrawals. This would mean that depositors reacted to the troubled situation of the Greek economy even before banks' financial profiles started to weaken.

Moreover, liquidity ratios worsened as deposit withdrawals increased. Even though the mean of the liquidity to assets ratio seems volatile (Figure Nr. 8), its first important fall is observed in the first quarter of 2010,

after depositors started their reaction with the crisis outbreak by the end of 2009. Then, the ratio reaches its minimum point in the first quarter of 2012, after depositor confidence was severely undermined by the public discussions of PSI and by the uncertainty related to political and social conflicts (the "new" phase of the crisis).

As previously said, and only by looking at the evolution of the key variables, it seems that in fact Greek depositors decided to withdraw their funds in response more to the increase in sovereign risk than to the deterioration in bank-level characteristics, at least at the beginning of the crisis. Equation (1) formally tests this. Results are discussed in the next section.

IV. Results

Table Nr. 2 presents the estimation results of Equation (1) with bank fixed effects. Column (1) shows the results for the whole database and columns (2) and (3) report separate estimations for the pre-crisis and the crisis period. Consistent with the crisis description of section II, the "crisis period" is considered to begin by the end of 2009. However, as seen from the above figures, the crisis effect on deposits seemed to be more severe since the middle of 2011. As also described in section II, since June 2011 the Greek banking sector started a restructuring process following the PSI program and the need to recapitalize it by public or private funds. This is the reason for the division between two sub-periods: column (4) presents the results from September 2009 to March 2011 and column (5) from June 2011 to September 2012. Although the number of observations (and banks) clearly falls in columns (4) and (5), especially in column (5) as a result of the restructuring process, it may be useful to compare these results with the whole period of crisis and to see if there are two different stages regarding the effect of variables on deposits during the Greek crisis.

Column (1) in Table Nr. 2 shows that the spread has a negative and significant impact on depositors' behavior. Also, bigger and better capitalized banks attract more deposits, while earnings (measured by ROAA) and liquidity ratios do not seem to exert a significant effect on Greek depositors over the whole period.

As Levy-Yeyati, Martínez Peria and Schmukler (2010) document for Argentina and Uruguay, these results support the importance of macroeconomic risk during the crisis period for the case of Greece too. The effect of spread on deposits is not significant in the pre-crisis period (column (2)) but is highly significant during the crisis, especially before mid-2011 (column (4)) when banks had not yet absorbed the effects of the crisis nor started their restructuring process. For this period, an increase of Greek spreads of one unit -of basis points- implies a decline in deposits of approximately 1.3%.

Table Nr. 2: Greek Deposits reaction to macroeconomic risk and bank-level variables

VARIABLES	Total period 2005-2012	Pre-crisis Q2.2005– Q2.2009	Crisis Q3.2009– Q3.2012	Q3.2009 – Q1.2011	Q2.2011 – Q3.2012
	(1)	(2)	(3)	(4)	(5)
	Log of deposits	Log of deposits	Log of deposits	Log of deposits	Log of deposits
Spread	-0.011***	-0.007	-0.010***	-0.013***	-0.004
	[-3.136]	[-0.311]	[-3.179]	[-4.868]	[-1.733]
Assets	0.690***	0.751***	0.780***	0.617***	0.524**
	[7.212]	[10.900]	[6.096]	[3.271]	[2.555]
Equity_assets	0.011***	0.012	0.008**	-0.004	0.013***
	[3.681]	[1.704]	[2.372]	[-1.150]	[5.733]
Impair_assets	-0.006	-0.048**	0.006	-0.003	0.006*
	[-0.767]	[-2.216]	[1.776]	[-0.455]	[2.247]
ROAA	0.060	0.032	-0.081*	-0.015	-0.041
	[1.049]	[0.870]	[-1.890]	[-0.237]	[-0.647]
Liquid_assets	-0.006	-0.006	-0.002	0.007*	0.005
	[-0.812]	[-1.271]	[-0.250]	[1.969]	[0.306]
Constant	4.573**	3.668**	3.287	5.951*	7.508*
	[2.662]	[2.957]	[1.516]	[1.854]	[2.209]
Observations	254	142	112	78	34
R-squared	0.703	0.817	0.851	0.675	0.847
Nº of banks	12	12	12	12	10
Prob > F	0.0000	0.0000	0.0000	0.0001	0.0000

Note: Bank-specific variables are taken from Greek banks quarterly financial statements and lagged one period (except for deposits). Greece vs. Germany spreads are calculated from Thomson Reuters daily series. Regressions are fixed effects with robust standard errors. T-statistics are in brackets.

*Significant at 10%, **Significant at 5%, ***Significant at 1%.

During the whole period, sovereign risk explained 55% of the change in deposits. It represented 23% in the pre-crisis period and 75% between September 2009 and March 2011. These percentages were calculated as the ratio between 1 minus the adjusted R^2 of the regression without the spread (only with bank-level characteristics as independent variables) and the adjusted R^2 of the complete regression (including the spreads). Table Nr. 3 presents these values and the resulting variance explained by country risk for regressions (1) to (4). Regression (5) is not presented because it includes too few observations so the R^2 may not be reliable. The adjusted R-square coefficients show that during crisis the joint significance of the bank-level variables falls (1- R^2 of the regression with only bank characteristics grows) and country risk becomes more significant to explain the behavior of deposits.

Table Nr. 3: Percentage explained by Country Risk (spreads) pre and during crisis

	Total Period 2005-2012		Pre-crisis Q2-05 –Q2-09		Crisis Q3-09 -Q3-12		Crisis I Q3-09 -Q1-11	
	Explained by *country risk*		Explained by *country risk*		Explained by *country risk*		Explained by *country risk*	
1- R^2within with only bank char.	38%	55%	19%	23%	25%	30%	49%	75%
R^2within reg. including spread	70%		81%		84%		65%	

Regarding the bank-level variables and the existence of market discipline, Table Nr. 2 sustains the "too big to fail" hypothesis as the largest banks in terms of their assets gained deposits. The impact of other variables depends of the period under analysis. For example, at the beginning of the crisis depositors did not withdraw their funds from more liquid institutions; however, this effect disappeared as the crisis developed.

The ratio of impairment charges for credit losses to total assets was significant for depositors before the crisis (Table Nr. 2, column (2)). However, during the crisis its coefficient changed signs and significance. The volatile behavior of this ratio during the crisis is related to the fact that at

the outbreak of the crisis all banks -and in particular the five larger banks- strongly increased their exposure to credit risk from the Greek Government debt and then reduced it as a consequence of the Greek banking sector restructuring process. As explained before, because of the discussions about PSI, since mid-2011, and until the completion of the program, Greek banks had to recognize large amounts of impairment charges with respect to the exchanged Greek government bonds and loans. Banks involvement in the PSI exchanged those charges for the impairments of new bonds and, consequently, provoked a large negative impact on their equity and capital adequacy. Figures Nr. 5 and 6 depict these behaviors, with equity to assets ratio dropping during the crisis and impairment charges ratio peaking in the year 2011 and then suddenly falling after completion of the program in the first quarter of 2012. Overall, the effect of the asset quality indicator on deposits is volatile; its sign and significance change across specifications, as other studies have shown (Calomiris and Powell, 2000; Martínez Peria and Schmukler, 2001).

Regarding capitalization, the equity-to-assets ratio has a positive and significant effect on deposits, for the whole period and also during the crisis. This is consistent with the findings of Berger and Turk-Ariss (2010) that depositors react more to equity ratios than to measures of portfolio performance. It is also consistent with the work of Levy-Yeyati, Martínez Peria and Schmukler (2010), where the capital-to-assets ratio became significant during crisis for the log of dollar time deposits in Argentina.

To sum up, the outbreak of the Greek macroeconomic crisis, whose risk is measured here by the evolution of sovereign spreads, generated an outflow of deposits in all banks regardless their idiosyncratic indicators.[10] This situation is specially clear in the first period of the crisis (Table Nr. 2, column (4)), when depositors started to withdraw their funds at the same time that international market sentiment declined sharply, but before the

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10. It should be mentioned that although Greece has a deposit insurance system (TEK) it is not considered here as is not expected to exert positive influence on depositors since it has vulnerabilities and lack of credibility. In the Financial System Stability Assessment of 2006, the IMF points out that: 80% of TEK´s assets are invested with participated banks; the deposit insurance agency does not know the amounts of the insured deposits by banks and does not have access to special financing; and efficiency and credibility of the TEK should be strengthened.

banking sector had to embrace the losses derived from holding Greek government debt. Since that moment, however, it could be considered that depositors began to exert a market discipline, at least by paying more attention to the equity-to-asset ratio (column (5)).

V. Robustness check

This section tests if the findings of Table Nr. 2 regarding the impact of sovereign risk on depositors can be replicated using alternative country risk variables. There is vast evidence that macroeconomic fundamentals and the probability of default have statistically and economically significant effects on sovereign spreads. This has frequently been proved for emerging markets but more recently has also been tested for euro area countries like Greece (Hilscher and Nosbusch, 2010; Caceres, Guzzo and Segoviano, 2010; Alogoskoufis, 2012).

As seen in Figure Nr. 1 and discussed in section III.3, there is a close relationship between Greek spreads and its debt-to-GDP ratio. Thus, as robustness check, the latter is used as the sovereign risk variable in Eq. (1): the independent variable *SPREAD* is replaced by the Government consolidated gross debt as percentage of GDP extracted from Eurostat. The new regression is also run with a dummy that takes into account the completion of the PSI program. This dummy is called "default" as the restructuring process that ended on April 2012 allowed Greece to effectively default on a great percentage of its debt. So, "default" takes value of 1 for the second and third quarter of 2012 and zero otherwise. The aim here is to test if depositors reacted more to a key country-specific fundamental, the debt-to-GDP ratio, than to the idiosyncratic indicators of banks, controlling for the default dummy and also for the interactions between this dummy and bank risk indicators.

These regressions are run for the pre-crisis and crisis periods, for the whole period with and without the interactions[11] and with two sets of controls: one is the same as in Table Nr. 2 and the other excludes the ratio "Impairment charges for credit losses to total assets". The reason is that

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11. *Interactions are not included in the crisis period so as to be comparable with the pre-crisis period, which cannot include the dummy of default since it does not cover the PSI progam.*

these impairments charges are strongly correlated to the government debt, as discussed in previous sections and presented in the correlation matrix in Appendix Table A.2. The relationship between impairment of assets and public debt is also documented in the literature. Using a panel data set of Greek commercial banks from 2003 to 2009, Louzis, Vouldis and Metaxas (2012) find a positive and significant impact of public debt on all types of non-performing loans. Deterioration of public finances leads to increase of NPLs by two channels: directly by the exposure to Greek sovereign bonds and indirectly through austerity measures and/or decreasing demand derived from the economic crisis that affects households and corporations solvency.

Table Nr. 4 presents the new results which are consistent with the findings of the previous section. The variable that represents the macroeconomic risk has a negative and significantly effect on deposits during the whole period, especially in the crisis period and even after controlling for the default dummy. Columns (1) to (4) show that Greek depositors did not react to the high debt ratio until the crisis outbreak in the end of 2009.

It is worth noting that although the dummy default is significant in the crisis period, for the whole period is only statistically significant after controlling for the interactions with bank risk indicators. Regarding these interactions, the fact that they are statistically significant (columns 7 and 8) provides additional evidence for the conclusion of the previous section: with the default on part of the Greek debt and the recapitalization and restructuring process of the Greek banking system, depositors started to monitor the "new" banks and market discipline appears to be present through assets, liquidity and capital ratios.

Table 4. Deposits reaction to macroeconomic risk measured by Debt to GDP (%) and Dummy of Default (=1 for Q2.2012 and Q3.2012)

VARIABLES	Pre crisis Q2.2005 -Q2.2009		Crisis Q3.2009 - Q3.2012		Total period. Q2.2005-Q3.2012 with interactions.			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Debt_gdp	-0.001	0.001	-0.004***	-0.003***	-0.005***	-0.004***	-0.005***	-0.004***
	[-0.214]	[0.411]	[-3.522]	[-3.579]	[-4.909]	[-4.389]	[-5.026]	[-4.420]
Default			-0.148*	-0.152***	-0.080	-0.072	-8.591***	-7.873***
			[-1.975]	[-3.244]	[-1.113]	[-1.291]	[-7.936]	[-8.318]
Assets	0.757***	0.729***	0.804***	0.723***	0.819***	0.794***	0.864***	0.834***
	[11.995]	[10.380]	[4.973]	[4.631]	[7.711]	[7.755]	[9.552]	[9.327]
Equity_assets	0.016*	0.013*	0.006	0.004	0.013**	0.013**	0.013*	0.013**
	[2.031]	[1.888]	[0.812]	[0.915]	[2.348]	[3.036]	[2.184]	[2.818]
ROAA	0.032	0.041	-0.108**	-0.105**	0.053	0.048	0.085*	0.079
	[0.690]	[1.138]	[-2.479]	[-2.585]	[0.943]	[0.869]	[1.915]	[1.741]
Liquid_assets	-0.004	-0.007	-0.002	0.003	-0.005	-0.003	-0.005	-0.003
	[-1.031]	[-1.278]	[-0.242]	[0.495]	[-0.585]	[-0.385]	[-0.548]	[-0.363]
Impair_assets		-0.058**		-0.012**		-0.009		-0.010
		[-2.521]		[-2.598]		[-1.430]		[-1.331]
Debt_gdp * Default							0.036***	0.027**
							[4.989]	[2.974]
Assets * Default							0.155***	0.181**
							[7.082]	[2.870]
Equity_assets * Default							0.100***	0.111***
							[9.228]	[4.416]
ROAA * Default							-0.087**	-0.082
							[-2.221]	[-1.574]
Liquid_assets * Default							0.379***	0.410***
							[18.169]	[5.932]
Impair_assets * Default								0.024
								[1.311]
Constant	3.555**	3.873**	3.452	4.761	2.924	3.293*	2.124	2.562
	[2.733]	[2.898]	[1.230]	[1.778]	[1.555]	[1.821]	[1.342]	[1.636]
Observations	143	142	113	112	256	254	256	254
R-squared	0.808	0.818	0.818	0.846	0.715	0.724	0.745	0.753
Number of id	12	12	12	12	12	12	12	12

*Note: Dependent variable: Log of Deposits. Method of estimation: fixed effects with robust standard errors, t-statistics in brackets. *Significant at 10% **Significant at 5% ***Significant at 1%*

When including debt-to-GDP instead of spreads, the positive sign and significance of the asset variable do not change. The equity-to-assets ratio remains significant for the whole period as in Table Nr. 2 but is no longer significant in the crisis period when the default dummy is included.[12] For the pre-crisis period, market discipline remains present with deposits responding positively to assets and negatively to impairment charges for credit losses.

The results are also robust when: (i) adding another country specific fiscal variable -the general government deficit as percentage of GDP-; (ii) estimating by ordinary least squares method (OLS); and (iii) taking into account the banks' ownership. Table A.3 in the Appendix compares columns (7) and (8) of Table Nr. 4 with the results of estimating the same regressions by OLS and with another specification that includes the deficit-to-GDP ratio. In a recent paper, Caceres, Guzzo and Segoviano (2010) find that the overall fiscal balance is a significant factor influencing sovereign spreads and, specifically for the case of Greece, their results show that this effect is significant although not as important as the debt-to-GDP ratio. Table A.3 presents similar evidence: when both the debt and deficit ratio are included in the regressions the main variable to explain the behavior of depositors is the debt-to-GDP ratio.

These equations are estimated by fixed effects (FE) and also by OLS. Although, as previously said, it seems appropriate to estimate by FE to allow bank unobserved heterogeneity to be correlated with independent variables, it should be noted that the most important results replicate under different estimation methods. The main difference between both methods is that without the estimation of the parameter αi, i.e. under OLS method, the profitability and the liquidity ratios become significant in explaining the behavior of depositors during the whole period.

Equation (1) is also estimated by dividing the sample according to the banks' ownership type. Since the biggest banks in Greece that engaged in merger or acquisitions process during the present crisis were foreign, it is relevant to test if the depositors had the same behavior despite the owner-

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12. When the default dummy is not included and the debt-to-DGP ratio replaces the variable "spread", the equity-to-assets ratio does remain statistically significant for the crisis period.

ship of the bank. Table A.4 in the Appendix shows that depositors reacted to sovereign risk by withdrawing their funds in all types of banks, regardless their bank-specific characteristics and their ownership type. This effect is more important during the crisis but in the case of foreign banks was also present in the pre-crisis period (although with a lower significance). Regarding bank controls, and comparing between the two types of ownership, it seems that for foreign banks depositors exert market discipline through assets and profitability and in the case of public and private banks market discipline goes more through capitalization ratios.

To conclude the robustness check section, a binary regression is estimated to investigate how the sovereign risk, the idiosyncratic indicators of the banks and their type of ownership influence the probability of a banking crisis. The changes in bank deposits could be one way to date a banking crisis (Reinhart and Rogoff, 2011), thus, the crisis dummy takes value of 1 when the deposits of a bank fall below the deposits mean of that same bank. Table Nr. 5 presents the results for the probit model and the logit model with fixed effects (xtlogit), with and without the sovereign risk and including both the spread and the debt-to-GDP ratio in the last specification. Results are consistent with the previous findings: the increase in sovereign risk, measured by spreads or macroeconomic fundamentals, significantly affects the probability of a banking crisis, whereas no bank risk indicators or foreign ownership appear to influence the likelihood of the crisis.[13]

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13. The same results are achieved if the crisis dummy takes value of 1 when deposits of a particular bank fall below the mean of the total deposits, instead of falling below its own mean.

Table Nr. 5: Probability of a banking crisis as a negative change in deposits
Methods of estimation: Probit and Logit with FE (Xtlogit)

EQUATION	VARIABLES	Probit				Xtlogit			
		(1) crisis	(2) crisis	(3) crisis	(4) crisis	(5) crisis	(6) crisis	(7) crisis	(8) crisis
crisis	Debt_gdp			0.036***	0.036***			0.054***	0.044**
				[5.770]	[4.451]			[4.011]	[2.365]
	Spread		0.084***		-0.001		0.133***		0.043
			[3.882]		[-0.037]		[3.364]		[0.815]
	Assets	0.049	-0.008	-0.017	-0.017	3.220***	2.379**	0.500	0.737
		[0.589]	[-0.087]	[-0.197]	[-0.193]	[3.403]	[2.341]	[0.445]	[0.624]
	Equity_assets	-0.013	0.001	-0.017	-0.017	0.078	0.120*	0.046	0.066
		[-0.414]	[0.038]	[-0.513]	[-0.511]	[1.174]	[1.710]	[0.670]	[0.898]
	ROAA	-0.502***	-0.305*	-0.116	-0.116	-0.154	-0.252	-0.181	-0.210
		[-3.207]	[-1.832]	[-0.663]	[-0.664]	[-0.295]	[-0.474]	[-0.348]	[-0.402]
	Liquid_assets	-0.015	0.051	0.046	0.046	-0.049	0.040	-0.027	-0.001
		[-0.227]	[0.756]	[0.688]	[0.668]	[-0.358]	[0.286]	[-0.189]	[-0.004]
	Impai_assets	0.266***	0.057	0.016	0.017	0.490***	0.116	0.109	0.055
		[4.272]	[0.728]	[0.232]	[0.222]	[3.410]	[0.775]	[0.829]	[0.373]
	Foreign	-0.242	0.071	0.016	0.014	0.193	0.758	0.865	0.917
		[-1.217]	[0.329]	[0.078]	[0.063]	[0.155]	[0.577]	[0.670]	[0.704]
	Constant	0.048	0.071	-4.166**	-4.188**				
		[0.029]	[0.041]	[-2.186]	[-2.096]				
	Observations	253	253	253	253	253	253	253	253
	Number of id					12	12	12	12

Note: Dependent variable: Crisis.
*Crisis takes value of 1 when deposits of a bank fall below the deposits mean of that same bank. As in the previous regressions, bank-specific variables are lagged one period. T-statistics are in brackets. *Significant at 10% **Significant at 5% ***Significant at 1.*

VI. Conclusions

This case study analyzes the behavior of Greek depositors since its entry to the Euro-area until the present financial crisis. The main finding, consistent with the work of Levy-Yeyati, Martínez Peria and Schmukler (2010), is that depositors react to macroeconomic risk and this effect increases during the crisis period. The results presented here are also consistent with the market discipline literature, which highlights the discipline that depositors exert mainly through assets and equity-to-assets ratio. On the other hand, depositors do not usually react to measures of assets quality as also documented in papers like Berger and Turk-Ariss (2010).

The main contribution of this paper is to present empirical evidence regarding the influence of sovereign risk on depositors' behavior for the case of a non-emerging market. It suggests that the sovereign systemic risk that usually determines a county's level of development is associated with the expectations and credibility it transmits and it shows how this risk can negatively affects the domestic economy. At the outbreak of the crisis Greece was classified as a developed country; however, in June 2013 it was downgraded to an emerging market status. Greece was classified as developed although: i) its fiscal and external situation seemed to be unsustainable during the whole period and ii) when the international crisis of 2009 unraveled it was the first sovereign to find itself in a confidence crisis even though the fiscal situation worsened in other countries much more than in Greece. Ultimately, as concluded by Alogoskoufis (2012) the Greek crisis "is not simply a debt crisis; it is a dual confidence crisis, due to the mismanagement of the expectations of international creditors and domestic consumers and investors." At a local scale, this loss of confidence negatively impacted on the banking system as Greek depositors decided to withdraw their funds despite the fact that it showed sound liquidity and solvency indicators, at least when the crisis started.

The major limitation of this empirical investigation is the number of observations, especially in the case of deposits. The ideal database would have been a daily series of bank-level deposits in order to see how deposi-

tors behave in smaller time frames according to each bank,[14] but the bank-level information was only available on a quarterly basis. Nevertheless, even with relative few observations, results are robust to different variables of macroeconomic risk and different estimation methods.

As final remarks, what this investigation suggests in broad terms is that governments should do everything they can to be credible and to avoid the mismanagement of expectations. In terms of policy conclusions, these results along with the findings of Levy-Yeyati, Martínez Peria and Schmukler (2010) emphasize the importance of supervision of the fundamental variables of the economy and, in particular, the importance of limit the exposure of banks to macroeconomic risk. The Greek case shows how the whole banking system can be compromised as a result of macroeconomic imbalances, not only coming from the financial area but also from the fiscal or external sector, and how theses imbalances might be overlooked until a confidence crisis puts them under the spotlight. The sharp increase in government debt needed to finance the fiscal imbalances generated a bulk of Government Greek bonds held in local banks that, in addition to the worsening conditions of private debtors, ended with the restructuring and recapitalization of banks. Before these losses materialized on banks financial statements, depositors had already started to withdraw their funds, simply because of increased uncertainty and declined market sentiment. In turn, these withdrawals negatively reinforced the banks delicate situation by decreasing their funding and liquidity, generating a vicious circle that perhaps could have been avoided if the macroeconomic situation had been controlled some years ago.

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14. For instance, Burdisso, Cohen Sabban and D´Amato (2003) show how the dynamic of deposits can change in small time frames, responding in different ways to the size and ownership of the banks, by exploiting the richness of a daily panel data set of individual bank's deposits.

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Appendix

Table A.1: Greek banks included in the database and significant events (M&A, changes in ownership, etc.) that occurred during the sample period June 2005- September 2012.

Commercial Banks	Ownership or M&A dealings
Agricultural Bank of Greece -ATEbank	Acquired by Piraeus Bank SA in July 2012.
Alpha Bank	-
Attica Bank	-
Emporiki Bank of Greece*	Became a subsidiary of Credit Agricole SA in 2006.
Eurobank Ergasias	Changed its name from Eurobank EFG to Eurobank Ergasias SA in August 2012.
General Bank of Greece - GENIKI*	-
Marfin Egnatia Bank	Egnatia Bank SA absorbed Laiki Bank (Hellas) SA and Marfin Bank and changed its name in June 2007.
National Bank of Greece	-
PRObank	-
Piraeus Bank	In July 2012 absorbed Agricultural Bank of Greece.
Proton Bank	Proton Investment Bank absorbed Omega Bank SA and Proton Securities and changed its name to Proton Bank in September 2006. In October 2011, Proton Bank was resolved and its banking license withdrawn. By decision of the Ministry of Finance and with state aid, a new legal entity was created to rescue its activities, New Proton Bank SA (a so called "bridge bank").
TT Hellenic Postbank *[2]	In December 2011 absorbed T Bank SA.

Notes: *Emporiki and GENIKI were acquired by Alpha Bank and Piraeus Bank, respectively, but the transactions finalized between the end of 2012 and 2013 so the mergers are not included in the sample period.*
[2] In January 2013, a newly established bank -"New Hellenic Postbank"- was capitalized by the Hellenic Financial Stability Fund, which will be its sole shareholder.

Table A.2: Correlation matrix.

	Spread	Debt_gdp	Default	Assets	Eq_asset	Imp_asset	ROAA	Liq_asset	Foreign
Spread	1.000								
Debt_gdp	0.796*	1.000							
Default	0.525*	0.326*	1.000						
Assets	0.153*	0.147*	0.141*	1.000					
Equity_assets	-0.235*	-0.161*	-0.133*	-0.416*	1.000				
Impair_assets	0.680*	0.521*	0.463*	-0.089	-0.302*	1.000			
ROAA	-0.133*	-0.272*	-0.290*	-0.225*	-0.083	0.117*	1,000		
Liquid_assets	-0.159*	-0.158*	-0.199*	-0.010	-0.069	-0.011	0.198*	1.000	
Foreign	0.047*	0.036	0.025	0.020	0.062*	0.215*	-0.077*	-0.146*	1.000

Note: This table presents the correlation between regressors included in Eq. (1) and the alternative measures of risk (spreads, debt, default) for the period June 2005-September 2012. The star means the correlation is significant at 1%. Bank-level variables are lagged one period. Default takes value of 1 for Q2.2012 and Q3.2012 and zero otherwise.

Table A.3: Robustness check with Debt-to-GDP, Deficit-to-GDP and Default and estimating by FE and OLS

VARIABLES	FE				OLS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Debt_gdp	-0.005***	-0.004***	-0.005***	-0.004***	-0.005***	-0.003***	-0.005***	-0.003***
	[-5.026]	[-4.420]	[-4.920]	[-4.301]	[-7.374]	[-4.175]	[-7.469]	[-4.365]
Deficit			0.002	0.003*			0.003	0.003
			[1.781]	[1.822]			[1.137]	[0.959]
Default	-8.591***	-7.873***	-7.623***	-6.893***	-2.063	-1.541***	-1.029	-0.687
	[-7.936]	[-8.318]	[-5.609]	[-5.902]	[-0.762]	[-3.344]	[-0.361]	[-0.695]
Assets	0.864***	0.834***	0.843***	0.813***	0.954***	0.941***	0.955***	0.942***
	[9.552]	[9.327]	[9.603]	[9.406]	[102.837]	[96.640]	[104.434]	[98.133]
Equity_assets	0.013*	0.013**	0.012*	0.012**	0.006	0.001	0.006*	0.001
	[2.184]	[2.818]	[2.149]	[2.833]	[1.638]	[0.170]	[1.684]	[0.237]
ROAA	0.085*	0.079	0.092*	0.086*	0.166***	0.186***	0.173***	0.192***
	[1.915]	[1.741]	[2.026]	[1.848]	[8.586]	[9.156]	[8.168]	[8.674]
Liquid_assets	-0.005	-0.003	-0.005	-0.004	0.023***	0.023***	0.023**	0.023***
	[-0.548]	[-0.363]	[-0.657]	[-0.473]	[2.597]	[2.799]	[2.591]	[2.786]
Impair_assets		-0.010		-0.010		-0.039***		-0.038***
		[-1.331]		[-1.341]		[-5.183]		[-5.118]
Debt_gdp * Default	0.036***	0.027**	0.030***	0.021*	0.037***	-0.000	0.030**	-0.006
	[4.989]	[2.974]	[3.558]	[1.931]	[3.338]	[-0.057]	[2.425]	[-0.784]
Assets * Default	0.155***	0.181**	0.149***	0.175**	-0.215***	0.045	-0.217***	0.044
	[7.082]	[2.870]	[6.603]	[2.876]	[-2.870]	[1.158]	[-2.885]	[1.122]
Equity_assets * Default	0.100***	0.111***	0.098***	0.109***	-0.018	0.090***	-0.019	0.090***
	[9.228]	[4.416]	[8.804]	[4.442]	[-0.617]	[5.804]	[-0.621]	[5.776]
ROAA * Default	-0.087**	-0.082	-0.088**	-0.084	0.017	-0.087***	0.010	-0.093***
	[-2.221]	[-1.574]	[-2.228]	[-1.576]	[0.484]	[-3.846]	[0.264]	[-3.824]
Liquid_assets * Default	0.379***	0.410***	0.375***	0.408***	0.052	0.310***	0.052	0.310***
	[18.169]	[5.932]	[17.741]	[5.983]	[0.650]	[7.600]	[0.650]	[7.586]
Impair_assets * Default		0.024		0.024		0.118***		0.118***
		[1.311]		[1.323]		[11.933]		[11.876]
Constant	2.124	2.562	2.435	2.883*	0.364*	0.380**	0.311	0.338*
	[1.342]	[1.636]	[1.583]	[1.902]	[1.910]	[1.983]	[1.645]	[1.760]
Observations	256	254	256	254	256	254	256	254
R-squared	0.745	0.753	0.748	0.756	0.977	0.978	0.977	0.979
Number of id	12	12	12	12				

*Note: Dependent variable is Log of Deposits. Variable Deficit is the ratio of Government Net Borrowing as percentage of GDP taken from Eurostat. Methods of estimation: fixed effects (FE) and ordinary least squares (OLS) with robust standard errors, t-statistics in brackets. *Significant at 10% **Significant at 5% ***Significant at 1%.*

Table A.4: Robustness check. Foreign vs. No Foreign Banks in Greece

	If foreign==1			If foreign==0		
	Total period	Pre-crisis	Crisis	Total period	Pre-crisis	Crisis
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	ldep	ldep	ldep	ldep	ldep	ldep
Spread	-0.024**	-0.089*	-0.015**	-0.008***	0.015	-0.009**
	[-5.551]	[-2.957]	[-4.406]	[-4.120]	[0.824]	[-2.531]
Assets	0.748**	1.057***	0.902**	0.616***	0.660***	0.643**
	[3.586]	[7.240]	[5.535]	[8.510]	[13.609]	[3.187]
Equity_assets	-0.017	-0.005	0.001	0.011***	0.012*	0.010**
	[-1.156]	[-0.556]	[0.172]	[4.777]	[2.178]	[3.122]
Impair_assets	0.002	0.016	0.007	-0.001	-0.070	0.004
	[0.270]	[0.856]	[2.035]	[-0.110]	[-1.765]	[1.086]
ROAA	0.163*	0.137**	-0.067	-0.085**	-0.029	-0.067
	[2.524]	[5.272]	[-0.743]	[-2.651]	[-1.025]	[-1.721]
Liquid_assets	0.008	0.015	0.007	-0.005	-0.010	-0.006
	[0.751]	[1.563]	[0.865]	[-0.927]	[-1.172]	[-1.148]
Constant	3.466	-1.703	1.061	6.134***	5.331***	5.612
	[0.932]	[-0.665]	[0.366]	[4.966]	[6.180]	[1.658]
Observations	77	42	35	177	100	77
R-squared	0.820	0.919	0.943	0.806	0.838	0.802
Number of banks	4	4	4	10	9	9

*Note: The dependent variable is the log of deposits. Bank-specific variables are taken from Greek banks quarterly financial statements and lagged one period. Columns (1) to (3) are regressions for foreign banks and columns (4) to (6) present the result for not foreign banks (public and private). In each case, regressions are estimated for the whole period and for the two subsamples: pre-crisis and crisis, defined as in Table 2. Method of estimation is fixed effects and standard errors are robust. The sum of the number of banks may not be the same as the total number of banks in Table 2 because some of them changed ownership during the whole period, so may be included in both types of ownership according to the period to be analyzed. T-statistics are in brackets. *Significant at 10%, **Significant at 5%, ***Significant at 1%.*