# Wealth shocks, credit-supply shocks, and asset allocation: Evidence from household and firm portfolios

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**Abstract**

We use a unique dataset with bank clients' security holdings for all German banks to examine how macroeconomic shocks affect asset allocation preferences of households and non-financial firms. Our analysis focuses on two alternative mechanisms which can influence portfolio choice: wealth shocks, which are represented by the sovereign debt crisis in the Eurozone, and credit-supply shocks which arise from reductions in borrowing abilities during bank distress. We document heterogeneous responses to these two types of shocks. While households with large holdings of securities from Portugal, Ireland, Italy, Greece, and Spain (PIIGS) increase diversification as a result of the Eurozone crisis, non-financial firms with similar levels of PIIGS holdings did not. Credit-supply shocks at the bank level (caused by bank distress) result in higher diversification, for both households and non-financial corporations. We also show that only shocks to corporate credit bear ramifications on bank clients' portfolio diversification, while shocks in retail credit are inconsequential. Our results are robust to falsification tests, propensity score matching techniques, and instrumental variables estimation.

**Keywords:** asset allocation; sovereign debt crisis; credit-supply shocks; bank distress
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## I. Introduction

How do macroeconomic shocks affect asset allocation preferences of households and non-financial firms? Did the sovereign debt crisis in the Eurozone increase these bank customers' risk aversion and motivate them to better diversify their portfolios? How do household and non-financial firms' portfolios respond to credit-supply shocks triggered by bank distress?

In this paper, we exploit a unique dataset from the Deutsche Bundesbank which provides information about bank clients' security holdings for *all* German banks for the period 2005 to 2012 to answer these questions. Importantly, our data allows us to establish the relative importance of two unrelated macroeconomic shocks. First, we examine the sovereign debt crisis in the Eurozone from 2009 which caused wealth shocks from declines in the value of security portfolios for clients with high shares of securities from Portugal, Ireland, Italy, Greece, and Spain (PIIGS). Second, we focus on credit-supply shocks arising from individual bank distress which leads to a reduction in borrowing abilities (and possibly income risk) for clients of the troubled bank.[1] Distress leads to a reduction in loan supply due to the illiquid nature of loans and the asymmetric information problem in the capital market, which prevents banks from offsetting a shortage of liquidity by selling assets or by issuing uninsured debt (Stein (1998)). As reported by Guiso, Jappelli and Terlizzese (1996), economic theory suggests that a reduction of the risky-share in households' portfolios can result from an increase in uninsurable income risk and expectations of contractions in future borrowing abilities. However, the mechanism through which bank-level credit-supply shocks lead to changes in diversification preferences is still unchartered territory. Our novel identification strategy enables us to fill this important gap in the economics literature.

Unlike much of the literature on household finance which documents cross country variation for asset allocation, and demographic determinants of stock market participation and rebalancing of portfolios, our study emphasizes the role macroeconomic shocks play for asset allocation. We present evidence of increased risk aversion in response to wealth shocks which result in better diversified household portfolios, measured by Herfindahl-Hirschman Indices (HHI) which are inversely related to portfolio diversification. However, what is surprising is that non-financial firms do not respond to wealth shocks by increasing diversification, a phenomenon not previously documented in the literature.[2] We attribute to this result to better resources for cash management and experience in a business environment which decrease the influence of behavioral biases in the context of investment decisions for firms. In other words, our findings suggest non-financial firms are, on average, more sophisticated investors than households, and negative experiences from macroeconomic shocks are less important in shaping firms' risk preferences. In contrast, credit-supply shocks from bank distress are likely to affect firms more than households because corporate loans are typically considered to be riskier than consumer loans. To test this prediction, we merge the data on banks' customer portfolios with confidential regulatory data on bank distress from the Deutsche Bundesbank to consider the effect of credit-supply shocks. This puts us in a unique position to identify an alternative channel by which macroeconomic shocks can trigger portfolio rebalancing. We are the first to show that reduced borrowing abilities for clients of troubled banks result in more diversified portfolios, for both households and non-financial corporations.

Why should macroeconomic shocks affect asset allocation and trigger active portfolio rebalancing? Malmendier and Nagel (2011) show that financial risk taking is inversely related to negative experiences during episodes of macroeconomic contraction. We suggest that the losses resulting from the Eurozone crisis qualify as a type of negative experience that can induce investors to become more risk averse and change their beliefs about the future. Recent negative returns for a certain asset class can have adverse effects on future expected returns, leading investors to dispose of these assets and causing a drop in the portfolio share of that asset class. This hypothesis reflects findings in the psychology literature according to which people rely more strongly on recent personal experiences than docu-

[1] We prefer using the wording "reduction in borrowing abilities" rather than "borrowing constraints", since our dataset does not allow us to identify customers that have been rejected loan applications (Jappelli (1990); Cox and Jappelli (1993)).

[2] The classification of households and non-financial corporations in this study follows the standards of the European system of national and regional accounts (ESA). ESA is consistent with the System of National Accounts of the United Nations and allows comparison of industry sectors across different EU statistics.

mented statistical evidence when forming expectations and making investment decisions (Nisbett and Ross (1980); Weber et al. (1993); Hertwig et al. (2004)). On the other hand, credit-supply shocks triggered by bank distress lead to reductions in borrowing abilities which, in turn, also affect risk preferences (Guiso, Jappelli, and Terlizzese (1996)). The reason for why credit-supply shocks motivate asset reallocations is the portfolio holders' anticipation of facing liquidity constraints if the distressed bank reduces its lending. The possibility of being liquidity constrained in the future leads bank customers to increase the liquidity of their security portfolio, and they also increasingly diversify their portfolio to counterbalance the increase in the risk of not being able to quickly raise liquidity at a reasonable cost (Koo (1991)). Furthermore, the risk from credit-supply shocks triggered by bank distress cannot be easily diversified away. This risk is therefore comparable to 'background risk' which arises from volatile entrepreneurial income, real estate income, or more variable labor income (Heaton and Lucas (2000)). Increases in background risk reduce the desired level of risk in the security portfolio, leading to a decrease in the risky share and/or an increase in diversification. In sum, both types of shocks, the wealth shock from the Eurozone crisis, and the credit-supply shock, can prompt portfolio rebalancing, albeit through different mechanisms.

Our research is important for the following reasons: First, households and non-financial firms control large proportions of the investable savings in a society. Understanding their responsiveness to wealth shocks and credit-supply shocks can shed light on the macroeconomic implications of their portfolio reallocations. Second, the literature on the impact of macroeconomic shocks on portfolio diversification is, at best, sparse. In particular, little is known about the consequences of wealth shocks arising from declines in the value of a certain class of securities. Third, while borrowing constraints have received considerable attention in the literature (Paxson (1990); Guiso, Jappelli, and Terlizzese (1996); Haliassos and Hassapis (1998)), the nexus between the credit supply of a financial institution and the portfolio choice of its customers has not yet been investigated. Fourth, the literature has so far focused almost exclusively on the role of households for investment decisions. While non-financial firms tend to hold sizeable securities portfolios comparisons between the portfolio allocation preferences of households and those of firms are virtually nonexistent.

Having access to a bank-level panel dataset which combines information about bank clients' security holdings obtained from the Securities Holdings Statistics (Statistik über Wertpapierinvestments)[3] of the Deutsche Bundesbank, bank characteristics and macroeconomic data, and regulatory data about bank distress provides a number of distinct advantages.

- The data represent the entire population of all German households' and non-financial firms' securities portfolios held with German banks. This gives us a unique opportunity to analyze asset allocation decisions in response to macroeconomic shocks for one of the largest economies in the world. Importantly, with total financial assets worth 4.3 trillion Euro German households are one of the biggest holders of financial wealth in the European Union. The value of the 24 million portfolios held by German households adds up to 790 billion Euro. Hence, about one fifth of the households' financial assets is held in securities and shares. Including the 484 billion Euro in the portfolios of nonfinancial firms, the total sum of assets rises to nearly 1.3 trillion Euros. In short, our study considers assets with an overall value of more than half of the German GDP. Moreover, holdings of financial assets in Germany are in size, participation rate and in distribution over the different assets types comparable to other Euro Zone countries. Table I presents a cross country comparison using OECD data of the financial assets holdings of France, Germany, Italy, Japan, Spain, UK and the U.S. Total financial assets of households per capita in Germany are similar in size as in France and Italy. Thus, the representativeness of our sample lends credibility to the findings in terms of their external validity, and allows generalizing from our results to other high income economies.
- For each securities portfolio, our data allow us to compute several different measures of diversification. We compute HHIs for asset classes (bonds, shares, and mutual funds) and issuers in terms of countries (domestic vs. foreign, with a further decomposition into PIIGS and non-PIIGs countries), and in terms of sectors (financials vs. non-financials). We choose this classification because asset class, geographic location, and industry are widely recognized by the asset allocation literature as the main criteria for improving portfolio diversifi-

3 See Amann et al. (2012) for a documentation of the Securities Holdings Statistics.

cation. While the typical choice for investors is in terms of asset class (mainly, between bonds and stocks), distinguishing among issuers enables us to observe changes in the 'risk-free asset' share (i.e. German government bonds). Separating between foreign and home securities allows us to discern whether German investors exploit the benefits of international diversification (which are known at least since Levy and Sarnat (1970)), and to what extent wealth and credit-supply shocks increase home bias (because of a 'flight to quality'). Finally, the distinction between financial and non-financial securities is helpful because of the interlinkages between the sovereign debt market and the domestic financial sector (Grammatikos and Vermeulen (2012); Mody and Sandri (2012)).

- We have information on both the nominal and the market value of all the securities. By focusing on the nominal value of the securities we are able to rule out by construction that changes in portfolio diversification are driven by changes in prices (passive rebalancing) rather than active trading on the part of investors (active rebalancing).
- The distinction in the database between securities portfolios held by households and non-financial firms permits direct comparisons between the investment behavior and diversification preferences of these two distinct groups of investors.
- Aggregating the data at the bank level allows ruling out heterogeneities that arise from different advisory practices and cultural traits of banks. Moreover, this setup also enables us to exploit the data about bank distress to identify the impact of a credit-supply shock on portfolio choice of households and firms.

We bring to bear new strategies and techniques to address the challenges inherent in the investigation of the impact of wealth shocks and credit shocks on portfolio diversification.

We establish the causal effects of the Eurozone sovereign debt crisis using difference in differences estimation (DiD) where we use the decline in sovereign bonds issued by PIIGS countries as a treatment. The sovereign debt crisis is plausibly exogenous to clients' portfolio choice at the individual bank level, i.e., this shock is orthogonal to bank-specific factors. It is unlikely that our results are driven by inflows and outflows of customers from one bank to another. Moreover, we also document the validity of the key identifying assumption for the use of DiD which posits treatment groups and control groups evolve similarly in the pre-treatment period.

Our first key result is that bank clients respond strongly to the Eurozone's sovereign debt crisis by actively rebalancing their portfolios. Bank customers with higher shares of PIIGS securities increase portfolio diversification to a greater extent than other clients. Moreover, the crisis leads to a lower HHI in terms of asset classes and issuers, for customers with high shares of PIIGS securities than for customers with low shares of PIIGS securities.[4] The decreases in HHI in terms of asset classes are driven by decreases in the overall share of bond securities and an increase in the share of stocks. The decrease in HHI in terms of issuer is driven by a decrease in the overall share of securities issued by foreign and domestic financial institutions, and an increase in the share of securities issued by nonfinancial corporations. The increase in diversification could be due to an increase in risk aversion, consistent with the finding that customers also bought more German government bonds as a share of total bonds. However, this is at odds with the decrease in the share of bonds and the increase in the share of stocks. A possible explanation is that customers shied away from certain categories of bonds as a result of the reputational damage resulting from the sovereign debt crisis. Rather than an increase in risk aversion, these results may be ascribed to a revision in the beliefs relative to the expected return and variance of returns of the average bond (not issued by the German government) versus the average stock. However, not all bank clients respond equally to the sovereign debt crisis. Our detailed investigation highlights that only households actively rebalance their portfolios, while the evidence for firms is weaker, and the rebalancing tends to be in the opposite direction (i.e., *lower* diversification).

These results are robust to propensity score matching techniques, falsification tests based on placebo crises, and we also scrutinize the role of intra-group correlation of standard errors. While our main tests cluster standard errors at the bank level, collapsing the observations in the pre- and post-treatment period yields virtually identical results. In short, our results constitute evidence that bank

[4] All variables are calculated using nominal values, as in Hildebrand, Rocholl, and Schulz (2012).

retail clients tend to 'fight' decreases in the value of their portfolio by increasing diversification, and we document heterogeneous responses between households and firms to this shock.

These heterogeneous responses by households and firms provide a solid justification for our second set of tests that focus on supply driven shocks in bank lending. If bank customers actively rebalance their portfolios in the presence of exogenous shocks to the value of their securities portfolio, it is important to document whether shocks in bank lending also lead to increased diversification of securities portfolios, and whether there are any heterogeneous responses to reductions in borrowing abilities between households and firms.

For the analysis of credit-supply shocks, we resort to an instrumental variables estimator. Credit-supply shocks are represented by declines in customer loans, our proxy for reductions in borrowing abilities.[5] Identification of causal effects of lending shocks on portfolio allocation choices is challenging because of possible Omitted Variable Bias (OVB) problems. We illustrate these problems with two examples. First, local economic growth affects both bank lending and bank clients' background risk. Second, time-invariant idiosyncratic bank characteristics can influence the type of customers attracted by the bank, and the degree to which financial advisors affect customers' portfolio allocation. We overcome these challenges by including both local real income growth and bank fixed effects in our regressions.[6] Moreover, potential time-varying bank-specific factors such as demand driven declines in lending that arise from increases in bank clients' risk aversion are also allowed for with the instrumental variables estimator.[7]

The empirical design of our tests allows us to exploit plausibly exogenous variation in bank distress, approximated by capital injections, concentration in the banks' loan portfolio, the presence of hidden liabilities, and the ratio of overnight loans to banks over total assets. These instrumental variables correlate positively with bank distress, during which banks reduce the volume of customer loans. Capital injections are provided by the bankers' association to distressed banks to avoid contagion to other institutions (Berger et al. (2012)). Loan portfolio concentration, measured by a HHI across business sectors, increases loan portfolio risk, and leads to higher probability of distress. Hidden liabilities allow postponing losses, which is typically done during periods of distress. In times of distress, banks increase the weight of overnight lending in the interbank market in an attempt to build up liquid assets. These variables are unlikely to be known by bank customers, and thus cannot affect their asset allocation choices.

Our second key result documents positive associations between a credit-supply shock, represented by declines in customer loans, and bank clients' portfolio diversification, in terms of asset classes and in terms of issuers. Bank distress displays consistently positive and significant effects on the diversification measures, *for both households and firms*. Importantly, we are the first to show that the increase in diversification following a credit-supply shock is stronger for firms than for households. These results not only confirm households' tendency to increase diversification in the presence of exogenous shocks, but also highlight that decreases in borrowing abilities (unlike exogenous shocks on the value of their security portfolio) have important effects on firms' diversification preferences.

To further disentangle the dynamics between the credit channel and portfolio choice, we look separately at drops in retail loans and drops in corporate loans: A drop in retail loans does not have any effect on diversification of either households or firms, while a drop in corporate loans leads to higher diversification in terms of asset class for both the households' and firms portfolios. The results for households suggest that what drives the increase in portfolio diversification is *not* a decrease in their own borrowing abilities, but rather an increase in background and income risk.[8] This is a key finding of our study, because it uncovers the importance of bank credit for relation between income risk and

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5 The instrument related to investment opportunities isolates the supply-shock from demand-driven components of lending.

6 Local real income growth can be considered a proxy for bank investment opportunities (Paravisini (2008)).

7 To rule out that our results are driven by cases for which distress of a big client is the cause of bank distress, we exclude cases for which capital injections are followed by a negative change in the total nominal value of the bank's clients' portfolio. The reasoning behind this strategy is that, if bank distress (and a resulting drop in customer loans) is caused by distress of a big client, such client should off-load its security portfolio to fill the cash shortfall.

8 This interpretation is corroborated by recent literature demonstrating that credit-supply shock on firms lead to contractions in corporate investment (Wardlaw (2010), Campello et al. (2011)), which may in turn cause a reduction in demand for labor (Greenwald and Stiglitz (1990)).

household portfolio choice: Shocks in corporate credit affect corporate investment and labor demand, and through their impact on background and income risk, they also affect household portfolio choice.

We also examine changes in the components of our diversification measures. The increase in portfolio diversification occurs along with an increase in the share of German government bonds, government bonds from non-PIIGS countries, and a decrease in government bonds from PIIGS, in line with the idea of a 'flight to quality'. Yet, these latter results hold only for the portfolio of households. For firms, the increase in diversification is associated with a drop in the share of securities issued by foreign (non-PIIGS) and German non-financial corporations, and an increase in the share of securities issued by foreign (non-PIIGS) and German financial institutions.

Our study connects to several strands in the literature. Portfolio diversification is a key topic in financial economics since the pioneering work by Markowitz (1952, 1959). However, several studies have shown individuals and households tend to hold underdiversified portfolios (Kelly (1995); Polkovnichenko (2005); Calvet, Campbell, and Sodini (2007)). Recent work on household finance emphasizes the dynamics of portfolio rebalancing of households following changes in portfolio risk (Calvet, Campbell, and Sodini (2009)), and the importance of macroeconomic variables for risk preferences (Malmendier and Nagel (2011)). We advance this literature and document the impact of macroeconomic shocks on portfolio diversification for both households and firms. Our paper also contributes to the literature about the role of financial intermediaries in household finance. Many studies investigate the role of financial intermediaries for portfolio allocation and examine specifically the impact of financial advice on individual investors' portfolios from a static point of view (Bluethgen et al. (2008); Jansen, Fischer, and Hackethal (2008); Hackethal, Inderst, and Meyer (2011); Hackethal, Haliassos, and Jappelli (2012); Kramer (2012)). These papers usually obtain data from a single financial institution which casts doubts on the external validity of the findings. In contrast to these studies, we are the first to have access to a dataset that matches information on portfolio composition of both households and firms with bank characteristics and confidential regulatory data on bank distress for a large sample of banks. Finally, while several studies demonstrate adverse effects of bank distress on economic growth, this literature has so far overlooked the impact of diminished borrowing abilities related to credit-supply shocks due to bank distress on portfolio choice. Bernanke (1983) and Stein (1998) show bank distress causes drops in loan supply and leads to increased cost of intermediation and lower growth.[9] Calomiris and Mason (2003) find evidence that reductions in loan supply due to bank distress increased economic contraction during the Great Depression. Bank distress propagates the crisis to the real economy through tighter credit standards on both nonfinancial corporations and households (Hempell and Sørensen (2010)). Indeed, shocks in loan supply due to bank distress spread to the real sector because of contractions in corporate investment (Wardlaw (2010), Campello et al. (2011)), associated with reductions in labor demand due to credit rationing (Greenwald and Stiglitz (1990)), and deteriorating real estate markets (Peek and Rosengren (2000)). Hence, not only do credit-supply shocks impair borrowing abilities of households and firms, but they also impose shocks in income risk, strengthening the incentive for households to reduce the riskiness of their security portfolio, especially if the impact of such shocks is not perceived to be short-lived (Guiso, Jappelli, and Terlizzese (1996); Angerer and Lam (2009)).

The rest of the paper is structured as follows. Section II describes the econometric strategy and provides details about our sample. In Section III, we report the main results and robustness checks, and Section IV concludes.

## II. Econometric strategy

### *II.A Exogenous shocks and portfolio diversification*

Exogenous shocks can generate active portfolio rebalancing, but need not necessarily generate changes in the degree of portfolio diversification. For the sake of simplicity, let us assume that portfo-

[9] Credit-supply shocks have negative effects on economic output because of incompleteness of financial markets: Financial intermediaries perform market-making and information gathering services that can hardly be replaced by the market. Disruptions in bank lending bear effects on the real economy because higher borrowing costs reduce the demand of households and small firms for current-period goods and services (Bernanke (1983)).

lios comprise only two asset categories, risky and risk-free assets, and the share of risky assets before the shock is lower than the share of risk-free assets.

*First scenario: Expected returns are time-invariant.* If investors perceive the shock to be unrelated to changes in investment opportunities (expected returns are time-invariant), a drop in the market value of the risky share of their portfolio (resulting in automatic reduction of the risky share, or passive rebalancing) would encourage them to rebalance their portfolio so that the portion of risky assets (in market values) remains unaltered. This type of rebalancing should keep the overall level of portfolio diversification in terms of asset classes (as measured by HHI in *nominal values*) constant.

*Second scenario: Investors become more risk averse.* On the other hand, if the shock is perceived to be related to a change in investment opportunities, investors may decide to dispose of the risky assets and use the proceeds to buy risk-free assets (flight to quality), which would result in a sharper reduction in the risky share (Calvet, Campbell, and Sodini (2009)). In this case, the level of portfolio diversification is likely to decrease (and HHI *increase*).[10]

*Third scenario: Two risky-asset categories.* However, a further possible scenario may emerge, if we relax-free asset exists (e.g. German government bonds), but there are two categories of risky assets, whose returns are not perfectly correlated: corporate bonds and equities. Investors only hold corporate bonds before the shock. If investors, as a result of the shock, want to reduce the overall riskiness of their portfolio, they have two choices: they can either reduce the overall risky share; or, while leaving the overall risky share unaltered, they may invest both in corporate bonds and in equities (i.e. HHI would *decrease*).

*Fourth scenario: Risk-free asset share less than 50%.* Finally, if the number of asset classes is large enough, so that the risk-free asset represents a minority of the total portfolio holdings (i.e. the risky share is higher than the risk-free share), flight to quality may occur along with a decrease in HHI. This is the most likely scenario in our setup.

### *II.B Methodology*

We follow a DiD approach to estimate the impact of the European sovereign debt crisis on the degree of diversification of bank customers' portfolios.[11] Our treatment group consists of banks for which in 2009 the share of PIIGS (i.e. total nominal value of PIIGS securities over total nominal value of the portfolio) was larger than the sample median. The dummy variable $Treatment_i$ takes on the value one if bank *i* belongs to the treatment group, and zero otherwise and, being time-invariant, is unidentified in the regressions. The post-treatment period is 2009-2012, while the pre-treatment period is 2005-2008. Our baseline specification is based on the following regression with clustered standard errors (Bertrand, Duflo, and Mullainathan (2004)):

$$Y_{it} = \beta_0 + Crisis_t\beta_1 + (Crisis_t \times Treatment_i)\beta_2 + \mathbf{X_{it}}\boldsymbol{\beta_3} + u_i + \gamma_t + \varepsilon_{it} \quad (1)[12]$$

Where $Y_{it}$ is the value taken by the HHI measure of interest in year *t*, $u_i$ denotes bank fixed effects, and $\gamma_t$ denotes year fixed effects. $Crisis_t$ takes on the value one if {*t* = 2009,2010,2011,2012}, and zero otherwise, and $\mathbf{X_{it}}$ is a $1\times k$ vector of covariates ($\boldsymbol{\beta_3}$ is a $k\times 1$ parameter vector)comprising bank-specific variables as well as macroeconomic indicators at both the national and regional level: *Fee Income Share*, and *County Real Income Growth*. The parameter $\beta_2$ is the coefficient of interest and represents the differential impact that the Eurozone crisis has on customers of banks in the treatment group.

We consider six different dependent variables: *HHI-Asset class*, *HHI-Asset class* (*Households*), *HHI-Asset class* (*Firms*) *HHI-issuer*, *HHI-Issuer* (*Households*), *and HHI-Issuer* (*Firms*).

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[10] Here, it becomes clear why we need to assume that the risky share is lower than the risk-free share. If the risky share is lower before the shock, a flight to quality can generate an increase in diversification. In terms of HHI, assume that the risky share is initially 30%, which leads to HHI(before)=$0.30^2+0.70^2=0.58$. After the shock, flight to quality leads to a further decrease in the risky share (assume by 10%), resulting in HHI(after)=$0.20^2+0.80^2=0.68>0.58$. On the other hand, if the weights before the shock were reverted, a decrease in the risky share by 10% would lead to HHI(after)=$0.40^2+0.60^2=0.52<0.58$.

[11] Guiso, Sapienza, and Zingales (2012) provide evidence of time-varying risk aversion following the 2008 global financial crisis.

[12] When we estimate these regressions using a Least Squares Dummy Variable (LSDV) approach with clustered standard errors at the bank level, rather than a Within-Group model with clustered standard errors (which is the same as using heteroskedasticity-robust standard errors (Stock and Watson (2008)), the results are virtually the same, although the standard errors for the Within-Group model (which should be preferred) are, as expected, smaller.

We define *Fee Income Share* as fee income to total bank's income. We expect this variable to be positively related to diversification, since investing in a wider range of financial products should generate more income for the bank due to higher transaction volume.[13] Finally, to allow for regional characteristics, we control for *County Real Income Growth*. This variable can proxy for investment opportunities (Paravisini (2008)), as well as for changes in income risk following changes in local economic conditions (Angerer and Lam (2009)).[14] The coefficient on *County Real Income Growth* could be positive if investors increase the level of portfolio diversification (lower HHI) to offset discount-rate risk during periods of low economic growth (Fama and French (1989)). However, a negative coefficient is consistent with the view that higher local economic growth brings down risk aversion, leading to an increase in the weight of classes of risky securities relative to government bonds.

The second part of our analysis is concerned with the impact of bank soundness and associated lending abilities on portfolio diversification of bank customers. We address potential endogeneity concerns in four ways. First, we reduce OVB concerns by allowing for regional growth: In regions where income growth is lower, both lending and portfolio choice may be affected. Second, we employ Within-Group (WG) regressions, which eliminate the concern of endogeneity due to correlation between the covariates and unobserved time-invariant bank characteristics. Third, to rule out that our results are driven by cases for which distress of a big client is the cause of bank distress (which would result in endogeneity) we exclude cases for which capital injections are followed by a negative change in the total nominal value of the bank's clients' portfolio. The reasoning behind this strategy is that, if bank distress (and a resulting drop in customer loans) is caused by distress of a big client, such client should off-load its security portfolio to fill the cash shortfall. Finally, we resort to IV estimation techniques. Potential time-varying bank-specific factors may jointly determine both bank lending to its customers and customer portfolio choice. For instance, a drop in loans to customers may be due to a shift in the level of customers' risk-aversion, which could affect even the level of portfolio diversification. Since we do not have data on variables related to borrower characteristics to match with our bank-level dataset, we cannot control for such demand-driven shocks that could lead to simultaneity bias. For this reason, we exploit orthogonality to portfolio diversification of variables related to bank distress (which should be negatively related to customer loans growth) and investment opportunities (to reduce demand-driven effects), and estimate the following 2SLS regressions:

$$\textit{Customer Loans Drop}_{it} = \mathbf{Z_{it}}\boldsymbol{\gamma_2} + \nu_{it}$$

$$Y_{it} = \alpha_0 + \textit{Customer Loans Drop}_{it}\,\alpha_1 + \mathbf{X_{it}}\boldsymbol{\alpha_2} + u_i + \gamma_t + \varepsilon_{it} \qquad (2)$$

where *Customer Loans Drop* is a dummy variable that takes on the value one if loans to customers of bank $i$ in year $t$ are lower than in year $t-1$, and zero otherwise; and $\mathbf{Z_{it}}$ is a $1\times l$ vector of instruments ($\boldsymbol{\gamma_2}$ is an $l\times 1$ parameter vector), comprising instruments that are included in the second stage, $\mathbf{X_{it}} \subset \mathbf{Z_{it}}$, and instruments that are excluded from the second stage, $\mathbf{W_{it}} \subset \mathbf{Z_{it}}$. We refer to four variables comprising the vector $\mathbf{W_{it}}$ as instrumental variables, and we choose them on the basis of their association with bank distress and investment opportunities:

*Capital Injection* is a dummy variable that takes on the value one if bank $i$ receives a capital injection in year $t$ and zero otherwise. In Germany, both the government and the bankers associations can provide capital support to troubled banks to avoid failure and contagion of distress to other banks. This variable is expected to be positively associated with bank distress (Berger et al. (2012)), during which banks may be forced to decrease the volume of loans to customers. In particular, Berger et al. (2012) find that capital injections reduce liquidity creation (Berger and Bouwman (2009))[15] because of a reduction in the asset-based liquidity creation, but do not reduce the liability-based liquidity creation.

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13 Mullainathan, Nöth, and Schoar (2010) provide evidence that financial advisers encourage customers to implement trading strategies involving higher fees and a larger transaction volume. Fee-generating activities (such as brokerage) have recently become more important, to compensate for the ongoing decline in interest margins.

14 In robustness tests, we replace year fixed effects with *Yield Curve Spread* as a proxy for changes in the conditions of the economic cycle. This variable is the difference in yields between long-term government bonds (seven years maturity) and short-term government bonds (one year maturity).

15 Liquidity creation refers to the ability of banks to generate liquidity by converting illiquid assets into liquid liabilities. Bank assets, liabilities are defined as liquid, semiliquid, or illiquid. The amount of liquidity created by each bank is calculated as a weighted average of the liquidity associated with each category, where the weights are negative for liquid assets/illiquid liabilities (and equity), zero for semiliquid assets/liabilities, and positive for illiquid assets/liquid liabilities. Off-balance sheet items are also classified into three categories: liquid, semiliquid, and illiquid guarantees (Berger and Bouwman (2009)).

This suggests that capital injections result in a reduction of illiquid assets such as loans to customers. We therefore expect the coefficient on *Capital Injection* in the first-stage regression to be positive.

*HHI-Loan-15* is HHI for the loan portfolio calculated across 15 business sectors. Higher loan portfolio concentration should lead to higher distress probability, and therefore we expect the coefficient on this variable to be positive.

*Hidden Liabilities Dummy* takes on the value one if a bank has hidden liabilities in a given year, and zero otherwise. An accounting option in the German GAAP makes it possible for banks to avoid write-offs on assets by creating hidden liabilities and postpone losses. This is likely to happen for banks in distress, and therefore we expect the coefficient on this variable to be positive in the first-stage regressions.

*Liquidity Ratio* is the ratio of overnight loans to banks divided by total assets. We control for this variable to reduce the probability that the reduction in customer loans is demand-driven, i.e., a result of a lack of lending projects with positive Net Present Value (NPV). During times of tight liquidity conditions, banks tend to reduce the maturity of term-lending in the interbank market to build up liquid assets (Acharya and Skeie (2011)). Similar to the instruments above related to bank distress, therefore, this variable is exogenous to customer portfolio allocation decisions but correlated with the probability of a reduction in customer loans, satisfying both the exclusion and the relevance restriction. We expect a positive coefficient on *Liquidity Ratio* in the first-stage regressions.

Similar to Berger et al. (2012) and Dam and Koetter (2012) we employ a linear probability model for the first-stage regressions.

### *II.C Data*

Our dataset is constructed by matching the Securities Holdings Statistics (Statistik über Wertpapier-investments) with data on capital injections from the banking association's insurance fund and other financial data and macroeconomic indicators. All data is provided by the Deutsche Bundesbank. The Securities Holdings Statistics contains data regarding the portfolio holdings of households and firms at the bank level. We obtain information on the market value and nominal value of the security holdings based on asset class (bonds, stocks, or investment certificates), type of issuer (government, nonfinancial corporation, or credit institution), and country of origin (Germany, PIIGS, or other countries). Considering the permutations between the country of origin and sector sub-categories, we have in total nine components for HHI by issuer, and three for HHI by asset class. For stocks the nominal value per share is calculated by dividing the book value of equity by the number of stocks outstanding. Negative market or nominal values indicate short positions. The category of investment certificates comprises mutual fund shares, both open and close ended funds (Deutsche Bundesbank (2007)). While we have no information on real estate holdings, this is unlikely to have a major effect on our results, given that housing is a highly illiquid asset, and therefore should not respond to short-run changes in background risk (Guiso, Jappelli, and Terlizzese (1996)).

Figure I shows the market value of stocks for the median portfolio and number of accounts for median bank over the sample period. As it can be expected, the financial crisis had a strong effect on both these measures. The drop in the number of accounts reduces the overall number of stocks held by bank clients, reinforcing the drop in the market value of stocks the median portfolio.

Table II reports descriptive statistics for the HHI measures and their related components. All variables are reported using both nominal and market values. We also report some descriptive statistics regarding the security accounts for each bank. The median bank has around 1,600 client security accounts, comprising both households and firm accounts. Since our sample covers around 2,000 banks, we exploit information on many more security portfolios that those considered in recent studies.[16]

In terms of nominal values, the median portfolio is worth 34,484 euros. The majority of the portfolios consist of bonds issued by financial institutions, either from Germany or from non-PIIGS countries. Stocks represent less than 10% of the portfolios, and investment certificates less than 0.5%. The average share for stocks is much larger than the one reported by Hildebrand, Rocholl, and Schulz (2012)

[16] For instance, Guiso, Jappelli, and Terlizzese (1996) examine a sample of 8,274 Italian households. For the US, the Survey of Consumer Finances contains information on 4,000 households.

for the portfolios of German banks (between 1.5% and 4%, depending on bank type). There is a significant difference between the average HHI for households firms, both in terms of asset class and issuer of the security: Households tend to hold less diversified portfolios than firms according to two-sample t-tests.

Let us not turn to the descriptive statistics for the market values. The median portfolio is worth around 44,883 euros. This difference with the nominal value of the median portfolio reported above is due to a market value for stocks much higher than the nominal value. For bonds market and nominal values are basically the same: The market value of bonds for the median portfolio is 29,267 euros in nominal values and 28,727 in market values. For stocks, the market value for the median portfolio is 15,598 euros (while it is 1,775 euros in nominal values). This results in the share of stocks soaring to 39.6%, while the share of bonds drops to 59.0% (the share of certificates rises to 1.4%). In contrast with the results for nominal values, in terms of market values households tend to hold more diversified portfolios than firms, in terms of both asset class and issuer. Since portfolio allocation decisions are of course based on market values, we interpret these findings as evidence that households tend to hold more diversified portfolios than firms. In the subsequent analysis, however, we focus on changes in nominal values, similar to Hildebrand, Rocholl, and Schulz (2012). This allows ruling out that changes in portfolio composition are a result of passive rebalancing resulting from changes in security prices.

**[Insert Figure I here]**

**[Insert Table II here]**

In the next section, we report our main findings and robustness checks. Unreported results are available in the Appendix.

## III. Results

### *III.A Impact of the Eurozone sovereign debt crisis*

Table III reports the results for the DiD regressions on the effect of the crisis on portfolio diversification. The proportion of PIIGS share for banks in the treatment group is larger for firms than for households.[17] We report the results for Within-Group regressions (also named Fixed-Effect). When year fixed effects are replaced by a proxy for changes in the yield curve (*Yield Curve Spread*) results are robust in terms of sign and significance of the coefficients, although the overall explanatory power of the models decreases. This is consistent with year fixed effects capturing time-varying macro-economic characteristics that are not correlated with the *Yield Curve Spread*.

The coefficient of interest, $\beta_2$, is negative and significant for the following dependent variables: *HHI-Asset Class*, *HHI-Asset Class* (*Households*), *HHI-Issuer*, and *HHI-Issuer* (*Households*). This indicates that households tend to increase diversification in terms of asset classes, while for firms the results are insignificant. The coefficient is *positive* and weakly significant is three cases out of four for the regressions on the firms portfolios. These results suggest that households and firms respond differently to shocks in the value of their security portfolio. The magnitude of $\beta_2$ suggests that the changes in HHI are rather modest, but the impact of being in the treatment group is not negligible. For instance, considering the results for the regressions using year fixed-effects, while *HHI-Issuer (Households)* for the control group decreases on average by 0.7% as a result of the crisis, for the treatment group the decrease is 2.1%; for firm portfolios, the crisis decreases the HHI in terms of issuer by two percentage points for the control group, but for the treatment group the decrease is just 0.8%. Being in the treatment group, therefore, changes the effects of the crisis on HHI substantially.

The coefficient on *Fee Income Share* is either positive and significant or insignificant, while the coefficient on *County Real Income Growth* is either negative and significant or insignificant. Therefore, contrary to our expectations, customer portfolios for banks that rely more on nontraditional banking activities do not display higher diversification. The results for *County Real Income Growth* are consistent with the view that higher local economic growth brings about an increase in the number of security classes in the portfolio.

[17] There are in total 861 banks for which the share of PIIGS is larger than the sample median for 2009. For these banks, the average share of PIIGS held by households is 0.3%, while the average share of PIIGS held by firms is 0.5%.

What drives these results? How do bank clients increase portfolio diversification across different asset classes and types of issuer? To answer these questions, we repeat estimation of model (1) for all components of *HHI-Asset Class* and *HHI-Issuer*. As before, we consider nominal values, and the regressions are run with the same variables on the RHS as for equation (1).

We start from an analysis of changes in the components of *HHI-Asset Class* (the share of bonds, stocks, and investment certificates). Results reported in the first three columns of Table IV show that $\beta_2$ is positive and significant for the share of stocks to total securities, while it is negative and significant for the share of bonds to total securities (0.019 and –0.019, respectively). The change in the share of investment certificates is negligible, but this category represents less than 0.5% of the total nominal value of the portfolios. These results confirm that an increase in portfolio diversification does occur as a result of the Eurozone crisis, and this occurs because of a migration from bonds to equities.

The results for the components of *HHI-Issuer* (reported in columns four to seven of Table IV) confirm those on *HHI-Asset Class*: $\beta_2$ is negative and significant for securities issued by either foreign (excluding PIIGS) or domestic financial institutions (–0.019 in both cases), and positive and significant for securities issued by foreign (excluding PIIGS) and domestic nonfinancial corporations (0.016 and 0.013, respectively). As shown in Table III, securities issued by the financial sector (both domestic and foreign) make up a large portion of the portfolios of bank customer. The shift towards the nonfinancial sector, hence, increases diversification.

Is there flight to quality from international to domestic government bonds? The results for regressions on the ratio of German government bonds to total bonds (last column of Table IV) show that the coefficient on $Crisis_t \times Treatment_i$ is positive and significant. The magnitude of the coefficient is, however, rather small (0.003). Since the mean of this ratio is 0.041, these results suggest that an increase in the level of risk aversion follows the shock in the value of the portfolio, but this does *not* cause an increase in portfolio concentration. In other words, a flight to quality (German bonds are a safe haven as a result of their triple-A status) is accompanied by a higher level of diversification for the asset categories included in the risky share of customers' portfolios.

**[Insert Tables III and IV here]**

The results for the whole sample and for the households' portfolios are consistent with the hypothesis that the wealth shock generated by the Eurozone crisis led to an increase in the level of risk aversion for households with a large share of PIIGS securities. This interpretation is support by the decrease in the HHI measures and an increase in the share of German government bonds. In other words, the increase in the level of risk aversion generates a flight to quality, but at the same time also an increase in diversification across asset classes and issuers for securities that are not German government bonds and are therefore, from the perspective of a German investor, be considered as different parts of the risky share. Similarly, the migration towards securities issued by the nonfinancial sector during the Eurozone crisis could be a result of the co-movements between sovereign spread and stress in the domestic financial sector (Mody and Sandri (2012)). Fear that the Eurozone crisis would drag down banks as well encouraged bank clients to shun securities issued by the financial sector.

However, the former is only one of the possible interpretations for our findings. In particular, this interpretation is at odds with the increase in the stocks share, since stocks are generally believed to be riskier than bonds. An alternate explanation is that customers shied away from certain categories of bonds as a result of the reputational damage resulting from the sovereign debt crisis. Rather than an increase in risk aversion, these results may be ascribed to a revision in the beliefs relative to the expected return and variance of returns for the average bond (not issued by the German government) versus the average stock. This interpretation is similar to the 'experience hypothesis' (Malmendier and Nagel (2011)): When investors experience negative returns on a particular asset class, they tend to shun such asset class in the future. The Eurozone crisis could have sparked uncertainty in the bond market and cause a drop in the portfolio share consisting of bonds.

The two interpretations above are not mutually exclusive, because the wealth shock resulting from the Eurozone crisis could have sparked both an increase in risk aversion and reputational damage for government bonds. Moreover, negative experiences can feed risk aversion (Guiso, Sapienza, and Zingales (2012)). In the next section, we examine whether a decrease in the borrowing abilities of bank customers generates an increase in risk aversion and changes in HHI.

*III.B Impact of a reduction in borrowing abilities*

Table V reports the results for the Within-Group regressions on the effects of a drop in customer loans. Similar to the results for the Eurozone crisis, unreported results where year fixed effects are replaced by a proxy for changes in the yield curve (*Yield Curve Spread*) are overall robust in terms of sign and significance of the coefficients, and explanatory power of the models (see table A.1 in Appendix).

The tests for over-identification (Hansen J-test) and weak-identification (Kleibergen-Paap test) suggest that our instruments are valid for all specifications. The Kleibergen-Paap statistic is larger than 10, which satisfies the rule of thumb by Staiger and Stock (2003). We also report the statistic for the C-test (or GMM-distance test, Baum, Shaffer, and Stillman (2007)) for endogeneity of *Customer Loans Drop*, which is significant in all cases except for *HHI-Issuer* (*Firms*), for which is weakly significant. This test is essentially a Hansen test for different subsets of orthogonality conditions. If applied to a potentially endogenous regressor, as in our case, rejection of the null hypothesis suggests that the regressor is indeed endogenous. In the case of conditional homoskedasticity, this test is numerically equivalent to a Hausman test (Baum, Shaffer, and Stillman (2007)). The C-tests supports the hypothesis that *Customer Loans Drop* (*CLD*) is indeed endogenous: the test statistic is significant at the 5% level in five cases out of six, and in the last case the test is significant at the 10% level.

The coefficients of the regressors for the first-stage regression are significant with a sign consistent with expectations (positive). The coefficient on *Customer Loans Drop* ($\alpha_1$) is negative and significant for all specifications, although it is only weakly significant for the regressions on *HHI-Issuer* (*Firms*). These results confirm the tendency of households to increase diversification in the presence of exogenous shocks (in this case, a shock in their borrowing abilities), but suggest that a decrease in borrowing abilities bears an impact even on firms' diversification preferences. The magnitude of the coefficients suggests that the reduction in HHI following a reduction in borrowing abilities is stronger for firms than for households.

The coefficient on *County Real Income Growth* is either negative and significant or insignificant, as before, while the coefficient on *Fee Share Income* is weakly significant or insignificant in all six specifications.

**[Insert Table V here]**

Two-sample t-tests with unequal variances reported at the bottom of Table (V) help clarify the dynamics of portfolio rebalancing after the credit shock. These tests are based on the difference in the averages of the components of the HHI for cases for which *Customer Loans Drop* is zero or one. The tests for *HHI-Asset Class*, *HHI-Asset Class* (*Households*) and *HHI-Asset Class* (*Firms*) suggest that the decrease in HHI is mainly due to an increase in the share of investment certificates (which, as said above, include mutual funds) and a decrease in the share of stocks. For *HHI-Asset Class* (*Firms*), even the share in bonds increases, but the test is only weakly significant. For the tests for HHI in terms of issuer, consistent with the results for the Eurozone crisis, a drop in borrowing abilities leads to an increase in the share of German bonds, for the full sample, the households', and the firms' portfolios. Moreover, the share in foreign (non-PIIGS) bonds also increases, while the share of PIIGS bonds decreases, for the full sample and the households' portfolios. This is in line with our hypothesis of higher risk aversion following a drop in borrowing abilities, because PIIGS bonds were the riskiest investments in the period 2009-2012. Both households and firms also decrease in the share of securities issued by the domestic non-financial sector. However, there are heterogeneities between the households and firms portfolios: Firms increase their share of German government bonds, but do not increase the share of foreign (non-PIIGS) bonds, and do not decrease significantly the share of PIIGS bonds. Instead, firms decrease the share of securities issued by foreign (non-PIIGS) and German non-financial corporations, and increase the share of securities issued by foreign (non-PIIGS) and German financial institutions.

To understand whether credit-supply shocks bear heterogeneous effects depending on whether the shock is on households or on firms, we examine reductions in retail loans separately from reductions in corporate loans. We report the results in the appendix (Table A.2). A drop in retail loans does not bear any ramifications in terms on diversification preferences of either households or firms. Conversely, a drop in corporate loans leads to higher diversification in terms of asset class for both the house-

holds' and firms portfolios. In particular, reductions in corporate lending leads to increased diversification in terms of asset class for both households and firms, while diversification in terms of issuer increases only for households: Consistent with the results in Table V, there is a weakly significant increase in *HHI-Issuer* (*Firms*). The results for households suggest that the change in diversification preferences is sparked by an increase in background and income risk for households. The impact on background and income risk is likely to take place through contractions in corporate investment related to the credit-supply shock (Wardlaw (2010), Campello et al. (2011)), which has a negative impact on labor demand (Greenwald and Stiglitz (1990)).

### *III.C Assumptions and sensitivity checks for DiD tests*

Figure II shows graphs for a visual inspection of the parallel trend assumption for the pre-treatment period for all dependent variables. Overall, the graphs suggest that the parallel trend assumption is not violated for any of the dependent variables.

Table VI reports the results for a placebo exercise based on a fictitious exogenous shock in the pre-crisis period (subpanel "Placebo crisis") and the results for the DiD regressions on the effect of the crisis on portfolio diversification using the 'collapsing' technique (subpanel "Collapsing technique").

For the first type of analysis, following Waldinger (2010) and Bechtel and Hainmueller (2011), we run the regressions again using only the pre-crisis period and moving the crisis year from 2009 to 2007. Therefore, our pre-treatment period becomes 2005-2006, and our post-treatment period becomes 2007-2008. This is to rule out that differential trends between the treatment and control group explain our findings. Inspection of the results suggests that pre-treatment trends were similar for the two groups: $\beta_2$ is insignificant for all specifications, and in some cases it has an opposite sign from that reported in Table III.

To implement the collapsing technique (Bertrand, Duflo, and Mullainathan (2004)), we take the bank-level average for each variable for the pre-treatment and post-treatment period separately, and run an OLS model on this two-period setting. This technique produces consistent standard errors. The results are virtually the same as those using simple clustering of the standard errors at the bank level.

**[Insert Figure II here]**

**[Insert Table VI here]**

What happens if a bank receives both treatments? Are there any heterogeneous responses related to the ability of households to absorb exogenous wealth shocks?

Table VII, for the subpanel "Drop in Customer Loans", reports the results of model (1) augmented with an interaction term between *Crisis* × *Treatment* (*Interaction*) and the dummy *Customer Loans Drop* (*Interaction* × *Customer Loans Drop = Interaction 2*). The results show that the two effects tend to reinforce each other for the household portfolios (for which they both have a negative effect), for both *HHI-Asset class* (*Households*) and *HHI-Issuer* (*Households*). For firms, the coefficient on *Interaction* on *HHI-Asset Class* (*Firms*) is positive and significant, while the coefficient on *Interaction 2* is negative but weakly significant. For the regression on *HHI-Issuer* (*Firms*) the coefficient on *Interaction* is positive and weakly significant and the coefficient on *Interaction 2* is insignificant.

Next, we examine heterogeneities in the response to the Eurozone crisis related to differences in the ability to absorb wealth shocks across counties. In particular, we examine whether the impact of the Eurozone crisis depends on the number of firms (scaled by population): In counties with a larger number of firms per capita, households should be less affected by a wealth shock, because of lower background risk. To this end, we construct an interaction term between a dummy variable *Entrepreneurship*, equal to 1 if the county lies above the 75$^{th}$ percentile in terms of number of firms per capita and 0 otherwise, and *Interaction* (*Interaction* × *Entrepreneurship = Interaction 3*). The results are reported in Table VII, for the subpanel "Entrepreneurship". Consistent with our hypothesis, the coefficient on *Interaction 3* is positive for the regressions on *HHI-Asset class* and *HHI-Asset class* (*Households*), although it is insignificant for all other cases. These results suggest that being in a county where there is a large number of firms per capita reduces the incentive of households to increase diversification in terms of asset class after a wealth shock.

**[Insert Table VII here]**

It could be argued that the changes in our diversification measures do not take into account drops in the number of security accounts resulting from higher risk aversion. To rule out that our findings are driven by a reduction in the number of security accounts, we estimate model (1) replacing our portfolio diversification measures with the percentage change in the number of security accounts. In Figure A.1 we show that the parallel trend assumption for this variable is plausible. The results shown in Table A.3 do not support the view that changes in our diversification measures are driven by a reduction in the number of security accounts. In fact, the number of security accounts tends to *increase*. An additional concern could be that we are not allowing for changes in other categories of financial assets, such as savings: When a client decides to open a security account, it is plausible that the funds for buying the securities are taken from his/her savings account. However, when we consider changes in the ratio of total savings to total assets, *Savings Ratio*, as additional control variable (which, as expected, is negatively related to the number of security accounts), the results for *Interaction* are virtually the same.

We provide an additional robustness check related to the magnitude of the effects when the definition of *Treatment* is based on the first and last quartile of the distribution of the share of PIIGS in 2009, rather than on the median: The dummy *Treatment* is now equal to one if the share of PIIGS is larger than the 75$^{th}$ percentile of the distribution, while it is equal to 0 if the share of PIIGS is smaller than the 25$^{th}$ percentile (all intermediate observations are discarded). If our hypothesis is correct, the magnitude of the coefficient on the interaction term *Treatment* × *Crisis* should be larger than for Table III, because of larger differences in terms of share of PIIGS in the portfolios of the treatment and control group. The results for this test are reported in the appendix (Table A.4), and confirm our intuition.

Finally, to ameliorate potential concerns regarding the parallel-trend assumption, we also apply propensity score matching (PSM) techniques. Several variables unaccounted for by our models may affect selection to the treatment group, such as regional characteristics, and other bank-specific variables. For instance, regional migration patterns may increase the probability that the customer holds PIIGS securities (e.g. regions with a larger share of Italian immigrants), while the level of political instability at the state level may increase the level of risk aversion. Banks with different lending strategies and riskiness of the loan portfolio may attract customers with different risk preferences and financial literacy. Accordingly, we employ the nearest-neighbor matching method with only one match and with replacement, matching on the following variables: The regional district where the headquarters of the bank are located (*Regional District*, or Regierungsbezirk); the difference in the election votes for the Bundesland and the county, based on the Bundesland coalition (*Difference in Votes*); a dummy that identifies private banks (*Private*); the share of loans to corporate customers divided by the total value of the loans portfolio (*Corporate Loans Share*); and the ratio of non-performing loans to total customer loans (*NPL Ratio*). The first two variables capture regional characteristics while the last two variables capture heterogeneities related to the loan policy of the bank, in terms of both lending strategy (corporate-oriented or retail-oriented), and the overall quality of the lending portfolio. Finally, the dummy identifying private banks may capture heterogeneities related to the level of sophistication of the customers. Table A.5 shows that after matching the comparability between the treatment and control subsamples improves considerably, as evidenced by the severe drop in the pseudo R-squared of the probit regression. The results for $\beta_2$ are still negative and significant for *HHI-Asset Class*, *HHI-Asset Class* (*Households*), *HHI-Issuer*, and *HHI-Issuer* (*Households*), and insignificant for *HHI-Asset Class* (*Firms*) and *HHI-Issuer* (*Firms*). Therefore, our results do not seem to be affected by confounding variables.[18]

### *III.D Robustness checks for the results on the reduction in borrowing abilities*

We now turn to a discussion of robustness tests for the *Customer Loans Drop* regressions. We provide several falsification tests to ensure that the reduction in HHI following a drop in customer loans is not a simple statistical artifact, and to address concerns related to pre-treatment trends or weakness of our instruments.

[18] We also tried dynamic panel data models (using the specification by Arellano and Bond (1991)) and the results remain virtually unchanged. In Table A.5 we show the results for a specification using 2 lags for the dependent variable. Using GMM-in-system (Arellano and Bover (1995), and Bond and Blundell (1998)) does not change substantially the results.

For the first falsification test we create placebo treatments (*Customer Loans Drop Placebo*) and repeat our analysis by moving the real drops back by three years. In other words, if *Customer Loans Drop* in 2011 is 1 (0), *then Customer Loans Drop Placebo* takes on the value 1 (0) for 2008. The results for this placebo exercise are reported in Table VIII, subpanel "Forwarded CLD", and support the view that placebo reductions in customer loans have no ramifications on portfolio diversification, since the coefficient on *Interaction* is insignificant for all six cases. For the subpanel "Forwarded CLD & IV" the IVs are also moved back by three years, to maintain the correlation structure between the IVs and CLD. Even in this case, the coefficient on *Interaction* is insignificant. These findings support the parallel trend assumption for the pre-treatment period.

As a second falsification test, we investigate the validity of our instruments using Monte Carlo techniques to simulate fictitious drops in customer loans for years for which *Customer Loans Drop* is equal to zero. In a nutshell, we generate 1,000 variables simulating randomized placebo treatments for observations for which there is no actual treatment. In so doing, we disrupt the correlation structure between the excluded instruments and the endogenous variable. Therefore, by construction, the instruments for the simulated placebo treatments are weak, and we can evaluate the chances that the estimated Kleibergen-Paap test statistic using our dataset be higher than 10 by pure fluke.

Table IX, subpanel "Montel Carlo 1", reports the results for this falsification exercise, confirming that the likelihood of an estimated Kleibergen-Paap statistic higher than ten is negligible. We report, for each dependent variable, the critical values for a one-tail test on the Kleibergen-Paap test, and the corresponding $\alpha_1$ (the coefficient on *Customer Loans Drop Placebo* in model (2)), for the significance levels: 1% ($KP_{(0.990)}$), 5% ($KP_{(0.950)}$), and 10%($KP_{(0.900)}$). We also report the average value for the foregoing statistics as well as for the p-value for the Hansen J-test. The results for the p-value of the Hansen J-test for the placebos are on average well above 0.10. For all dependent variables, the maximum Kleibergen-Paap statistic is well below 10, and its average value is just above one.[19] On average, $\alpha_1$ is very close to 0. When we consider only values for the Kleibergen-Paap statistic above their 90$^{th}$, 95$^{th}$, or 99$^{th}$ percentile, the average $\alpha_1$ remains well below the estimated $\alpha_1$ as reported in Table V, which for convenience we report in Table IX as well. The former falsification test is basically a test of the likelihood that we obtain strong instruments by chance. In other words, it lends support to the validity of the Kleibergen-Paap test.

Now, we address a second issue. Provided that the instruments are strong, what is the probability that the significance of $\alpha_1$ is driven by chance or data mining? To address this issue, we employ a reshuffling procedure that destroys the correlation structure between the endogenous variable *Customer Loans Drop* and the dependent variable. The reshuffling is performed so that the intra-cluster structure between the dependent variable and the controls, the proportion of treated observations, and the correlation structure between the endogenous variable and the excluded instruments is maintained.[20] Then, we run model (2) on the new dataset. The results reported in Table IX, subpanel "Monte Carlo 2", suggest that the probability of overrejection of the null hypothesis ($\alpha_1$ =0) are minor. A comparison of the estimated T($\alpha_1$) in Table XI with the critical values T$(\alpha_1)_{(0.005)}$, T$(\alpha_1)_{(0.025)}$, and T$(\alpha_1)_{(0.050)}$ constructed using Monte Carlo simulations suggests that the estimates for $\alpha_1$ are significant at the 1% or 5% level in all cases except for *HHI-Issuer* (*Firms*), for which the estimates are significant at the 10% level.

**[Insert Table IX here]**

Finally, similar to what reported in section III.C for the regressions on the Eurozone crisis, we investigate the possibility that the results for the regressions on the diversification measures may have been affected by a reduction in the number of security accounts. The results reported in Table A.7 suggest that drops in customer loans do not influence the number of security accounts. Even in this case, the coefficient on *Savings Ratio* is negative and significant.

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19 The minimum and maximum Kleibergen-Paap statistics are 0.030 and 4.649, respectively.

20 The reshuffling can be performed as follows. Let **G** be a matrix comprising both the $N \times 1$ vector of observations for *Customer Loans Drop* and the $N \times l$ matrix of excluded instruments **W**, such that **G** is a $N \times (l + 1)$ matrix. Generate two uniformly-distributed random variables, $R_1(m)$ and $R_2(m)$, with $M$ observations, such that $M = N$. Given $n_1 = \lfloor N \times R_1(m_1) \rfloor$ and $n_2 = \lfloor N \times R_2(m_2) \rfloor$, exchange $\mathbf{G}(n_1)$ with $\mathbf{G}(n_2)$.

## IV. Conclusions

The literature on portfolio choices lacks an investigation of heterogeneities in the diversification preferences of households and firms. This issue is important because firms can be less subject than households to behavioral biases, because they are, on average, more sophisticated investors as a result of better financial resources and experience in a business environment. In particular, firms should be less prone to overweighting negative experiences in their decision-making process. Thus, households and firms can react differently to macroeconomic shocks that affect their wealth or their borrowing abilities. Despite this important difference, the literature on portfolio allocation focuses prevalently on households and neglects firms. In addition to this, the literature has only recently attempted to tease out the impact of financial institutions in shaping the allocation preferences of their customers. This is mainly a consequence of the dearth of data sets with information on the security holdings of customers for a large number of banks. Finally, despite the body of evidence on the impact of borrowing abilities on portfolio choice, there is currently no evidence regarding the effects of a distress-related credit-supply shock on portfolio allocation of bank customers.

In this paper, we aim to offer several contributions to the literature on portfolio choice by investigating the impact of macroeconomic shocks on portfolio choice. We are the first to directly compare the diversification preferences of households and firms and their reaction to a wealth shock, and a credit-supply shock. We exploit a novel unique data set on bank customers' security holdings for *all* German banks which enables us to distinguish security holdings of households from security holdings of firms. This unique data set allows us to uncover important heterogeneities between households and firms in terms of average diversification preferences and in terms of portfolio rebalancing following a macroeconomic shock. We exploit this dataset to test the impact of two macroeconomic shocks that have so far been neglected in the household finance literature: the Eurozone debt crisis and bank-level credit crunches (driven by distress). The first shock is clearly exogenous to portfolio choice of bank clients, and this enables us to employ difference in differences estimation to tease out the reaction to a wealth shock deriving from holding PIIGS securities at the onset of the Eurozone crisis. The second shock is not exogenous, and for this reason we employ instrumental-variable techniques to extrapolate the impact of diminished borrowing opportunities deriving from a credit-supply shock.

Our results show that macroeconomic shocks affect the degree of portfolio diversification of bank customers. Wealth shocks deriving from a drop in the market value of the security portfolio and shocks in borrowing abilities deriving from a reduction in bank customer loans result in higher diversification, in terms of both asset class and issuer of the security, and flight to quality.

One possible interpretation of these findings is that wealth shocks and borrowing abilities shocks increase the degree of risk aversion, i.e. they affect risk preferences of bank customers. A second possible explanation, however, is that these shocks cause revision of beliefs about future returns of different types of securities (Malmendier and Nagel (2011)). The latter interpretation (experience hypothesis) is better suited to explain one of our main findings: The share of bonds in the portfolio drops as a result of the Eurozone sovereign debt crisis for customers with large shares of PIIGS securities.

We identify substantial heterogeneities in the response of households and firms to a wealth shock relative to a shock in their borrowing abilities. Households increase diversification as a result of the shock. Conversely, firms do not increase the degree of diversification of their security portfolio following a drop in the market value of the security portfolio. In fact, there is some evidence that they *decrease* portfolio diversification. A possible explanation for such finding is the possibility that recent negative experiences affect less financially sophisticated investors (households) more strongly. On the other hand, both households and firms increase portfolio diversification when their bank curtails the provision of customer loans. In particular, a reduction in corporate loans leads to higher diversification for both households and firms, while a reduction in retail loans does not have any ramifications on our measures of portfolio diversification. The latter result urges us to conclude that the increased diversification in households portfolios is due to higher background/income risk generated by a drop in corporate investment (and a consequent drop in labor demand). These findings are important because they provide a 'missing link' in the literature on the real effects of bank distress and household portfolio choice: Not only does bank distress affect corporate investment and labor demand, but it can also indirectly impose shocks on household portfolio choice.

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**Table I: Representativeness – Germany and selected other countries**

| | Germany | France | Italy | Japan | Spain | UK | USA |
|---|---|---|---|---|---|---|---|
| **Household total financial assets** *(percentage of GDP in 2011)* | 180 | 200 | 230 | 320 | 160 | 280 | 330 |
| **Total financial assets of households per capita** *(US dollars at current PPPs in 2010)* | 70389 | 70835 | 76408 | 105265 | 53023 | 104905 | 159854 |
| **Financial assets of households by type of assets** *(percentage of total assets in 2010)* | | | | | | | |
| 1. Currency and deposits | 40.0 | 28.6 | 30.0 | 54.3 | 49.0 | 28.2 | 13.7 |
| 2. Securities other than shares | 5.5 | 1.6 | 18.8 | 2.6 | 2.9 | 1.4 | 10.8 |
| 3. Money owed to households | 0.0 | 0.7 | 0.4 | 0.0 | 0.0 | 0.4 | 1.6 |
| 4. Shares and other equity | 18.8 | 24.5 | 29.7 | 10.8 | 28.9 | 15.3 | 43.4 |
| 5. Insurance technical reserves | 35.0 | 37.3 | 18.2 | 28.0 | 15.4 | 51.7 | 30.4 |
| 6. Other Accounts | 0.8 | 7.3 | 2.8 | 4.3 | 3.7 | 3.0 | 0.0 |

**Table II: Descriptive statistics for HHI measures and related components, and for the number of security accounts.**

| **PANEL A: Components of HHI Asset class and HHI Issuer** | **Nominal Values** | | | **Market Values** | | |
|---|---|---|---|---|---|---|
| | **Observations** | **Mean** | **Standard Deviation** | **Observations** | **Mean** | **Standard Deviation** |
| *Bonds Share* | 13966 | 0.894 | 0.137 | 13966 | 0.590 | 0.204 |
| *Stocks Share* | 13966 | 0.102 | 0.129 | 13966 | 0.396 | 0.203 |
| *Certificates Share* | 13966 | 0.003 | 0.051 | 13966 | 0.014 | 0.057 |
| *Foreign (non-PIIGS) Government Share* | 13966 | 0.043 | 0.051 | 13966 | 0.025 | 0.031 |
| *Foreign (non-PIIGS) Non-Financial Corporations Share* | 13966 | 0.076 | 0.080 | 13966 | 0.213 | 0.107 |
| *Foreign (non-PIIGS)Financial-Institutions Share* | 13966 | 0.411 | 0.086 | 13966 | 0.297 | 0.102 |
| *German Government Share* | 13966 | 0.028 | 0.041 | 13966 | 0.018 | 0.027 |
| *German Non-Financial Corporations Share* | 13966 | 0.054 | 0.061 | 13966 | 0.169 | 0.090 |
| *German Financial-Institutions Share* | 13966 | 0.384 | 0.093 | 13966 | 0.274 | 0.102 |
| *PIIGS Government Share* | 13966 | 0.001 | 0.007 | 13966 | 0.001 | 0.006 |
| *PIIGS Non-Financial Corporations Share* | 13966 | 0.001 | 0.003 | 13966 | 0.002 | 0.003 |
| *PIIGS Financial-Institutions Share* | 13966 | 0.001 | 0.012 | 13966 | 0.002 | 0.010 |

| **PANEL B: Different types of HHI** | **Nominal Values** | | | | | **Market Values** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Full sample** | | **Households** | **Firms** | | **Full sample** | | **Households** | **Firms** | |
| | **Mean** | **S.D.** | **Mean** | **Mean** | **t-test** | **Mean** | **S.D.** | **Mean** | **Mean** | **t-test** |
| *HHI Asset Class* | 0.849 | 0.118 | 0.850 | 0.723 | 38.74*** | 0.592 | 0.113 | 0.586 | 0.633 | -15.131*** |
| Observations | 13966 | | 13966 | 13966 | | 13966 | | 13966 | 13966 | |
| *HHI Issuer* | 0.358 | 0.078 | 0.360 | 0.342 | 9.67*** | 0.280 | 0.058 | 0.279 | 0.324 | -25.49*** |
| Observations | 13966 | | 13966 | 15566 | | 13966 | | 13966 | 13966 | |

| **PANEL C: Statistics on security accounts (all values are reported in Euros)** | **Nominal Values** | | | **Market Values** | | |
|---|---|---|---|---|---|---|
| | **25$^{th}$ percentile** | **Median** | **75$^{th}$ percentile** | **25$^{th}$ percentile** | **Median** | **75$^{th}$ percentile** |
| *Total portfolio value* | 20,107 | 31,484 | 43,450 | 32,753 | 44,883 | 60,389 |
| Observations | 13966 | 13966 | 13966 | 13966 | 13966 | 13966 |
| *Bonds* | 17,814 | 29,267 | 41,073 | 17,250 | 28,727 | 40,362 |
| Observations | 13966 | 13966 | 13966 | 13966 | 13966 | 13966 |
| *Stocks* | 1,169 | 1,775 | 2,751 | 10,791 | 15,598 | 22,258 |
| Observations | 13966 | 13966 | 13966 | 13966 | 13966 | 13966 |

| | **25$^{th}$ percentile** | **Median** | **75$^{th}$ percentile** |
|---|---|---|---|
| *Number of accounts per bank* | 581 | 1590 | 3774 |
| Observations | 13966 | 13966 | 13966 |

*** Denotes significance at the 1% level.

**Table III. Effect of the Eurozone crisis on portfolio diversification**.

We run model (1) with standard errors clustered at the bank level. *Crisis* is a dummy variable that takes on the value one for the 2009-2012 period, and zero otherwise. *Treatment* is a dummy variable equal to one if in 2009 the share of PIIGS is larger than the sample median, and zero otherwise. Being time-invariant, *Treatment* is unidentified in the regressions. The effect of the European sovereign debt crisis is assessed by examining the impact of *Interaction = Crisis × Treatment*. *Fee Income Share* measures the share of fee-generating activities as fee income to total bank's income. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

| | Panel A: HHI-Asset Class | | | Panel B: HHI-Issuer | | |
|---|---|---|---|---|---|---|
| *SUBPANEL: With Year FE* | Full sample | Households | Firms | Full sample | Households | Firms |
| *Crisis* | -0.035*** | -0.033*** | -0.015 | -0.009*** | -0.007*** | -0.020*** |
| | (-12.847) | (-12.272) | (-1.367) | (-4.841) | (-3.682) | (-2.964) |
| ***Interaction*** | **-0.013*** ** | **-0.014*** ** | **0.019** | **-0.014*** ** | **-0.014*** ** | **0.012*** |
| | **(-3.921)** | **(-4.276)** | **(1.640)** | **(-6.196)** | **(-6.153)** | **(1.696)** |
| *Fee Income Share* | 0.001*** | 0.001** | 0.001 | 0.000 | -0.000 | 0.001 |
| | (3.769) | (2.512) | (1.219) | (1.197) | (-0.108) | (0.860) |
| *County Real Income Growth* | 0.000 | 0.000 | 0.000 | -0.000*** | -0.000** | 0.000 |
| | (0.271) | (0.233) | (0.175) | (-2.705) | (-2.453) | (0.408) |
| **Constant** | 0.842*** | 0.848*** | 0.702*** | 0.354*** | 0.361*** | 0.338*** |
| | (150.174) | (130.435) | (43.374) | (79.890) | (71.885) | (32.754) |
| **Year FE** | YES | YES | YES | YES | YES | YES |
| **Observations** | 13,647 | 13,647 | 13,647 | 13,647 | 13,647 | 13,647 |
| **R-squared** | 0.335 | 0.341 | 0.008 | 0.215 | 0.206 | 0.005 |
| **Bank FE** | YES | YES | YES | YES | YES | YES |
| *SUBPANEL: With Year Curve Spread* | Full sample | Households | Firms | Full sample | Households | Firms |
| *Crisis* | -0.076*** | -0.073*** | -0.042*** | -0.026*** | -0.024*** | -0.026*** |
| | (-22.319) | (-22.511) | (-3.768) | (-11.387) | (-10.308) | (-3.806) |
| ***Interaction*** | **-0.013*** ** | **-0.014*** ** | **0.019*** | **-0.014*** ** | **-0.014*** ** | **0.013*** |
| | **(-3.755)** | **(-4.098)** | **(1.658)** | **(-6.030)** | **(-5.974)** | **(1.709)** |
| *Fee Income Share* | 0.001* | 0.000 | 0.001 | -0.000 | -0.001** | 0.000 |
| | (1.688) | (0.574) | (0.795) | (-0.957) | (-2.207) | (0.653) |
| *County Real Income Growth* | -0.001*** | -0.001*** | -0.000 | -0.001*** | -0.001*** | -0.000 |
| | (-6.961) | (-7.278) | (-0.044) | (-13.015) | (-13.375) | (-0.030) |
| *Yield Curve Spread* | 0.017*** | 0.017*** | 0.005 | 0.005*** | 0.004*** | 0.004 |
| | (12.566) | (12.302) | (1.025) | (5.346) | (4.005) | (1.141) |
| **Constant** | 0.862*** | 0.870*** | 0.722*** | 0.374*** | 0.382*** | 0.342*** |
| | (166.720) | (143.063) | (45.963) | (92.970) | (82.643) | (34.308) |
| **Year FE** | NO | NO | NO | NO | NO | NO |
| **Observations** | 13,647 | 13,647 | 13,647 | 13,647 | 13,647 | 13,647 |
| **R-squared** | 0.275 | 0.278 | 0.005 | 0.152 | 0.140 | 0.004 |
| **Bank FE** | YES | YES | YES | YES | YES | YES |

**Table IV. Results on the effect of the Eurozone crisis for the components of different HHI measures.**

We run model (1) with standard errors clustered at the bank level. *Crisis* is a dummy variable that takes on the value one for the 2009-2012 period, and zero otherwise. *Treatment* is a dummy variable equal to one if in 2009 the share of PIIGS is larger than the sample median, and zero otherwise. Being time-invariant, *Treatment* is unidentified in the regressions. The effect of the European sovereign debt crisis is assessed by examining the impact of *Interaction = Crisis × Treatment*. *Fee Income Share* measures the share of fee-generating activities as fee income to total bank's income. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

| | Bonds Share | Stocks Share | Certificates Share | German FI Share | German NF Share | Foreign FI Share | Foreign NF Share | German Gov. Bonds Share |
|---|---|---|---|---|---|---|---|---|
| *Crisis* | -0.025*** | 0.025*** | -0.000 | -0.005*** | 0.016*** | -0.012*** | 0.018*** | -0.007*** |
| | (-9.538) | (9.654) | (-0.310) | (-2.701) | (11.879) | (-6.182) | (10.820) | (-5.422) |
| ***Interaction*** | **-0.019*** ** | **0.019*** ** | **0.001** | **-0.019*** ** | **0.013*** ** | **-0.019*** ** | **0.016*** ** | **0.003** ** |
| | **(-5.015)** | **(4.879)** | **(1.069)** | **(-7.326)** | **(7.843)** | **(-7.898)** | **(6.869)** | **(2.035)** |
| *Fee Income Share* | 0.002*** | -0.001*** | -0.000 | -0.000 | 0.000 | -0.000 | 0.000 | 0.000 |
| | (2.822) | (-2.711) | (-0.749) | (-0.458) | (0.109) | (-0.983) | (0.317) | (1.069) |
| *County Real Income Growth* | 0.000 | -0.000 | -0.000 | -0.000 | 0.000 | -0.000** | 0.000 | 0.000* |
| | (1.641) | (-1.333) | (-0.805) | (-1.486) | (0.328) | (-2.287) | (0.813) | (1.825) |
| **Constant** | 0.885*** | 0.111*** | 0.005** | 0.390*** | 0.043*** | 0.424*** | 0.060*** | 0.035*** |
| | (103.690) | (13.236) | (2.340) | (75.888) | (15.746) | (80.089) | (14.874) | (9.593) |
| **Year FE** | YES | YES | YES | YES | YES | YES | YES | YES |
| **Observations** | 13,647 | 13,647 | 13,647 | 13,647 | 13,647 | 13,647 | 13,647 | 13,582 |
| **R-squared** | 0.207 | 0.216 | 0.001 | 0.235 | 0.303 | 0.177 | 0.259 | 0.029 |
| **Bank FE** | YES | YES | YES | YES | YES | YES | YES | YES |

Notes: The variables are defined as nominal value for that asset category over the total nominal value of the portfolio at the bank level, except for German Government Bonds Share, which is calculated as the nominal value of German Government Bonds over the total nominal value of bonds in the portfolio.

FI = financial institutions (both shares and bonds)

NF = non-financial corporations (both shares and bonds)

Gov. = government bonds

Foreign = foreign countries other than PIIGS.

**Table V. Instrumental-Variable estimation of effects of a decrease in lending (*Customer Loans Drop*).**
We run model (2) using Within-Group regressions with heteroskedasticity-robust standard errors clustered at the bank level (at both the first and the second stage). Observations for which the change in the total nominal value of the portfolio from $t-1$ to $t$ is negative and there is a capital injection in year $t-1$ are excluded. *Customer Loans Drop* is instrumented by *Capital Injection*, *HHI-Loan-15*, *Hidden Liabilities Dummy*, and *Liquidity Ratio*. For the two-sample t-tests a positive statistic implies that the average value of that variable is larger for *Customer Loans Drop* equal to one than it is for *Customer Loans Drop* equal to zero.

| | Panel A: HHI-Asset Class | | | Panel B: HHI-Issuer | | |
|---|---|---|---|---|---|---|
| SUBPANEL: *Second-stage regression results* | Full sample | Households | Firms | Full sample | Households | Firms |
| ***Customer Loans Drop*** | -0.065** | -0.068** | -0.129** | -0.042*** | -0.031** | -0.060* |
| | (-2.321) | (-2.432) | (-2.523) | (-2.823) | (-2.157) | (-1.888) |
| *County Real Income Growth* | -0.000 | -0.000 | 0.000 | -0.000*** | -0.000*** | 0.000 |
| | (-0.368) | (-0.608) | (0.547) | (-2.777) | (-2.917) | (0.640) |
| *Fee Income Share* | -0.001 | -0.001 | -0.000 | -0.001 | -0.001* | 0.000 |
| | (-0.925) | (-0.942) | (-0.092) | (-1.137) | (-1.655) | (0.361) |
| **Year FE** | YES | YES | YES | YES | YES | YES |
| **Bank FE** | YES | YES | YES | YES | YES | YES |
| **Observations** | 12,123 | 12,123 | 12,123 | 12,123 | 12,123 | 12,123 |
| **Number of banks** | 2,018 | 2,018 | 2,018 | 2,018 | 2,018 | 2,018 |
| **Endogeneity test (for CLD)** | 9.105*** | 9.014*** | 5.254** | 7.977*** | 4.334** | 3.043* |
| **Hansen J** | 5.266 | 2.438 | 2.680 | 2.655 | 1.756 | 2.147 |
| **Hansen J, P-value** | 0.153 | 0.487 | 0.444 | 0.448 | 0.625 | 0.542 |
| **Hansen J-test, DF** | 3 | 3 | 3 | 3 | 3 | 3 |
| SUBPANEL: *First-stage regression results* | | | | | | |
| ***Capital Injection*** | 0.113** | 0.113** | 0.113** | 0.113** | 0.113** | 0.113** |
| | (1,976) | (1,976) | (1,976) | (1,976) | (1,976) | (1,976) |
| ***HHI-Loan-15*** | 0.006*** | 0.006*** | 0.006*** | 0.006*** | 0.006*** | 0.006*** |
| | (5,966) | (5,966) | (5,966) | (5,966) | (5,966) | (5,966) |
| ***Hidden Liabilities Dummy*** | 0.037** | 0.037** | 0.037** | 0.037** | 0.037** | 0.037** |
| | (2,001) | (2,001) | (2,001) | (2,001) | (2,001) | (2,001) |
| ***Liquidity Ratio*** | 0.006*** | 0.006*** | 0.006*** | 0.006*** | 0.006*** | 0.006*** |
| | (4,419) | (4,419) | (4,419) | (4,419) | (4,419) | (4,419) |
| **F-test ( 12, 2017)** | 121.33*** | 121.33*** | 121.33*** | 121.33*** | 121.33*** | 121.33*** |
| **Kleibergen-Paap F-stat** | 15.72 | 15.72 | 15.72 | 15.72 | 15.72 | 15.72 |
| SUBPANEL: *Two-sample t-test (with unequal variances)* | | | | | | |
| *Bonds Share* | 0.381 | 0.531 | 1.775* | | | |
| *Stocks Share* | -2.038** | -2.229** | -3.084*** | | | |
| *Certificates Share* | 4.106*** | 4.247*** | 3.150*** | | | |
| *German Government Share* | | | | 4.845*** | 4.831*** | 1.898** |
| *Foreign (non-PIIGS) Gov. Share* | | | | 2.995*** | 3.003*** | 0.095 |
| *PIIGS Government Share* | | | | -2.490** | -3.277*** | -0.993 |
| *Foreign (non-PIIGS) NF Share* | | | | -1.483 | -0.773 | -3.054*** |
| *Foreign (non-PIIGS) FI Share* | | | | 0.247 | 0.429 | 2.187** |
| *German NF Share* | | | | -1.836* | -3.100*** | -3.471*** |
| *German FI Share* | | | | -1.560 | 1.506 | 3.363*** |
| *PIIGS NF Share* | | | | 0.875 | 0.746 | 0.144 |
| *PIIGS FI Share* | | | | 1.653 | 1.295 | 0.703 |

**Table VI. Effect of the Eurozone crisis on portfolio diversification**: **Placebo tests for parallel trend assumption and 'collapsing' technique.**
For the subpanel *Placebo crisis*, we run a model (1) for the pre-treatment period only, using 2005-2006 (2007-2008) as the pre-treatment (post-treatment) period instead of 2005-2008 and 2009-2012. In other words, we create a placebo sovereign debt crisis for 2007-2008. The effect of the placebo sovereign debt crisis is assessed by examining the impact of *Placebo Interaction = Placebo Crisis × Treatment*. For the subpanel "*Collapsing technique*", we take the bank-level average for each variable for the four years in the pre-treatment and post-treatment period separately, and run an OLS model on this two-period setting. *Fee Income Share* measures the share of fee-generating activities as fee income to total bank's income. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

| | Panel A: HHI-Asset Class | | | Panel B: HHI-Issuer | | |
|---|---|---|---|---|---|---|
| *SUBPANEL: Placebo crisis* | Full sample | Households | Firms | Full sample | Households | Firms |
| *Crisis* | 0.021*** | 0.021*** | 0.009 | 0.020*** | 0.021*** | -0.001 |
| | (10.960) | (10.462) | (0.896) | (14.459) | (15.688) | (-0.156) |
| ***Placebo Interaction*** | **0.001** | **0.003** | **0.017** | **-0.003** | **-0.002** | **0.010** |
| | **(0.396)** | **(1.206)** | **(1.510)** | **(-1.571)** | **(-1.325)** | **(1.390)** |
| *Fee Income Share* | 0.000 | -0.000 | 0.001 | 0.002*** | 0.001 | 0.002 |
| | (0.654) | (-0.236) | (0.800) | (3.742) | (1.320) | (1.243) |
| *County Real Income Growth* | -0.000 | -0.000 | 0.002** | -0.000* | -0.000 | 0.001 |
| | (-1.430) | (-1.503) | (2.357) | (-1.677) | (-1.369) | (1.555) |
| **Constant** | 0.856*** | 0.867*** | 0.694*** | 0.337*** | 0.351*** | 0.321*** |
| | (85.977) | (65.388) | (24.814) | (56.754) | (48.984) | (17.527) |
| **Year FE** | YES | YES | YES | YES | YES | YES |
| **Observations** | 7,114 | 7,114 | 7,114 | 7,114 | 7,114 | 7,114 |
| **R-squared** | 0.104 | 0.111 | 0.005 | 0.140 | 0.157 | 0.002 |
| **Bank FE** | YES | YES | YES | YES | YES | YES |
| *SUBPANEL: Collapsing technique* | Full sample | Households | Firms | Full sample | Households | Firms |
| *Crisis* | -0.025*** | -0.025*** | -0.003 | -0.008*** | -0.007*** | -0.005 |
| | (-11.044) | (-9.659) | (-0.301) | (-5.922) | (-4.377) | (-0.676) |
| ***Interaction*** | **-0.014*** ** | **-0.016*** ** | **0.003** | **-0.009*** ** | **-0.010*** ** | **0.007** |
| | **(-5.672)** | **(-5.904)** | **(0.247)** | **(-6.372)** | **(-6.740)** | **(0.851)** |
| *Fee Income Share* | 0.002*** | 0.002*** | 0.001* | 0.000 | -0.000 | 0.003** |
| | (3.337) | (3.680) | (1.758) | (0.503) | (-0.325) | (2.267) |
| *County Real Income Growth* | 0.001*** | 0.001*** | 0.002* | 0.000** | 0.000** | -0.002* |
| | (4.309) | (4.084) | (1.780) | (2.027) | (2.422) | (-1.785) |
| **Constant** | 0.855*** | 0.855*** | 0.693*** | 0.374*** | 0.380*** | 0.304*** |
| | (104.594) | (101.938) | (28.327) | (84.616) | (85.498) | (15.624) |
| **Year FE** | YES | YES | YES | YES | YES | YES |
| **Observations** | 3,384 | 3,384 | 3,384 | 3,384 | 3,384 | 3,384 |
| **R-squared** | 0.398 | 0.355 | 0.010 | 0.232 | 0.200 | 0.011 |
| **Bank FE** | YES | YES | YES | YES | YES | YES |

**Table VII. Effect of Eurozone crisis: Heterogeneous responses.**

We run model (1) with standard errors clustered at the bank level. As for Table III, *Interaction = Crisis × Treatment*, while *Interaction 2 = Interaction × Customer Loans Drop*, and *Interaction 3 = Interaction × Entrepreneurship*, where *Entrepreneurship* is a dummy variable equal to 1 if the county lies above the 75$^{th}$ percentile in terms of number of firms per capita and 0 otherwise. *Fee Income Share* measures the share of fee-generating activities as fee income to total bank's income. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

| | Panel A: HHI-Asset Class | | | Panel B: HHI-Issuer | | |
|---|---|---|---|---|---|---|
| *SUBPANEL: Drop in Customer Loans* | Full sample | Households | Firms | Full sample | Households | Firms |
| *Crisis* | -0.055*** | -0.054*** | -0.035*** | -0.021*** | -0.019*** | -0.021*** |
| | (-21.958) | (-22.279) | (-4.034) | (-12.186) | (-11.586) | (-3.891) |
| ***Interaction*** | **-0.010*** ** | **-0.011*** ** | **0.024** ** | **-0.012*** ** | **-0.012*** ** | **0.015*** |
| | **(-2.996)** | **(-3.325)** | **(2.019)** | **(-5.224)** | **(-5.361)** | **(1.925)** |
| ***Interaction 2*** | **-0.009*** ** | **-0.009*** ** | **-0.018*** | **-0.006*** ** | **-0.006*** ** | **-0.011** |
| | **(-2.948)** | **(-3.135)** | **(-1.869)** | **(-3.190)** | **(-2.654)** | **(-1.614)** |
| *Fee Income Share* | 0.000 | -0.000 | 0.001 | -0.000 | -0.001*** | 0.000 |
| | (0.772) | (-0.367) | (0.648) | (-1.367) | (-2.638) | (0.681) |
| *County Real Income Growth* | -0.001*** | -0.001*** | -0.000 | -0.001*** | -0.001*** | -0.000 |
| | (-11.149) | (-11.100) | (-0.087) | (-13.938) | (-13.835) | (-0.093) |
| **Constant** | 0.875*** | 0.884*** | 0.724*** | 0.378*** | 0.386*** | 0.342*** |
| | (172.077) | (145.701) | (47.248) | (96.150) | (85.189) | (36.025) |
| **Year FE** | YES | YES | YES | YES | YES | YES |
| **Observations** | 13,283 | 13,283 | 13,283 | 13,283 | 13,283 | 13,283 |
| **R-squared** | 0.264 | 0.267 | 0.005 | 0.149 | 0.140 | 0.004 |
| **Banks FE** | YES | YES | YES | YES | YES | YES |
| *SUBPANEL: Entrepreneurship* | Full sample | Households | Firms | Full sample | Households | Firms |
| *Crisis* | -0.057*** | -0.055*** | -0.033*** | -0.025*** | -0.024*** | -0.018*** |
| | (-25.093) | (-24.415) | (-3.895) | (-17.206) | (-16.349) | (-3.204) |
| ***Interaction*** | **-0.018*** ** | **-0.020*** ** | **0.009** | **-0.013*** ** | **-0.014*** ** | **0.007** |
| | **(-5.181)** | **(-5.808)** | **(0.789)** | **(-5.775)** | **(-6.402)** | **(0.965)** |
| ***Interaction 3*** | **0.011** ** | **0.011** ** | **-0.003** | **0.001** | **0.003** | **-0.005** |
| | **(2.293)** | **(2.531)** | **(-0.194)** | **(0.340)** | **(0.836)** | **(-0.428)** |
| *Fee Income Share* | 0.001** | 0.001 | 0.002* | -0.000 | -0.000 | 0.001 |
| | (2.332) | (1.637) | (1.659) | (-0.174) | (-1.410) | (1.645) |
| *County Real Income Growth* | -0.002*** | -0.002*** | -0.001 | -0.001*** | -0.001*** | -0.000 |
| | (-15.144) | (-15.460) | (-1.549) | (-17.586) | (-17.350) | (-0.818) |
| **Constant** | 0.874*** | 0.881*** | 0.720*** | 0.382*** | 0.390*** | 0.334*** |
| | (125.405) | (121.324) | (46.437) | (86.598) | (84.386) | (33.270) |
| **Year FE** | YES | YES | YES | YES | YES | YES |
| **Observations** | 8,418 | 8,418 | 8,418 | 8,418 | 8,418 | 8,418 |
| **R-squared** | 0.365 | 0.376 | 0.007 | 0.264 | 0.250 | 0.004 |
| **Banks FE** | YES | YES | YES | YES | YES | YES |

**Table VIII. Instrumental-Variable estimation of effects of a decrease in lending (*Customer Loans Drop*). Placebo test based on placebo drops occurring three years prior to the actual drop (*Customer Loans Drop Placebo*).**

For the subpanel "*Forwarded CLD*" we run model (2) for placebo drops in customer loans. The placebo drops are simply the real drops moved back by three years. In other words, if *Customer Loans Drop* in 2011 is 1 (0), then *Customer Loans Drop Placebo* (*CLDP*) takes on the value 1 (0) for 2008. For the subpanel "*Forwarded CLD & IV*" the IVs are also moved back by three years, to maintain the correlation structure between the IVs and CLD. *Fee Income Share* measures the share of fee-generating activities as fee income to total bank's income. *** p<0.01, ** p<0.05, * p<0.1.

| | Panel A: HHI-Asset Class | | | Panel B: HHI-Issuer | | |
|---|---|---|---|---|---|---|
| *SUBPANEL: Forward CLD* | Full sample | Households | Firms | Full sample | Households | Firms |
| ***Customer Loans Drop Placebo*** | **0.300** | **0.217** | **0.146** | **0.070** | **0.027** | **-0.039** |
| | **(1.281)** | **(1.151)** | **(0.502)** | **(0.941)** | **(0.412)** | **(-0.221)** |
| *County Real Income Growth* | 0.001 | 0.000 | 0.002 | -0.000 | -0.000 | 0.000 |
| | (0.639) | (0.364) | (1.572) | (-0.219) | (-0.734) | (0.621) |
| *Fee Income Share* | 0.000 | -0.000 | 0.002 | 0.001 | 0.000 | 0.000 |
| | (0.210) | (-0.173) | (0.902) | (1.260) | (0.472) | (0.337) |
| **Year FE** | YES | YES | YES | YES | YES | YES |
| **Bank FE** | YES | YES | YES | YES | YES | YES |
| **Observations** | 6,296 | 6,296 | 6,296 | 6,296 | 6,296 | 6,296 |
| **Number of banks** | 1,650 | 1,650 | 1,650 | 1,650 | 1,650 | 1,650 |
| **Endogeneity test for *CLDP*** | 4.905** | 3.786* | 0.318 | 1.745 | 0.912 | 0.286 |
| **Hansen J** | 0.056 | 0.383 | 3.394 | 0.303 | 0.930 | 2.499 |
| **Hansen J, P-value** | 0.997 | 0.944 | 0.335 | 0.960 | 0.818 | 0.476 |
| **Hansen J-test, DF** | 3 | 3 | 3 | 3 | 3 | 3 |
| **Kleibergen-Paap** | 0.601 | 0.601 | 0.601 | 0.601 | 0.601 | 0.601 |
| *SUBPANEL: Forward CLD & IV* | Full sample | Households | Firms | Full sample | Households | Firms |
| ***Customer Loans Drop Placebo*** | **0.029** | **0.023** | **0.017** | **0.011** | **0.010** | **-0.023** |
| | **(0.672)** | **(0.534)** | **(0.290)** | **(0.514)** | **(0.480)** | **(-0.638)** |
| *County Real Income Growth* | -0.000 | -0.001* | 0.001* | -0.000* | -0.000* | 0.001 |
| | (-1.469) | (-1.679) | (1.936) | (-1.924) | (-1.826) | (1.448) |
| *Fee Income Share* | 0.000 | -0.000 | 0.001 | 0.001*** | 0.001* | 0.000 |
| | (0.130) | (-0.339) | (0.959) | (2.590) | (1.678) | (0.470) |
| **Year FE** | YES | YES | YES | YES | YES | YES |
| **Bank FE** | YES | YES | YES | YES | YES | YES |
| **Observations** | 6,297 | 6,297 | 6,297 | 6,297 | 6,297 | 6,297 |
| **Number of banks** | 1,656 | 1,656 | 1,656 | 1,656 | 1,656 | 1,656 |
| **Hansen J** | 3.811 | 4.296 | 1.655 | 1.754 | 2.238 | 3.232 |
| **Hansen J, P-value** | 0.283 | 0.231 | 0.647 | 0.625 | 0.525 | 0.357 |
| **Hansen J-test, DF** | 3 | 3 | 3 | 3 | 3 | 3 |
| **Kleibergen-Paap** | 11.01 | 11.01 | 11.01 | 11.01 | 11.01 | 11.01 |

**Table IX. Falsification test for IV estimation of effects of a decrease in lending (*Customer Loans Drop*). Critical values for the Kleibergen-Paap (and associated values for $\alpha_1$), and for T($\alpha_1$).**

For the subpanel "*Monte Carlo 1*" we run model (2) for placebo drops in customer loans. First, we generate a variable (*Customer Loans Drop Placebo*) which takes on the value zero for all cases for which *Customer Loans Drop* is also zero. Second, we randomly select a large number of observations for *Customer Loans Drop Placebo* and we replace them with one. This number is chosen so that the proportion between cases for which *Customer Loans Drop Placebo* equals one in the subsample (i.e. the one for which *Customer Loans Drop* equals zero) is the same as that for which Customer Loans Drop equals one in the whole sample. Third, we run model (2) using *Customer Loans Drop Placebo* as the main explanatory variable. $KP_{(0.990)}$, $KP_{(0.950)}$, $KP_{(0.900)}$ denote the 99th, 95th, and 90th percentile of the Kleibergen-Paap test statistic, respectively. For the subpanel "*Monte Carlo 2*" $T(\alpha_1)_{(0.005)}$, $T(\alpha_1)_{(0.025)}$, $T(\alpha_1)_{(0.050)}$ denote the left critical value for a two-tailed test at the 1%, 5%, and 10% level of significance, respectively. We employ a reshuffling procedure that destroys the correlation structure between the endogenous variable *Customer Loans Drop* and the dependent variable. The reshuffling is performed so that the intra-cluster structure between the dependent variable and the controls, the proportion of treated observations, and the correlation structure between the endogenous variable and the excluded instruments is maintained. Monte Carlo simulations based on 1,000 replications.

| | Panel A: HHI-Asset Class | | | Panel B: HHI-Issuer | | |
|---|---|---|---|---|---|---|
| *SUBPANEL: Montel Carlo 1* | Full sample | Households | Firms | Full sample | Households | Firms |
| *Average* $\alpha_1$ | -0.007 | -0.007 | -0.007 | -0.002 | -0.002 | 0.000 |
| *Average Kleibergen-Paap* | 1.036 | 1.036 | 1.036 | 1.036 | 1.036 | 1.036 |
| *Average Hansen J, P-value* | 0.294 | 0.283 | 0.699 | 0.498 | 0.487 | 0.696 |
| $KP_{(0.990)}$ | 3.459 | 3.459 | 3.459 | 3.459 | 3.459 | 3.459 |
| *Average* $\alpha_1$ *for* $KP > KP_{(0.990)}$ | -0.001 | 0.001 | 0.017 | 0.006 | 0.007 | 0.013 |
| $KP_{(0.950)}$ | 2.493 | 2.493 | 2.493 | 2.493 | 2.493 | 2.493 |
| *Average* $\alpha_1$ *for* $KP > KP_{(0.950)}$ | 0.012 | 0.012 | 0.013 | 0.004 | 0.004 | 0.000 |
| $KP_{(0.900)}$ | 2.044 | 2.044 | 2.044 | 2.044 | 2.044 | 2.044 |
| *Average* $\alpha_1$ *for* $KP > KP_{(0.900)}$ | -0.010 | -0.012 | -0.005 | -0.002 | -0.003 | 0.000 |
| **Estimated $\alpha_1$ (see Table V)** | **-0.065**** | **-0.068**** | **-0.129**** | **-0.042***** | **-0.031**** | **-0.060*** |
| **Estimated KP (see Table V)** | **15.72** | **15.72** | **15.72** | **15.72** | **15.72** | **15.72** |
| *SUBPANEL: Monte Carlo 2* | Full sample | Households | Firms | Full sample | Households | Firms |
| $T(\alpha_1)_{(0.005)}$ | -2.583 | -2.565 | -2.618 | -2.501 | -2.698 | -2.809 |
| $T(\alpha_1)_{(0.025)}$ | -1.985 | -1.937 | -1.995 | -2.133 | -2.116 | -2.124 |
| $T(\alpha_1)_{(0.050)}$ | -1.695 | -1.696 | -1.775 | -1.804 | -1.811 | -1.863 |
| **Estimated T($\alpha_1$) (see Table V)** | **-2.321** | **-2.432** | **-2.523** | **-2.823** | **-2.157** | **-1.888** |
| **Kleibergen-Paap** | **18.56-36.64** | **18.56-36.64** | **18.56-36.64** | **18.56-36.64** | **18.56-36.64** | **18.56-36.64** |

**Figure I. Market value of stocks for median portfolio and number of accounts for median bank.**

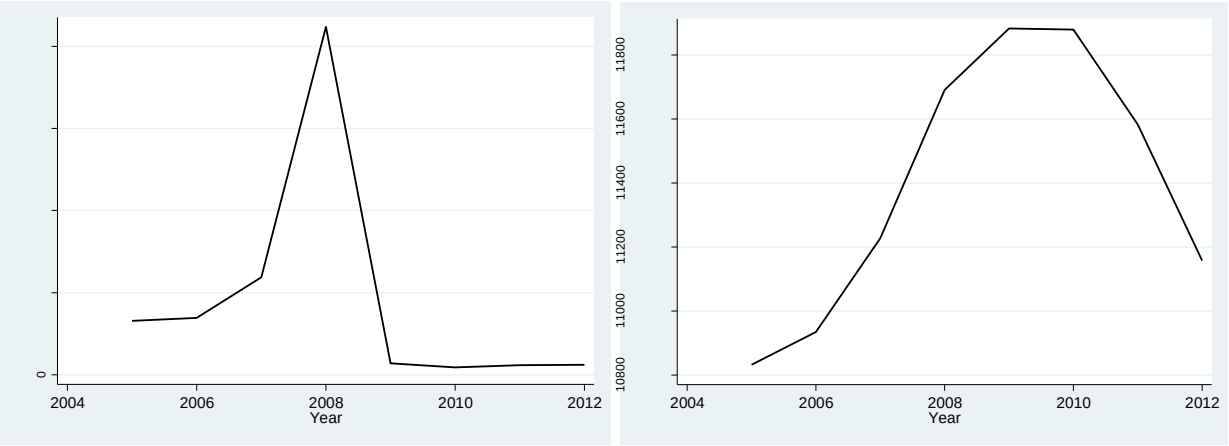
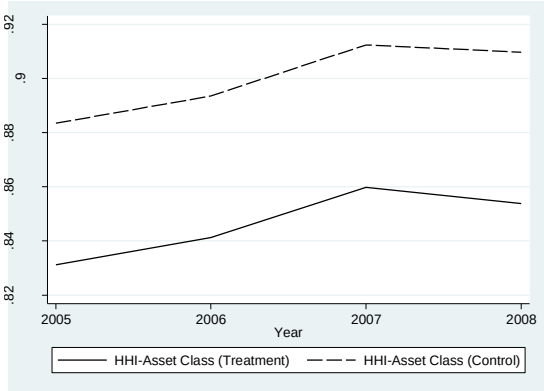
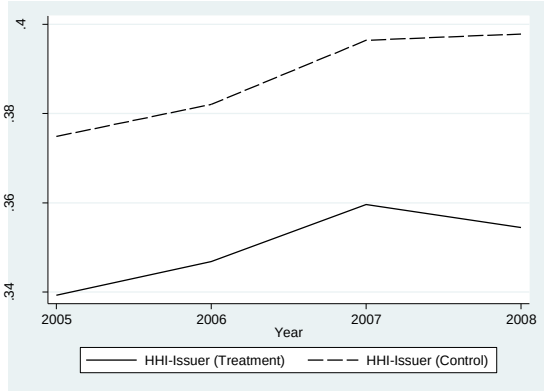


**Figure II. Parallel trend assumption tests for the DiD on the Eurozone crisis: Pre-treatment period.**
Each graph shows the time trend (from 2005 to 2008) of the dependent variable for the treatment group (solid line) and control group (dashed line).

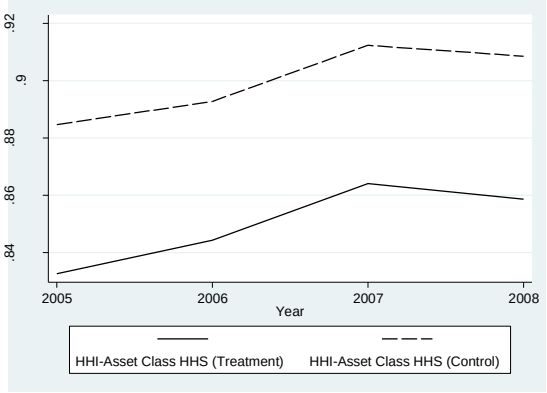
a) HHI-Asset Class



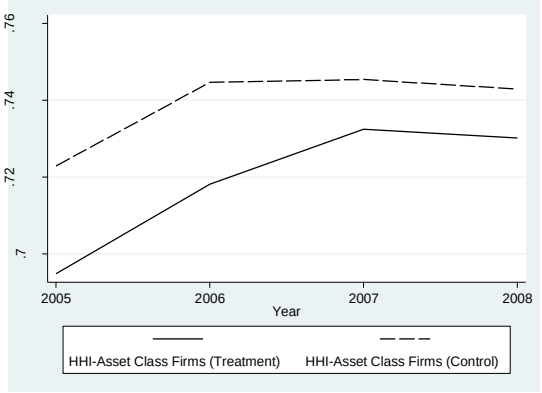

b) HHI-Issuer



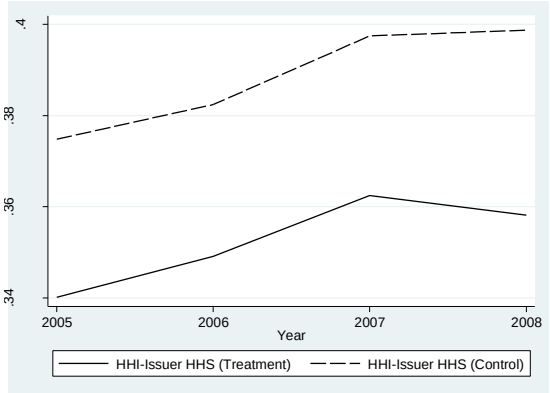

c) HHI-Asset Class (Households)



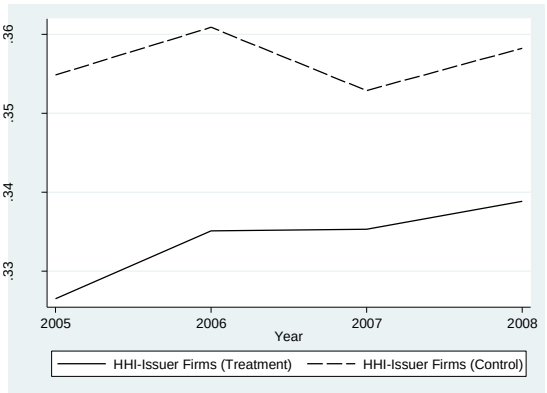

d) HHI-Asset Class (Firms)




e) HHI-Issuer (Households)




f) HHI-Issuer (Firms)



# APPENDIX

**Table A.1. Instrumental-Variable estimation of effects of a decrease in lending. Results using *Yield Curve Spread* instead of year fixed effects.**
We run model (2) using Within-Group regressions with heteroskedasticity-robust standard errors clustered at the bank level (at both the first and the second stage). Observations for which the change in the total nominal value of the portfolio from *t*–1 to *t* is negative and there is a capital injection in year *t*–1 are excluded. *Customer Loans Drop* is instrumented by *Capital Injection*, *HHI-Loan-15*, *Hidden Liabilities Dummy*, and *Liquidity Ratio*. For the two-sample t-tests a positive statistic implies that the average value of that variable is larger for *Customer Loans Drop* equal to one than it is for *Customer Loans Drop* equal to zero. T-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

| | Panel A: HHI-Asset Class | | | Panel B: HHI-Issuer | | |
|---|---|---|---|---|---|---|
| *Second-stage regression* | (1) | (2) | (3) | (1) | (2) | (3) |
| ***Customer Loans Drop*** | **-0.073*** ** | **-0.062*** ** | **-0.133*** ** | **-0.035*** ** | **-0.018** | **-0.061** ** |
| | **(-3.061)** | **(-2.685)** | **(-2.735)** | **(-2.661)** | **(-1.494)** | **(-1.990)** |
| *County Real Income Growth* | -0.002*** | -0.002*** | 0.000 | -0.002*** | -0.002*** | -0.000 |
| | (-6.701) | (-7.806) | (0.380) | (-9.943) | (-12.132) | (-0.068) |
| *Fee Income Share* | -0.001 | -0.001 | 0.000 | -0.001* | -0.001** | 0.000 |
| | (-1.199) | (-1.166) | (0.146) | (-1.651) | (-2.272) | (0.440) |
| *Yield Curve Spread* | -0.051*** | -0.049*** | -0.038*** | -0.024*** | -0.021*** | -0.019*** |
| | (-12.632) | (-12.520) | (-4.502) | (-11.061) | (-10.465) | (-3.666) |
| **Year FE** | NO | NO | NO | NO | NO | NO |
| **Bank FE** | YES | YES | YES | YES | YES | YES |
| **Observations** | 12,141 | 12,141 | 12,141 | 12,141 | 12,141 | 12,141 |
| **Number of banks** | 2,019 | 2,019 | 2,019 | 2,019 | 2,019 | 2,019 |
| **Endogeneity test for *CLDP*** | 7.990*** | 5.793** | 6.708*** | 6.041** | 1.056 | 3.251* |
| **Hansen J** | 5.183 | 3.513 | 0.793 | 1.068 | 2.571 | 2.286 |
| **Hansen J, P-value** | 0.159 | 0.319 | 0.851 | 0.785 | 0.463 | 0.515 |
| **Hansen J-test, DF** | 3 | 3 | 3 | 3 | 3 | 3 |
| **Kleibergen-Paap** | 19.60 | 19.60 | 19.60 | 19.60 | 19.60 | 19.60 |

**Table A.2. Instrumental-Variable estimation of effects of a decrease in lending. Results Impact of a drop in loans to households (*Retail Loans Drop*) and firms (*Corporate Loans Drop*).**

We run model (2) using Within-Group regressions with heteroskedasticity-robust standard errors clustered at the bank level (at both the first and the second stage). Observations for which the change in the total nominal value of the portfolio from *t*–1 to *t* is negative and there is a capital injection in year *t*–1 are excluded. *Retail Loans Drop* and *Corporate Loans Drop* are instrumented by *Capital Injection*, *HHI-Loan-15*, *Hidden Liabilities Dummy*, and *Liquidity Ratio*. T-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

| | Panel A: HHI-Asset Class | | | Panel B: HHI-Issuer | | |
|---|---|---|---|---|---|---|
| *SUBPANEL: Retail Loans* | Full sample | Households | Firms | Full sample | Households | Firms |
| ***Retail Loans Drop*** | **-0.112** | **-0.105** | **-0.186** | **-0.112** | **-0.088** | **-0.146** |
| | **(-0.868)** | **(-0.828)** | **(-0.992)** | **(-1.412)** | **(-1.189)** | **(-1.120)** |
| *County Real Income Growth* | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 |
| | (0.426) | (0.368) | (1.094) | (0.150) | (0.011) | (1.280) |
| *Fee Income Share* | 0.001 | 0.001 | 0.001 | 0.000 | -0.000 | 0.001* |
| | (1.593) | (1.540) | (1.593) | (0.043) | (-0.653) | (1.687) |
| **Year FE** | YES | YES | YES | YES | YES | YES |
| **Bank FE** | YES | YES | YES | YES | YES | YES |
| **Observations** | 10,120 | 10,120 | 10,120 | 10,120 | 10,120 | 10,120 |
| **Number of banks** | 1,916 | 1,916 | 1,916 | 1,916 | 1,916 | 1,916 |
| **Endogeneity test (*RLD*)** | 0.043 | 0.015 | 0.495 | 1.856 | 1.255 | 1.767 |
| **Hansen J** | 5.743 | 4.546 | 4.264 | 2.563 | 1.924 | 1.111 |
| **Hansen J, P-value** | 0.125 | 0.208 | 0.234 | 0.464 | 0.588 | 0.775 |
| **Hansen J-test, DF** | 3 | 3 | 3 | 3 | 3 | 3 |
| **Kleibergen-Paap** | 1.222 | 1.222 | 1.222 | 1.222 | 1.222 | 1.222 |
| *SUBPANEL: Corp.te Loans* | Full sample | Households | Firms | Full sample | Households | Firms |
| ***Corporate Loans Drop*** | **-0.072**** | **-0.074**** | **-0.131**** | **-0.046***** | **-0.036**** | **-0.061*** |
| | **(-2.506)** | **(-2.485)** | **(-2.438)** | **(-3.069)** | **(-2.363)** | **(-1.815)** |
| *County Real Income Growth* | -0.000 | -0.000 | 0.000 | -0.000** | -0.000*** | 0.000 |
| | (-0.397) | (-0.500) | (0.581) | (-2.516) | (-2.664) | (0.702) |
| *Fee Income Share* | 0.000 | 0.000 | 0.000 | 0.000 | -0.000 | 0.000 |
| | (0.723) | (0.430) | (0.334) | (0.021) | (-0.845) | (0.576) |
| **Year FE** | YES | YES | YES | YES | YES | YES |
| **Bank FE** | YES | YES | YES | YES | YES | YES |
| **Observations** | 12,057 | 12,057 | 12,057 | 12,057 | 12,057 | 12,057 |
| **Number of banks** | 2,012 | 2,012 | 2,012 | 2,012 | 2,012 | 2,012 |
| **Endogeneity test (*CLD*)** | 8.552*** | 7.910*** | 4.814** | 8.840*** | 3.666* | 3.132* |
| **Hansen J** | 4.174 | 1.462 | 2.840 | 2.528 | 3.756 | 2.653 |
| **Hansen J, P-value** | 0.243 | 0.691 | 0.417 | 0.470 | 0.289 | 0.448 |
| **Hansen J-test, DF** | 3 | 3 | 3 | 3 | 3 | 3 |
| **Kleibergen-Paap** | 22.84 | 22.84 | 22.84 | 22.84 | 22.84 | 22.84 |

**Table A.3. Effect of Eurozone crisis on number of security accounts.**
We run model (1) with standard errors clustered at the bank level. *Crisis* is a dummy variable that takes on the value one for the 2009-2012 period, and zero otherwise. The dependent variable is winsorised at the 1st and 99th percentile. *Treatment* is a dummy variable equal to one if in 2009 the share of PIIGS is larger than the sample median, and zero otherwise. Being time-invariant, *Treatment* is unidentified in the regressions. The effect of the European sovereign debt crisis is assessed by examining the impact of *Interaction = Crisis × Treatment*. *Fee Income Share* measures the share of fee-generating activities as fee income to total bank's income. *Savings Ratio* is calculated as total savings divided by total assets. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

| | Dependent variable: % Change in accounts | |
|---|---|---|
| *Crisis* | -0.041*** | -0.057*** |
| | (-16.135) | (-22.221) |
| ***Interaction*** | **0.022*** ** | **0.023*** ** |
| | **(7.102)** | **(7.492)** |
| *Fee Income Share* | 0.001 | 0.001** |
| | (1.435) | (2.121) |
| *County Real Income Growth* | -0.000* | 0.000 |
| | (-1.773) | (0.843) |
| *Savings Ratio* | | -0.001*** |
| | | (-3.926) |
| Constant | -0.039*** | 0.035** |
| | (-3.813) | (2.020) |
| **Year FE** | YES | YES |
| **Bank FE** | YES | YES |
| **Observations** | 11,534 | 11,254 |

**Table A.4. Effect of Eurozone crisis: Alternative definition for *Treatment*.**

We run model (1) with standard errors clustered at the bank level. *Crisis* is a dummy variable that takes on the value one for the 2009-2012 period, and zero otherwise. *Treatment* is a dummy variable equal to one if in 2009 the share of PIIGS is larger than the 75th percentile, and zero if it is smaller than the 25th percentile (the remaining observations are discarded). Being time-invariant, *Treatment* is unidentified in the regressions. The effect of the European sovereign debt crisis is assessed by examining the impact of *Interaction = Crisis* × *Treatment*. *Fee Income Share* measures the share of fee-generating activities as fee income to total bank's income. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

| | Panel A: HHI-Asset Class | | | Panel B: HHI-Issuer | | |
|---|---|---|---|---|---|---|
| | Full sample | Households | Firms | Full sample | Households | Firms |
| *Crisis* | -0.031*** | -0.028*** | -0.011 | -0.004 | -0.002 | -0.004 |
| | (-7.924) | (-7.257) | (-0.675) | (-1.526) | (-0.618) | (-0.448) |
| ***Interaction*** | **-0.027*** ** | **-0.026*** ** | **0.026** | **-0.026*** ** | **-0.025*** ** | **0.012** |
| | **(-5.292)** | **(-5.181)** | **(1.479)** | **(-7.651)** | **(-7.044)** | **(1.107)** |
| *Fee Income Share* | 0.002*** | 0.001** | 0.002 | 0.000 | 0.000 | 0.001 |
| | (3.738) | (2.247) | (1.427) | (1.365) | (0.078) | (1.224) |
| *County Real Income Growth* | 0.000 | 0.000 | 0.000 | -0.000 | -0.000 | -0.000 |
| | (0.829) | (0.524) | (0.239) | (-1.471) | (-1.329) | (-0.085) |
| **Constant** | 0.838*** | 0.845*** | 0.665*** | 0.348*** | 0.354*** | 0.315*** |
| | (126.779) | (104.160) | (35.215) | (63.279) | (56.635) | (26.596) |
| **Year FE** | YES | YES | YES | YES | YES | YES |
| **Observations** | 6,347 | 6,347 | 6,347 | 6,347 | 6,347 | 6,347 |
| **R-squared** | 0.327 | 0.321 | 0.009 | 0.195 | 0.169 | 0.003 |
| **Banks FE** | YES | YES | YES | YES | YES | YES |

**Table A.5. Effects of the Eurozone crisis: Propensity score matching.**
We employ nearest-neighbor matching technique with replacement based on one match. The covariates employed for the matching are the same for all regressions, regardless of the dependent variable: *Regional District*, *Private*, *Difference in Votes*, *Corporate Loans Share*, and *NPL Ratio*. The pseudo R-squared refers to the probit regressions for estimation of the propensity score. Treatment observations for which the propensity score is higher than the maximum (less than the minimum) of the propensity score of the controls are dropped. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

| | Panel A: HHI-Asset Class | | | Panel B: HHI-Issuer | | |
|---|---|---|---|---|---|---|
| *SUBPANEL: Main regression* | Full sample | Households | Firms | Full sample | Households | Firms |
| *Crisis* | -0.041*** | -0.038*** | -0.022 | -0.012*** | -0.010*** | -0.024*** |
| | (-11.278) | (-10.936) | (-1.564) | (-5.517) | (-4.600) | (-2.648) |
| ***Interaction*** | **-0.008**** | **-0.010***** | **0.023** | **-0.012***** | **-0.013***** | **0.014** |
| | **(-2.062)** | **(-2.727)** | **(1.611)** | **(-4.959)** | **(-5.126)** | **(1.481)** |
| *Fee Income Share* | 0.002*** | 0.002*** | 0.003** | 0.001*** | 0.001* | 0.002* |
| | (3.443) | (2.609) | (2.000) | (3.225) | (1.839) | (1.686) |
| *County Real Income Growth* | -0.000 | -0.000 | 0.000 | -0.000*** | -0.000*** | 0.001 |
| | (-0.222) | (-0.544) | (0.627) | (-3.272) | (-3.098) | (1.399) |
| **Constant** | 0.827*** | 0.835*** | 0.680*** | 0.339*** | 0.346*** | 0.319*** |
| | (111.580) | (98.925) | (35.156) | (75.527) | (65.414) | (21.545) |
| **Year FE** | YES | YES | YES | YES | YES | YES |
| **Observations** | 8,400 | 8,400 | 8,400 | 8,400 | 8,400 | 8,400 |
| **R-squared** | 0.334 | 0.354 | 0.006 | 0.245 | 0.230 | 0.004 |
| **Bank FE** | YES | YES | YES | YES | YES | YES |
| *SUBPANEL: Probit regression* | | | | | | |
| ***Regional District*** | -0.006*** | -0.006*** | -0.006*** | -0.006*** | -0.006*** | -0.006*** |
| | (-14.454) | (-14.454) | (-14.454) | (-14.454) | (-14.454) | (-14.454) |
| ***Private*** | 0.087* | 0.087* | 0.087* | 0.087* | 0.087* | 0.087* |
| | (2,024) | (2,024) | (2,024) | (2,024) | (2,024) | (2,024) |
| ***Difference in Votes*** | -0.011*** | -0.011*** | -0.011*** | -0.011*** | -0.011*** | -0.011*** |
| | (-5,866) | (-5,866) | (-5,866) | (-5,866) | (-5,866) | (-5,866) |
| ***Corp. Loans Share*** | -0.002** | -0.002** | -0.002** | -0.002** | -0.002** | -0.002** |
| | (-2,436) | (-2,436) | (-2,436) | (-2,436) | (-2,436) | (-2,436) |
| ***NPL Ratio*** | -0.013*** | -0.013*** | -0.013*** | -0.013*** | -0.013*** | -0.013*** |
| | (-4,586) | (-4,586) | (-4,586) | (-4,586) | (-4,586) | (-4,586) |
| *Pseudo R2* | | | | | | |
| Before matching | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 |
| After matching | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |

**Table A.6. Effect of Eurozone crisis, dynamic model estimation.**

We run model dynamic panel data models with two lags for the dependent variable and with standard errors clustered at the bank level. We employ the two-step estimator with Windmeijer's correction for standard errors. *Crisis* is a dummy variable that takes on the value one for the 2009-2012 period, and zero otherwise. *Treatment* is a dummy variable equal to one if in 2009 the share of PIIGS is larger than the sample median, and zero otherwise. Being time-invariant, *Treatment* is unidentified in the regressions. The effect of the European sovereign debt crisis is assessed by examining the impact of *Interaction = Crisis* × *Treatment*. *Fee Income Share* measures the share of fee-generating activities as fee income to total bank's income. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

| | Panel A: HHI-Asset Class | | | Panel B: HHI-Issuer | | |
|---|---|---|---|---|---|---|
| | Full sample | Households | Firms | Full sample | Households | Firms |
| *Crisis* | -0.024*** | -0.027* | -0.009 | -0.006*** | -0.006*** | -0.010 |
| | (-9.737) | (-1.835) | (-0.922) | (-4.633) | (-4.388) | (-1.238) |
| ***Interaction*** | **-0.010*** ** | **-0.009*** ** | **0.003** | **-0.003*** | **-0.004** ** | **0.007** |
| | **(-3.769)** | **(-3.702)** | **(0.235)** | **(-1.849)** | **(-2.186)** | **(0.748)** |
| *Fee Income Share* | 0.000 | 0.001* | 0.001 | 0.000 | 0.001 | 0.001 |
| | (0.562) | (1.646) | (1.196) | (0.191) | (1.367) | (1.119) |
| *County Real Income Growth* | 0.000** | 0.000 | 0.000 | -0.000 | -0.000 | 0.000 |
| | (2.525) | (1.185) | (0.008) | (-0.250) | (-0.628) | (0.380) |
| **Year FE** | YES | YES | YES | YES | YES | YES |
| **Observations** | 7,660 | 7,660 | 7,660 | 7,660 | 7,660 | 7,660 |

**Table A.7. Effect of drop in customer loans on number of security accounts.**
We run model (2) on the using Within-Group regressions with heteroskedasticity-robust standard errors clustered at the bank level (at both the first and the second stage). The dependent variable is winsorised at the 1st and 99th percentile. Observations for which the change in the total nominal value of the portfolio from *t*–1 to *t* is negative and there is a capital injection in year *t*–1 are excluded. *Customer Loans Drop* is instrumented by *Capital Injection*, *HHI-Loan-15*, *Hidden Liabilities Dummy*, and *Liquidity Ratio*. T-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

| | Dependent variable: % Change in accounts | |
|---|---|---|
| ***Customer Loans Drop*** | **0.002** | **-0.008** |
| | **(0.117)** | **(-0.517)** |
| *Fee Income Share* | 0.001* | 0.002** |
| | (1.876) | (2.490) |
| *County Real Income Growth* | 0.000 | 0.000 |
| | (0.577) | (0.838) |
| *Savings Ratio* | | -0.001*** |
| | | (-4.730) |
| **Year FE** | YES | YES |
| **Bank FE** | YES | YES |
| **Observations** | 9,679 | 9,451 |
| **Hansen J** | 4.125 | 2.356 |
| **Hansen J, P-value** | 0.248 | 0.502 |
| **Hansen J-test, DF** | 3 | 3 |
| **Kleibergen-Paap** | 12.05 | 24.63 |

**Figure A.1. Parallel trend assumption tests for the DiD on the Eurozone crisis: Pre-treatment period trend.**

% Change in the number of security accounts.