The Run for Safety:

Financial Fragility and Deposit Insurance

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Abstract

We examine the liquidity shocks to banks that can arise during a crisis due to concerns about safety by uninsured depositors. The analysis exploits exogenous changes in the deposit insurance threshold and a unique dataset with detailed information on balances and depositor characteristics for every bank account in Denmark. Our key result is that lowering the deposit insurance threshold during a crisis causes deposit mass in the ranges that become uninsured to decrease by almost 50% in non-systemic banks whereas the decrease is much smaller in systemic banks. While the money stays within the banking system in the aggregate, the reallocation imposes significant funding shocks for banks and affects their lending. We also find heterogeneity in bank liquidity risk arising due to differences in depositor characteristics.

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1. Introduction

An important concern in most crises is that sudden fear about safety by individuals with uninsured deposits can lead to runs on banks and destabilize the financial system. Governments often respond to this risk by raising deposit insurance limits and the 2007-2008 financial crisis was no exception: countries around the globe, including the United States and every country in the European Union, extended deposit insurance coverage (IMF, 2013).[1] However, given that deposit insurance comes at the cost of moral hazard and distorted incentives for risk-taking, there is substantial debate as to whether extending coverage is the right policy response.[2] To assess the necessity of extending coverage during a crisis, we need a better understanding of the counterfactual: "what if the deposit insurance limit was not raised?"

In this paper, we study the run on uninsured deposits in a crisis and quantify the liquidity risk it poses to banks. Our laboratory is Denmark, which is similar to the U.S. in terms of the design of its deposit insurance scheme and its macro-economic trajectory through the crisis.[3] We use a unique dataset with annual balances for every bank account in Danish banks held by individuals during the period 2003-2011 as well as detailed information on the balance sheets and demographic characteristics of individual account holders. We can thus observe withdrawals by each depositor and also examine whether the funds are reallocated within the banking system.

Our analysis exploits a salient change to the Danish deposit insurance scheme for identification. While insurance was made unlimited shortly after the failure of Lehman Brothers in September 2008, a limit of DKK 750,000 (around USD 125,000) was introduced in October 2010. The threshold was decided by the European Union and uniform across all member states, hence it was exogenous to the Danish banking system and left a substantial portion of deposits in Danish banks uninsured. Importantly, the deposit insurance limit was reduced when the Danish financial system was weakened by the sovereign debt crisis in Europe[4] and suffered a spate of bank failures.[5] As a policy reform that

[1] This view also comes forth in the statement of FDIC Chairman Sheila Bair before the Congress. While asking for a temporary increase in deposit insurance coverage from $100000 to $250000, she told Congress that raising limits would help address "an increasing crisis of confidence that is feeding unnecessary fear in the marketplace"

[2] See Thomas Sargent's discussion for a critical perspective on the widespread decision to extend deposit insurance coverage during the crisis (See Arthur Roinick: "Interview with Thomas Sargent" Federal Reserve Bank of Minneapolis, The Region, September, 2010, 31). See also Allen et al (2014) for theoretical a framework that helps to analyze the costs and benefits associated with government guarantees.

[3] Note that similar to the U.S, there was a large shock to house prices in Denmark and household leverage was very high.

[4] The CDS spread on the sovereign bonds was higher at the end of 2011 than at the peak of the 2007-2008 financial crisis. The Danish economy experienced an 8 percent drop in seasonally adjusted real GDP between Q4 2007 and Q2 2009.

[5] There were 11 failures of Danish banks in 2010 and another 10 in 2011 (Rangvid et al., 2013).

suddenly exposed depositors to risk in the midst of a banking crisis, it provides a unique opportunity to study the risk posed to the system by depositor concerns about safety.

In our main analysis, we study how bank deposits in a window around DKK 750,000 evolved after the financial crisis. If depositors did not respond to the deposit insurance reform, we should expect deposit mass above and below the threshold to evolve similarly throughout the sample period. By contrast, if depositors concerned about safety withdrew uninsured deposits to limit their exposure to the risk of bank failures, we should observe a sharp drop in deposit mass above the threshold relative to deposit mass below the threshold.

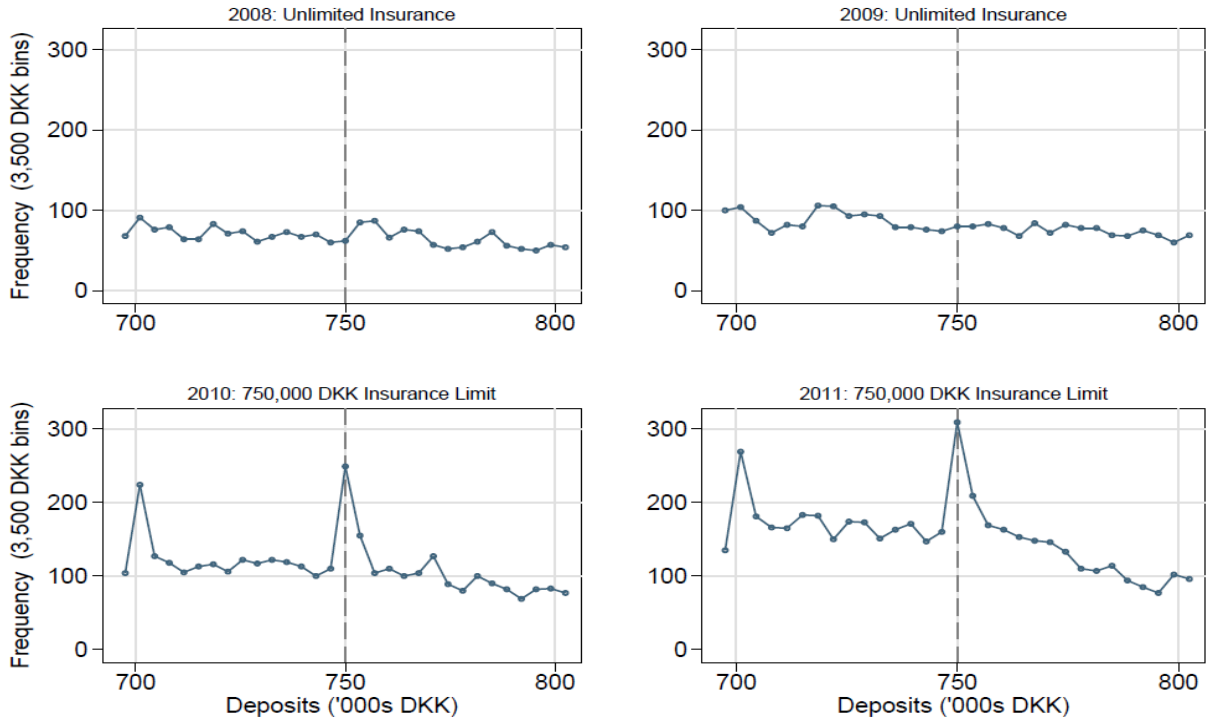

FIGURE 1 – BUNCHING IN THE DEPOSIT DISTRIBUTION AROUND 750,000 DKK

Notes: Figure 1 plots the empirical distribution of deposits for a 100,000 DKK range around 750,000 DKK for the years 2008 – 2011. The empirical distribution is presented as frequency plots, where the sample of deposit accounts is divided into 3,500 DKK bins and counts are recorded for each bin in a 50,000 DKK range above and below 750,000 DKK. Thus, each point on the frequency plot is the count of the number of deposit account with balances 1,250 DKK either side of that deposit balance.

Figure 1 illustrates our main finding in a series of histograms of raw account balances in a narrow window around 750,000 DKK. While the distribution is smooth in 2008 and 2009, considerable

excess mass emerges at 750,000 DKK exactly when this becomes the deposit insurance limit in 2010. The sudden bunching at the threshold is strongly suggestive that some depositors drew down account balances to the insurance limit to reduce exposure to bank failures.

While the histograms provide compelling graphical evidence of depositors withdrawing deposits above the insurance threshold, we also apply a regression framework, which allows us to extend the analysis beyond the narrow window of deposits where bunching is discernable by visual inspection. Thus, we study broader deposit ranges to provide more credible estimates of the overall impact on banks.

Our main regression results imply that deposit mass in the range DKK 750,000 - DKK 1,000,000 decreased by 30% relative to deposit mass in the range DKK 500,000 - DKK 750,000 when comparing the pre-reform years 2008-2009 to the post-reform years 2010-2011. We show that deposit mass above and below the threshold evolved very similarly in earlier years, which makes it plausible that the divergence in 2010 was caused by the reform. We explore the heterogeneity of this result across banks with different characteristics as well as over time and find two striking results. First, the relative decline in deposit mass above the insurance threshold was much less pronounced in systemically important banks. Second, the loss of uninsured deposits was substantially exacerbated between 2010 and 2011. Specifically, in systemic banks, deposit mass above the insurance limit had fallen by 8% in 2010 and 20% in 2011 relative to deposit mass below the insurance limit whereas, in non-systemic banks, the corresponding fall was 25% in 2010 and 50% in 2011.[6]

Both dimensions of heterogeneity point to implicit guarantees as an important driver of depositor behavior. First, the relatively modest deposit losses by systemic banks is clearly consistent with depositor beliefs that these banks were more likely to be bailed out in case of failure than non-systemic banks. While other explanations are possible, for instance that superior risk management techniques made large banks less likely to fail in the eyes of depositors, they seem unlikely given that further tests show a similar difference between systemic and non-systemic banks within a small sample of large banks. Second, part of the sharp increase in deposit losses between 2010 and 2011 can plausibly be ascribed to a shock to beliefs about implicit guarantees caused by the sudden failure of a major bank in February 2011 where uninsured depositors suffered a haircut of around 40%.[7]

[6] The same patterns emerge in the bunching analysis: bunching is generally much more pronounced in non-systematic banks than in systemic banks and grows substantially between 2010 and 2011.

[7] Immediately prior to its failure, Amagerbanken was ranked 11 among Danish banks in terms of assets

Depositors had never before lost money in bank failures, hence beliefs that all deposits benefitted from implicit guarantees were most likely widespread.

While the results show that the concerns about safety caused large withdrawals of deposits above DKK 750,000, the question still remains whether this had a significant impact on bank liquidity. To the extent that depositors simply moved funds between banks to keep account balances below the insurance limit, we should expect total deposits in the banking system to remain constant and the liquidity of the average bank to be unaffected. The regressions discussed above do indeed suggest that outflows of deposits above the insurance threshold were accompanied by significant inflows below. However, the liquidity shock may have been highly heterogeneous with banks having a large share of deposits above the insurance threshold being more adversely affected.

To test this formally, we regress banks' overall deposit growth over the period 2007-2011 on the share of deposits above DKK 750,000 in 2007 while controlling for other bank characteristics and find evidence of a sizable differential liquidity shock. Specifically, increasing the initial share of deposits above the insurance threshold from the 25th to the 75th percentile reduces the subsequent growth in total deposits by around 20 percentage points. Further, we investigate whether the differential liquidity shock to banks had significant real effects in the form of reduced lending. We regress lending growth over the period 2007-2011 on deposit growth over the same period while instrumenting the latter with the share of deposits above DKK 750,000 in 2007. The results imply that a 1% decrease in deposits induced by reallocations of deposits reduced lending by 0.35%.

To further understand the factors underlying the search for safety, we investigate whether individuals differ systematically in their propensity to reallocate deposits. Firstly, we find that when individuals reallocate deposits, most do not just withdraw the balance up to the deposit insurance threshold, but move significantly larger amounts. We also find that depositors who are more sophisticated which we proxy by their education levels are more likely to reallocate deposits. Depositors with more volatile income, depositors with higher past unemployment rates and self-employed depositors are also more likely to move uninsured deposits to other banks, which suggests that income risk makes individuals more inclined to be concerned about the safety of their savings. On the other hand, depositors with loan linkages and depositors in systemically important banks are less likely to reallocate deposits, which suggests that strong bank relationships and depositor beliefs about implicit guarantees attenuate concerns about safety.

Our key estimate that up to 50% of uninsured deposits were withdrawn from non-systemic banks implies that a relatively high insurance limit is required to ensure the stability of the financial system during a crisis. In other words, entering the crisis, if the fraction of uninsured deposits in the banking system is high, many banks are most likely unable to withstand the resulting liquidity shocks in the absence of further explicit or implicit government guarantees. The estimated magnitudes also raise questions as to whether the current liquidity requirements put in place under Basel III would suffice to protect the stability of the system the next time around.

The paper contributes to the literature highlighting the importance of deposit insurance in mitigating financial fragility (Diamond and Dybvig, 1983; Demirgüç-Kunt and Detragiache, 2002; Demirgüç-Kunt et al, 2008; Egan et al. 2015). While the stability provided by deposit insurance is widely accepted, it has proven difficult to estimate the magnitude of liquidity risk associated with depositor concerns about safety during a systemic crisis. Our paper helps to fill this void while also showing how deposit insurance allows the banking system to accommodate the demand for safe assets by individuals during a crisis (Gatev and Strahan, 2006; Gorton et al, 2012).

Moreover, our results contribute to the empirical literature that examines responses of individual depositors to shocks (Kelly and O'Grada, 2008; Iyer and Puri, 2012; Iyer et al., 2015). A unique feature of our analysis is that we study responses of individual depositors during a systemic crisis. Furthermore, to the best of our knowledge, we are the first to show that the heterogeneity in depositors' behavior can be partly explained by the characteristics of their balance sheet. The results highlight the need to incorporate heterogeneity in depositor balance sheets in addition to heterogeneity in signals about bank solvency in theoretical frameworks trying to model bank runs (Goldstein and Pauzner, 2005).[8] The results have implications for the design of regulatory policies, like liquidity coverage ratios, that aim to account for depositor characteristics when measuring banks' liquidity risk.

Our analysis also relates to the theoretical literature on bank runs that emphasizes the role of fundamentals in triggering depositor concerns about safety (Gorton, 1988; Chari and Jaganathan, 1988; Goldstein and Pauzner, 2005). We show that bunching of account balances at the pre-crisis insurance threshold of DKK 300,000 emerged suddenly in 2008, which suggests that depositors are less concerned about safety in normal times and that a financial crisis can act as a wake-up call. This is consistent with models highlighting the fragility associated with creation of private money by

[8] See Bryant (1980), Postlewaite and Vives (1987), and Rochet and Vives (2005) for models based on coordination problems. See Jacklin and Bhattacharya (1988), Chen (1999), Calomiris and Kahn (1991) and Diamond and Rajan (2001) for information-based models of runs.

intermediaries in the presence of shocks (Gorton and Pennachi, 1990; Dang et al, 2013) as well as models of neglected risk (Gennaioli et al, 2012, 2014).[9]

Finally, the paper speaks to current discussions about banks that are too-big-to-fail. A key question is whether implicit government guarantees can affect the competitive landscape by favoring large banks in the funding markets. The existing literature has examined the equity market reactions and the sensitiveness of bond yields to bank risk after the announcement of too-big-to-fail guarantees (Flannery and Sorescu, 1996; Flannery, 2010; Strahan, 2013). Our finding that reallocations are more significant for smaller banks is consistent with depositor perception of too-big-to-fail guarantees. These results suggest that beliefs about too-big-to-fail guarantees can have direct bearing on funding for small banks during a crisis.[10]

The rest of the paper proceeds as follows. Section 2 describes the institutional environment. Section 3 describes the data and presents summary statistics. Section 4 presents the empirical results. Section 5 concludes.

2. Background

2.1 The financial crisis in Denmark

In the years prior to the global financial crisis in 2007-2008, Danish banks expanded their lending substantially in response to strong domestic credit demand and a booming housing market. Credit growth far outpaced the growth in deposits and Danish banks therefore increasingly relied on financing from foreign financial institutions often in the form of short-term loans and bonds. Leverage ratios were thus soaring and liquidity ratios plummeting, but with abundant liquidity in international money markets, profitability was generally high and no Danish banks failed during this period (Rangvid et al., 2013).

While Danish banks had very limited direct exposure to the U.S. mortgage-backed securities that were the immediate cause of the financial crisis, they were adversely affected when the market for short-term financing froze (Shin, 2009). At the same time, the Danish housing market was deteriorating

[9] Deposits above the insurance threshold are akin to privately issued demandable debt backed by banks assets. See also Morrison and White, 2011; Gorton and Ordonez, 2014.

[10] During the current financial crisis, FDIC provided unlimited insurance to transaction accounts in banks (TAGP) due to concerns that transaction accounts might move from small banks to large banks because of implicit too-big-to-fail guarantees.

and several banks with large exposure to real estate developers failed; most prominently Bank Trelleborg in March 2008 and Roskilde Bank, the 11th largest bank in Denmark, in August 2008.

When Lehman Brothers failed in September 2008 and international credit markets froze, the funding situation of many Danish banks became critical and a law was swiftly adopted that temporarily extended an unlimited government guarantee to all bank liabilities. Banks wishing to benefit from the government guarantee were required to contribute to a fund designed to absorb part of the losses incurred under the guarantee and to pay an annual commission to the government. Only a handful of very minor banks chose not to participate in the program, which became effective on 10 October 2008 and was set to expire on 30 September 2010.

During the period 2008-2010, a total of 30 small and medium-sized Danish banks were seized by the government or absorbed by competing banks after failing to meet the capital requirements of the regulatory authority (Rangvid et al., 2013).

2.2 Deposit Guarantees

In Denmark, the Danish Guarantee Fund provides deposit insurance since 1987. Funded by mandatory contributions from all licensed banks in proportion to their deposits, the guarantee covers deposits up to a threshold whether held by individuals or firms. For the purposes of the guarantee, deposits are computed separately in each bank, which allows depositors to increase effective insurance coverage by holding accounts in several banks.

Prior to the financial crisis, bank deposits up to DKK 300.000 were covered by the deposit insurance. While deposits above this threshold were not explicitly guaranteed, creditors had not suffered losses for decades when Danish banks were in distress and were thus covered by some measure of implicit guarantees. Legally, it was not possible to impose losses on uninsured depositors without a highly disruptive bankruptcy, which was generally considered undesirable by the government as well as other financial institutions. Hence, other commercial banks or the central bank would typically assume both assets and liabilities of a distressed bank before it came to a bankruptcy and effectively bail out uninsured depositors. The notion that large deposits benefitted from an implicit guarantee was confirmed by the two bank failures in March and August 2008 where no depositors suffered losses.

In October 2008, at roughly the same time as the Danish government extended a temporary guarantee to all bank liabilities, the European Commission proposed to raise the minimum level of

protection of the ordinary deposit insurance schemes. A Danish law adopted in Spring 2009 implemented the new European rules by raising the threshold of the deposit insurance to EUR 100.000 (approximately DKK 750.000) as from 1 October 2010. However, it was not anticipated that when the new insurance threshold came

The explicit deposit guarantee was thus changed twice during and after the financial crisis: until 9 October 2008, deposits below DKK 300.000 were guaranteed; between 10 October 2008 and 30 September 2010, all deposits were guaranteed, either by the deposit insurance or by the government; and from 1 October 2010, deposits below DKK 750.000 were guaranteed. However, it must be noted that the sovereign debt crisis that hit Europe in 2010 was not anticipated. Thus, at the point when the threshold was reduced from unlimited coverage to DKK 750.000, the Danish economy was severely weakened by the sovereign debt crisis.

Two other events may have changed perceptions about the implicit guarantee enjoyed by depositors not covered by an explicit guarantee. As from 1 October 2010, a government agency known as Financial Stabilitet was vested with the power to seize a failed bank and write down the bank's liabilities to the value of its assets as assessed by a team of independent auditors. This bank resolution mechanism made it legally possible to shift part of the cost of bank failures to uninsured depositors without the costly disruptions associated with a bankruptcy. While it was *a priori* uncertain whether the provisions would be used in practice, it became clear that they would in February 2011 when Amagerbanken, the 11th largest bank in Denmark, failed and uninsured depositors suffered haircuts of more than 40% as the bank was resolved. This event immediately induced Moody's to downgrade the long-term credit ratings of major Danish banks reflecting a decrease in the agency's assumptions about systemic support from 'high' to 'low' (Moody's, 2011).[11]

3. Data

We obtain information about bank account balances from the records of the Danish tax authorities. At the end of each year, all financial institutions in Denmark report the balance of all accounts held by Danish residents to the Danish tax authorities. The reports are compulsory and reliable as they are used for tax enforcement. We consolidate the account-level information at the bank-individual level, which is the relevant level for deposit insurance purposes, by summing accounts held by the same individual in the same bank. For each individual, we thus observe the end-of-year

[11] The long-term rating of two systemic banks, Danske Bank and FIH Erhvervsbank, was downgraded together with three large but non-systemic banks. The long-term rating of three other systemic banks, Nordea, Sydbank and Jyske Bank, were placed on review for a possible downgrade.

consolidated account balance in each Danish bank for each of the years 2003-2011. To this dataset, we add comprehensive information about individuals from administrative registers (e.g. age, gender, income, unemployment, education, debt and holdings of securities) as well as balance sheet information about banks from the Danish Central Bank. For computational tractability, we limit the analysis to a 10% random sample of the full adult population.

Table 1 reports summary statistics for our key bank-level variables. The first columns concern the full sample of banks whereas the subsequent columns reports separate information for two subsamples: the 6 largest banks, which we will consider as systemically important banks in the later analysis, and all other banks. While it is generally not straightforward to delineate systemic and non-systemic banks, our cut-off is based on the following two arguments: First, there is a clear break in the bank size distribution after the 6th largest bank: the 4th, 5th and 6th largest banks are of a roughly similar size whereas the 7th largest bank is only around half that size.[12] Second, when the financial regulator explicitly named the systemically important financial institutions in 2014, the list comprised precisely 6 institutions. As shown in bottom of the table, our sample of individuals owned 655,000 deposit accounts in 2007, of which around 70% were held in systemic banks and the remaining around 30% were held in non-systemic banks. A total of 8,000 accounts had a balance above DKK 750,000 with a similar distribution across systemic and non-systemic banks. Thus, before the crisis slightly more than 1% of all accounts exceeded the insurance threshold to be introduced in 2010.

Despite the relatively small number of large accounts, they are nevertheless an important source of funding for banks. To measure the significance of these large deposits, we sum account balances exceeding DKK 750,000 across all accounts in a given bank and normalize it with the bank's total deposit base. To be precise about how the measure is constructed, an account with a balance of DKK 900,000 contributes DKK 150,000 to the numerator and DKK 900,000 to the denominator of this measure whereas an account with a balance of DKK 600,000 contributes only to the denominator. Table 1 shows that the average of this measure was around 18% for systemic banks and 11% for non-systemic banks in 2007. The simple average across all banks was only slightly above 12% (because systemic banks are few in numbers relative to non-systemic banks).

This measure serves two purposes in the analysis. First, by tracking how it evolved over time, we get a sense of the magnitude of the run on uninsured deposits around the introduction of the DKK

[12] According to the publicly available financial accounts, Nykredit Bank had total assets of DKK 135 billion (4th largest), Sydbank of 132 billion (5th largest) FIH Erhversbank of 113 billion (6th largest) and Bank DnB Nord of 69 billion (7th largest) at the end of 2007 (Finanstilsynet, 2007).

750,000 insurance limit in 2010 and the failure of Amagerbanken in 2011. As shown in Figure 4, there was sharp drop in account balances above DKK 750,000 in non-systemic banks between 2009 and 2011, but a small increase for systemic banks over the same period. At the end of 2011, the share of deposits over the threshold in systemic banks was not much below the level in 2007 whereas in non-systemic banks it had dropped by almost 50%. These patterns suggest that there was a quantitatively important run on uninsured deposits, notably in non-systematic banks, in the course of 2010 and 2011.

Second, we use the cross-sectional variation in reliance on deposits larger than DKK 750,000 in 2007 to identify the real effects of the changes in effective deposit guarantees in 2010-2011. We essentially test whether banks, which were relying more heavily on deposits that became uninsured, experienced a lower growth in total deposits over the period 2007-2011 and whether the lower growth in deposits lead to a lower growth in lending. Clearly, this identification strategy requires significant cross-sectional variation in reliance on deposits above the threshold so that banks were *differentially* exposed to the run on these deposits. To illustrate that the variation is substantial, we note that in the 5 banks least exposed to the run, deposits above the threshold accounted for less than 2% of total deposits in 2007 whereas in the 5 most exposed banks, it was more than 27%.

Finally, Table 1 reports summary statistics on the two outcome variables to be used in the bank-level regressions. The average growth in deposits was 37% in the full sample over the period 2007-2011 and virtually identical for systemic and non-systemic banks whereas the average growth in lending was 10% in the full sample and somewhat lower for systemic than for non-systemic banks. We also report summary statistics on two key financial ratios that serve as controls in the bank-level regression analysis: the ratio of equity to total assets, which averages 15% in the full sample and is considerably lower for systemic than for non-systemic banks, and the ratio of loans to total assets, which averages 63% in the full sample and somewhat lower for systemic than for non-systemic banks.

4. Results

The results are reported in the following four subsections. Section 4.1 provides more evidence on bunching of account balances at the deposit insurance threshold: it extends the bunching evidence presented in the introduction to the DKK 300,000 threshold that was effective until 2008 and reports separate results for systemic and non-systemic banks. Section 4.2 investigates the change in the wider distribution of account balances induced by the deposit insurance reforms and ultimately estimates the responsiveness of bank deposits to insurance coverage. Section 4.3 studies the real effects of the deposit insurance reforms: it quantifies the bank-level funding shock associated with deposit

reallocations as well as the resulting contraction in lending. Section 4.4 uses the comprehensive information from administrative registers to identify depositor characteristics associated with a higher propensity to reallocate deposits across accounts.

4.1 Bunching at the Deposit Insurance Threshold

Figure 1 presented in the introduction showed clear evidence of bunching of account balances at the DKK 750,000 deposit insurance threshold in 2010-2011. Figure 3 reports analogous evidence for the DKK 300,000 threshold that was effective until 2008 when the government introduced the unlimited guarantee. In 2006-2007, there are no signs of bunching at the DKK 300,000 threshold; in 2008 bunching appears in the full sample of banks and in 2009 the bunching largely disappears.

We interpret these patterns as evidence that the financial crisis acted as a wake-up call and triggered concerns about safety, which induced some depositors to draw down account balances to the insurance threshold. Most likely, the unlimited guarantee extended in October 2008 mitigated some of these concerns before the time we observe account balances in December 2008. The fact that bunching at DKK 300,000 had disappeared by December 2009 is not surprising given the existence of an unlimited guarantee since October 2008 and the announcement in April 2009 that the applicable threshold as from the expiration of the unlimited guarantee would be DKK 750,000.

Figure 4 provides evidence of bunching at the DKK 750,000 threshold for systemic and non-systemic banks separately. The difference is most clearly visible in 2010 where non-systemic banks record 3-4 times more accounts at the threshold than at deposit levels in the close vicinity whereas no such bunching is observed for systemic banks. Also systemic banks exhibit some signs of bunching in 2011, but the spike at the threshold is still much lower than in non-systemic banks when compared to the number of accounts in the vicinity of the threshold.[13]

The striking difference between systemic and non-systemic banks points implicit bailout guarantees as an important factor in explaining depositor behavior. Depositors that are not covered by deposit insurance or an explicit government guarantee presumably still perceive some probability of being bailed out in case of bank failure. The fact that depositors in systemic banks are less likely to draw account balances down to the insurance threshold than depositors in non-systemic banks suggests that the former perceive a higher probability of bailout than the latter. This could be because the largest banks are perceived as "too-big-to-fail" and almost certain to be bailed out in case of distress.

[13] Figure A1 in the Appendix shows that also the bunching at the DKK 300,000 threshold in 2008 is driven almost entirely by non-systemic banks.

4.2 Changes in the wider distribution of account balances

The emergence of bunching at the deposit insurance threshold coinciding with financial turmoil (the financial crisis in 2008) and with a reduced probability of bailout (the expiration of unlimited government guarantees in 2010) is highly suggestive of depositors drawing down account balances to limit their exposure to bank failures. It should be emphasized, however, that reallocations of deposits do not necessarily give rise to bunching. For instance, in the case of a depositor splitting a DKK 800,000 account into two DKK 400,000 accounts, no bunching is observed. In order to gauge the full magnitude of deposit reallocations, we need to consider changes in the wider distribution of account balances. To do this, we estimate the following baseline model:

$$\log(deposits)_{itk} = \alpha + \beta_1 Above_k + \beta_2 After_t + \beta_3 Above_k \times After_t + \gamma X_i + \varepsilon_{itk}$$

The dependent variable is deposits (in logs) in bank i at year t in range k. We consider ranges of DKK 50,000 between DKK 500,000 and DKK 999,999, hence the estimation includes 10 observations per bank-year. The variable is constructed such that an account of say DKK 625,000 contributes DKK 50,000 to each of the deposit ranges DKK 500,000 - DKK 549,999 and DKK 550,000 - DKK 599,999 and DKK 25,000 to the deposit range DKK 600,000 - DKK 649,999. The explanatory variables are: *Above* indicating that the range starts at DKK 750,000 or above and *After* indicating the years 2010 and 2011 as well as all the interaction between these two variables and a set of controls capturing bank characteristics in 2007. The model is estimated for the period 2007-2011 and the results are reported in Table 2.

The coefficient on *After* in Column (1) shows that deposits below DKK 750.000 increased by 37% between 2007-2009 and 2010-2011, which suggests that there was significant growth in deposits in the banking system in the ranges that remained insured after 2010.[14] The coefficient on *After* × *Above* shows that deposits above DKK 750.000 decreased by 31% relative to this trend. [15] The divergence is strongly significant and highly suggestive that the removal of the unlimited deposit insurance in 2010 caused a large decrease in deposits above DKK 750.000 either by inducing reallocation of existing large accounts across banks or by deterring the creation of new large accounts. The results are robust to bank fixed effects as shown in Column (2). We find a similar pattern when we use the same methodology to examine the changes in the distribution of account balances at the onset of the financial crisis in 2008. As shown in Columns (3)-(4), deposits below the insurance threshold of DKK

[14] Note that exp(0.316)-1=37%
[15] Note that exp(-0.373)-1=-31%

300,000 increased by 12% from 2007 to 2008 while deposits above decreased by 7% relative to this trend.[16]

To further investigate the role of depositor beliefs about implicit bailout guarantees, we exploit the timing of the failure of the 11th largest bank in Denmark where uninsured depositors were not bailed out. As described in the background section, Denmark has a long-standing practice of bailing out creditors of troubled banks. This practice was continued in the two bank failures just before the financial crisis and, within the framework of the explicit unlimited government guarantee, in the eight bank failures occurring between September 2008 and October 2010. When the 11th largest bank failed in February 2011, however, uninsured depositors suffered a significant haircut. Arguably, this event was a significant shock to beliefs about implicit bailout guarantees as evidenced by Moody's downgrade of the ratings of Danish banks immediately after the failure.

In Table 3, we thus examine the timing of the deposit reallocations by replacing *After* in the baseline model with separate dummies for 2010 and 2011. Column (1) shows a decrease in deposits above the threshold relative to deposits below the threshold of 23% in 2010 and 39% in 2011. Column (2) shows that the relative decrease from 2010 to 2011 is even larger when bank fixed effects are included.[17] These results suggest that implicit guarantees are as important in shaping depositor behavior as explicit guarantees: the reallocations of large deposits coinciding with the expiration of the explicit government guarantee in 2010 were substantial, but the reallocations occurring after the failure of the 11th largest bank in 2011, which plausibly lowered expectations about future bailouts, were of a similar magnitude.

We then turn to the difference between systemic and non-systemic banks by augmenting the baseline with the dummy *Systemic* as well as its interactions with the main variables of interest. In Column (3), the large and significant coefficients on *2010* and *2011* indicate that there was considerable growth in deposits below the insurance threshold in non-systemic banks from 2007-2009 to 2010-2011 whereas the small and insignificant coefficients on their interaction with *Systemic* suggest that systemic and non-systemic banks did not differ in this respect. The negative and significant coefficients on *Above x 2010* and *Above x 2011* show a large and growing decrease in deposits above the threshold relative to below in non-systemic banks: around 24% in 2010 and 40% in 2011. [18] However, the positive and significant coefficients on *Above x Systemic x 2010* and *Above x Systemic x 2011* show that the relative

[16] Note that exp(0.11)-1=12% and exp(-0.0687)-1=-7%
[17] Note that exp(-0.255)-1=-23% and exp(-0.493)-1=-39%
[18] Note that exp(-0.268)-1=-24% and exp(-0.514)-1=-40%

decrease in deposits above the threshold was much smaller in systemic banks: around 8% in 2010 and 20% in 2011.[19] In sum, the growth in deposit ranges that became uninsured in 2010 was generally lower than in deposit ranges that remained insured, but the difference was much less pronounced in systemic than in non-systemic banks. Column (4) shows that the results are robust to including bank fixed effects absorbing all time-invariant unobservable characteristics of banks. They are also robust to alternative choices of deposit ranges; in unreported estimations we used other ranges than the one used in the main specifications and found very similar results.

As discussed above, the striking difference between responses in systemic banks and non-systemic banks is plausibly driven by beliefs that the former banks are more likely to be bailed than the latter in the case of distress, however, there are other possible explanations. For instance, depositors may view large banks as better managed and thus less likely to encounter financial difficulties than small banks regardless of the implicit guarantees. This could be true if economies of scale allow larger banks to develop superior risk management practices that lower earnings volatility and exposure to losses. Although all the results reported above are robust to bank fixed effects, depositors could be valuing the risk management practices of large banks more during times of crisis.

To investigate whether the differential depositor responses in systemic and non-systemic banks are due to differences in implicit bailout guarantees or management practices, we re-estimate the model while limiting the sample to the largest 12 banks. The 6 systemic banks are considerably larger than the following 6 banks, however, the latter are almost certainly large enough to exhaust the economies of scale (Wheelock and Wilson, 2001) and it is therefore much less likely that there are qualitative differences in management practices within this smaller sample of large banks than within the full sample of banks. By contract, implicit bailout guarantees may very well exhibit important non-linearities with the very largest and systemic banks being much more likely to be bailed out than somewhat smaller and non-systemic banks.

Column (5) shows that the results are strikingly similar to the those for the full sample. On the one hand, deposits below the threshold increased at a rapid pace in both systemic and large non-systemic banks and the growth rates are statistically indistinguishable. On the other hand, deposits in ranges above the threshold decreased by 50% relative to deposits below the threshold in large non-systemic banks, which is significantly different from the 20% relative decrease in systemic banks.[20] These results are consistent with the notion that the relatively modest responses by uninsured

[19] Note that exp(-0.268+0.185)-1=-8% and exp(-0.514+0.287)-1=-20%
[20] Note that exp(-0.693)-1=-50% and exp(-0.693+0.466)=-20%

depositors in systemic banks owe themselves to implicit bailout guarantees, but are difficult to reconcile with the alternative explanation highlighting better management practices and lower risk of distress.

One potential concern with the results presented in Tables 2 and 3 is that the differences in deposit growth rates for ranges above and below the threshold and for systemic and non-systemic banks could conceivably reflect differences in the underlying trends rather than the effect of events in 2010 and 2011. To address this concern, we estimate the previous models with a full set of year dummies, which allows us to inspect trends for the entire time period.

Figure 5a plots point estimates and confidence intervals for *Above* × *Year* in a specification that is analogous to Column (1) in Table 3. The results imply that, as an average across all banks, deposits above and below DKK 750,000 followed roughly the same trend over the period 2006-2009, but diverged sharply in 2010 with deposits above the threshold decreasing rapidly relative to deposits below the threshold. Likewise, Figure 5b shows point estimates and confidence intervals for *Above* × *Year* × *Non-Systemic* in a specification that is analogous to Column (3) in Table 3: the relative trend in deposits above and below DKK 750,000 was roughly similar for systemic and non-systemic banks over the period 2006-2009, but diverged sharply in 2010 with deposits above the threshold decreasing much more rapidly relative to deposits below the threshold in non-systemic than in systemic banks. These patterns reassure us that the estimates presented in Table 3 do not reflect differential underlying trends across deposit ranges and bank type.

While the results above provide strong evidence that depositors responded to the reduction of insurance coverage in 2010, it is not clear whether the estimated coefficients on *Above* × *After* capture the true magnitude of reallocated deposits above DKK 750,000. Suppose an individual holds an account with a balance of DKK 1,500,000 in 2009 and moves DKK 550,000 to a new account in another bank in 2010 to reduce exposure to bank failures, thus leaving DKK 950,000 on the existing account. The transaction reduces deposit mass in the range DKK 750,000 - DKK 999,999 by DKK 50,000 or 20%, but increases deposit mass in the range DKK 500,000 - DKK 749,999 by the same amount. In this example, the estimated coefficient on *Above* × *After* would be -40%, which overstates the true effect of -20% by "double-counting" the mass of reallocated deposits. More generally, to the extent that deposits above the threshold are shifted to accounts in the range DKK 500,000 – DKK 750,000, the estimates in Tables 2 and 3 do not correctly identify the size of the reallocation. We address this potential problem in two ways.

First, we re-estimate the baseline model for the fixed sample of accounts with a balance above DKK 500,000 in 2009. This eliminates the "double-counting" of deposits reallocated to new accounts by excluding such new accounts from the estimating sample. The results in Column (1) of Table 4 documents a significant decrease in accounts above the threshold relative to accounts below the threshold although the point estimates are slightly smaller than in the full sample: around 11% in 2010 and 25% in 2011. [21] In line with our previous findings, Column 2 shows that the relative decrease in deposits above the threshold is considerably smaller in systemic banks: 6% in 2010 and 11% in 2011. [22] When we restrict to the sample of the 12 largest banks, which account for the vast majority of the aggregate deposit mass, in Column (3), the relative decrease in deposits above the threshold in large non-systemic banks is almost as large as the estimates in Table 3: 20% in 2010 and 43% in 2011. [23]

Second, we re-estimate the baseline model while in each year *t* excluding all deposits held by individuals who owned an account exceeding DKK 500,000 in year *t-1*. This addresses the concern that some of the deposit growth in the range DKK 500,000 – DKK 750,000 could be driven by reallocations from uninsured accounts by excluding all individuals who could have engaged in such reallocations. Column (4) shows that a significant decrease in accounts above the threshold relative to accounts below the threshold around the deposit insurance reform: 23% in 2010 and 42% in 2011. [24] As before, as shown in Column (5), the relative decrease is much smaller in systemic banks, and, as shown in Column (6) particularly pronounced in large non-systemic banks: 25% in 2010 and 51% in 2011. [25]

It is striking that the two approaches employed in Table 4 often yields almost identical results given that they exploit completely different variation in the data: Columns (1)-(3) exclusively uses variation in pre-existing large accounts whereas Columns (4)-(6) relies entirely on variation in new and pre-existing small accounts.

4.3 Real effects at the bank-level

While the results above highlight the importance of the deposit insurance threshold, notably for non-systemic banks, the question still remains whether the reallocation of uninsured deposits at the depositor-level give rise to a significant funding shock at the bank-level. In principle, it is possible that the reallocation of uninsured deposits across banks cancelled out and left all banks with an unchanged deposit base.

[21] Note that exp(-0.12)-1=-11% and exp(-0.285)=-25%
[22] Note that exp(-0.123+0.055)-1=-6% and exp(-0.299+0.184)=-11%
[23] Note that exp(-0.217)-1=-20% and exp(-0.554)=-43%
[24] Note that exp(-0.263)-1=-23% and exp(-0.546)=-42%
[25] Note that exp(-0.282)-1=-25% and exp(-0.712)=-51%

To address this question, we estimate a simple bank-level equation with the percentage change in total deposits over the period 2007-2011 as dependent variable and the share of deposits over the DKK 750,000 insurance threshold in 2007 as explanatory variable using ordinary least squares. The results shown in Column (1) of Table 5 suggest that banks with a higher share of deposits over the threshold in 2007 experienced a significantly lower growth in total deposits over the period 2007-2011. This result holds when controls for other bank characteristics are introduced in Column (2). The point estimate implies that banks with a share of deposits above DKK 750,000 at the 75th percentile (a share of around 20%) experienced a growth in total deposits over the period 2007-2011 that was around 20 percentage points lower than banks at the 25th percentile (a share of around 6%).[26] This is suggestive that deposit reallocations had a very significant impact on bank funding.

We proceed to investigate whether the funding shock associated with deposit reallocations had real effects in terms of lending. We estimate a simple bank-level equation with the percentage change in lending over the period 2007-2011 as dependent variable and the percentage change in total deposits over the same period as explanatory variable. To address the obvious endogeneity problem, we instrument the percentage change in total deposits with the fraction of deposits over DKK 750,000 in 2007. As shown in Column (3), the point estimate is around 0.4 suggesting that a 10% decrease in deposits due to reallocations of uninsured deposits leads to a 4% decrease in lending.

The instrumented deposit growth variable remains statistically significant when we include controls for bank size, capitalization and liquidity in Column (4) and the point estimate changes only marginally. While it cannot be excluded that the results are partly driven by unobserved bank characteristics, the fact that the controls raise the explanatory power of the model significantly while leaving the main coefficient of interest almost unchanged makes it unlikely that the estimates suffer from endogeneity bias. The reduced form equation reported in Columns (5) and (6) shows that banks with a higher fraction of deposits above DKK 750,000 in 2007 experienced significantly lower lending growth over period 2007-2011.

In a final robustness test, we have estimated the instrumented lending equation at the bank-municipality level. This allows us to employ municipality fixed effects that capture municipality-level demand shocks, which could potentially correlate with the fraction of deposits above DKK 750,000 (to the extent that banks are concentrated geographically) and thus bias the estimates. The results (not reported) are consistent with the bank-level results reported above.

[26] We are not allowed to report the exact percentiles for confidentiality reasons. The average share of deposits above DKK 750,000 is 6.45% for the 5 banks around the 25th percentile and 19.55% for the 5 banks around 75th percentile.

4.4 Mover characteristics

We explore the determinants of the search for safety by investigating whether individuals differed systematically in their propensity to move deposits across accounts in response to the reduction of insurance coverage in 2010. We restrict the analysis to the roughly 7,700 accounts with a balance above DKK 750,000 in 2009 and define a *mover* as an individual who owns at least one of these accounts and satisfies the following two criteria: (i) the account balance was below DKK 750,000 in 2011 and (ii) the total balance of other accounts owned by the individual increased by at least the same amount net of DKK 275,000. The netting accounts for "normal" movements on large accounts: DKK 275,000 is the average annual change in the balance of accounts exceeding DKK 750,000 during the period 2003-2007. It follows directly from this definition that *non-movers* either kept the account balance above DKK 750,000 through 2011 or reduced the balance below the threshold without a corresponding increase in the balance of other accounts.

It should be emphasized that *movers* could be defined in many other ways. For instance, a broader definition would simply require individuals to reduce the account balance below the insurance threshold or by some percentage. By adding the condition that uninsured deposits are reallocated to other accounts, our preferred definition excludes individuals who withdraw deposits from the banking system altogether to meet liquidity needs or reduce leverage. A narrower definition would only include individuals who reduce account balances precisely to the insurance threshold: the "bunchers" identified in Section 4.1. As opposed to this definition, we include individuals who reduce balances far below the threshold, for instance individuals who split their DKK 1,000,000 account into two DKK 500,000 accounts. We also note that our sample of *movers* surely includes some individuals who did not move due to concerns about safety, but incidentally satisfy the *mover* definition. To shed light on the magnitude of this noise, we have computed the number of individuals who satisfy the two mover criteria in each year and find an average of 476.2 in the period 2005-2009 compared to 1,278 in 2011.

Table 6 reports a comprehensive set of summary statistics for *movers* and *non-movers* respectively. In terms of individual characteristics (Panel A), it is interesting to note that *movers* tend to have higher past unemployment rates, lower incomes and less leverage whereas their banks (Panel B) are less likely to be systemic and they are less likely to have a bank loan. Both movers and non-movers increase the average account balance (Panel C) considerably between 2009 and 2011, but *movers* tend to increase their total deposits in the banking system whereas *non-movers* tend to withdraw deposits. Interestingly, *movers* typically reduce account balances far below the insurance threshold, from around DKK 1000,000 to around DKK 500,000 for the average *mover*. This implies that runs on uninsured deposits spill over

to insured deposits and that banks, in principle, are exposed to runs beyond their stock of uninsured funding. For each DKK of uninsured deposits reallocated to other accounts by *movers*, an additional DKK of insured deposits was also reallocated.

Table 7 formalizes this analysis by estimating a probability model of the decision to reallocate deposits: a dummy variable indicating if the individual is a *mover* regressed on a range of variables capturing individual characteristics, bank-relationship characteristics and bank characteristics as well as municipality fixed effects (Column 2) and bank fixed effects (Column 3). The results reveal several interesting patterns. First, individuals with more volatile income and higher past unemployment rates and individuals who are self-employed are more likely to be *movers*. This suggests that income risk makes individuals more inclined to search for safety for their savings. Second, depositors with loan linkages and depositors in systemic banks are less likely to be movers. This suggests that strong bank relationships and depositor beliefs about implicit guarantees attenuate concerns about safety.

4. Conclusion

We examine the fragility that arises due to the sudden concerns about safety by uninsured depositors during a crisis. We find that liquidity risks to banks that can arise due to withdrawals of uninsured deposits during the crisis are significantly large. We estimate withdrawals of almost 50% of the uninsured balances in non-systemic banks in the crisis.[27] Given the estimated magnitudes, the results suggest that if the fraction of uninsured deposits in the banking system is large, there might be little choice but to increase deposit insurance limits to protect the stability of the banking system.

The results also speak to the new regulatory measures have been put in place, in the aftermath of the current financial crisis, to avoid providing further guarantees to systemically important banks the next time around. For instance, Basel III requires banks to hold liquidity buffers assuming a runoff rate of 10% on uninsured deposits and a higher capital level of 8%.[28] However, evaluating these measures in light of the large magnitudes associated with withdrawals of uninsured deposits (runoff rates of up to 50%), raise questions as to whether these would suffice to protect the stability of the system, next time around. In particular, for systemic banks that generally have a large bulk of their deposits over the insurance limits, based on the current safety nets in place, providing guarantees seems inevitable.[29]

[27] See Table 4, column 3. For the entire sample of non-systemic banks we find estimated withdrawals of 25% of uninsured balances (Table 4, column 2).
[28] In the great depression banks suffered runs despite having much higher levels of capital than the proposed 8% under Basel III.
[29] In the U.S, the fraction of uninsured deposits in systemically important banks is around 40% of total deposits.

This leaves us with the question as to what can be done, in light of the non-trivial moral hazard costs associated with these guarantees. One possible solution could be to provide explicit guarantees to banks but increase the level of regulation in case banks opt-in for these guarantees. However, this mechanism comes with the difficulties associated with regulating systemically important banks and the risk of political capture by these institutions. The other solution, which has been advocated, is narrow banking (Pennacchi, 2012) or breaking up large banks. The important question that arises with these policies is whether illiquid assets that are traditionally financed by banks can be financed by a less fragile form of financing (long-term bonds or equity) without significantly raising the cost of capital. Or putting it differently, can we do without banks in their current form and not substantially increase the costs of financing in the economy. Answering these questions is beyond the scope of this paper but important from the perspective of designing a financial system that is less fragile without compromising on liquidity creation.

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FIGURE 2 – EVOLUTION OF THE SHARE OF DEPOSITS OVER 750,000 DKK

Notes: Figure 1 illustrates the differential outflow of deposits over 750,000 DKK across small and systemic banks for the period 2006 – 2011. The share is calculated as the DKK value of bank deposits over 750,000 DKK at each bank type (systemic or small), divided by the total DKK value of deposits at each bank type. Out of the sample of 92 banks, 6 are considered systemic.

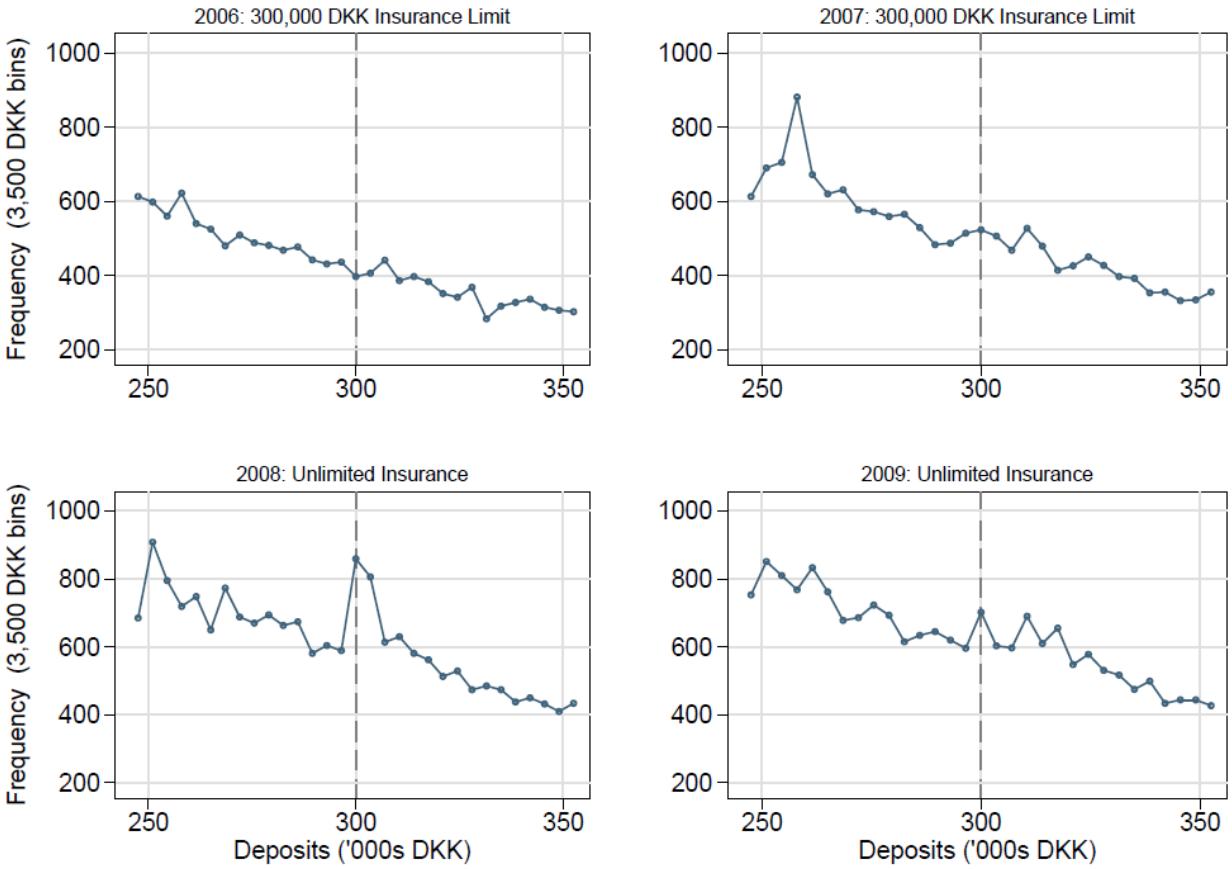

FIGURE 3 – BUNCHING IN THE DEPOSIT DISTRIBUTION AROUND 300,000 DKK

Notes: Figure 1 plots the empirical distribution of deposits for a 100,000 DKK range around 300,000 DKK for the years 2006 – 2009. The empirical distribution is presented as frequency plots, where the sample of deposit accounts is divided into 3,500 DKK bins and counts are recorded for each bin in a 50,000 DKK range above and below 300,000 DKK. Thus, each point on the frequency plot is the count of the number of deposit account with balances 1,250 DKK either side of that deposit balance.

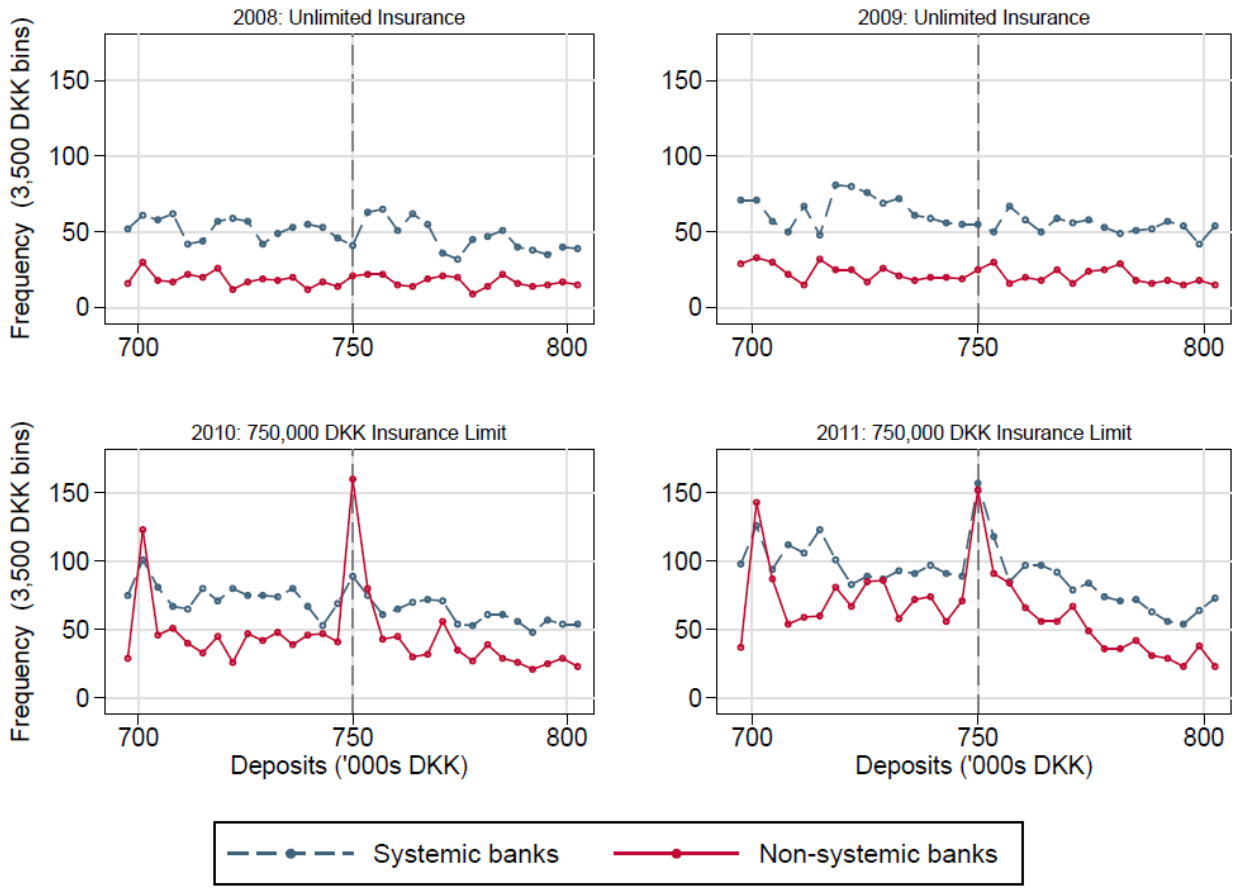

FIGURE 4 – BUNCHING AROUND 750,000 DKK, SYSTEMIC VS. NON-SYSTEMIC BANKS

Notes: Figure 1 plots the empirical distribution of deposits for a 100,000 DKK range around 300,000 DKK for the years 2006 – 2009, split by systemic and non-systemic banks. The empirical distribution is presented as frequency plots, where the sample of deposit accounts is divided into 3,500 DKK bins and counts are recorded for each bin in a 50,000 DKK range above and below 300,000 DKK. Thus, each point on the frequency plot is the count of the number of deposit account with balances 1,250 DKK either side of that deposit balance.

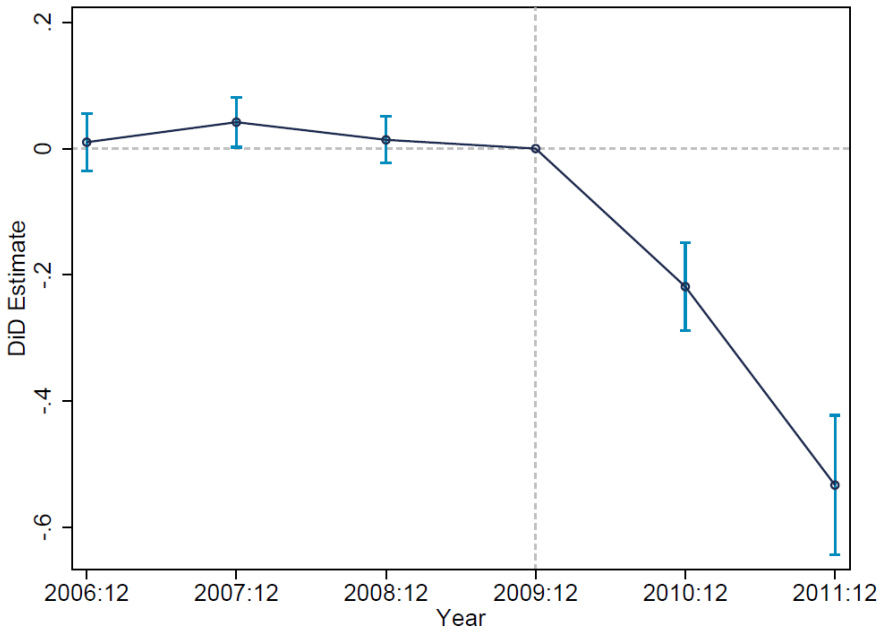

FIGURE 5A – DIFFERENCES-IN-DIFFERENCES ESTIMATES

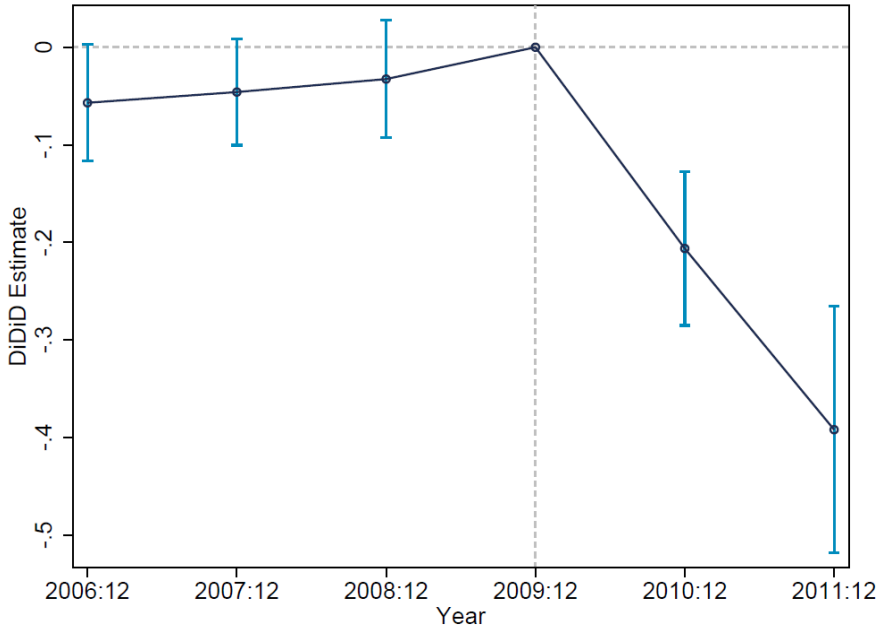

FIGURE 5B – DIFFERENCES-IN-DIFFERENCES-IN-DIFFERENCES ESTIMATES

Notes: Figures 5a and 5b show the double- and triple-differences coefficients, respectively, from regressions where the left-hand-side variable is the log of deposits 500,000 DKK – 1,000,000 DKK and the right-hand-side variables are analogous to the results reported in Tables 2 and 3. All regressions include deposit range and bank fixed-effects. Standard errors are clustered at the bank-level and robust. Confidence bands report the 95 percent confidence interval for the estimates.

TABLE 1 – SUMMARY STATISTICS, BANK-LEVEL VARIABLES

	All banks		Non-systemic banks		Systemic banks	
	Mean	SD	Mean	SD	Mean	SD
Share of total deposits > 750,000 DKK	0.12	0.09	0.11	0.09	0.18	0.06
Deposits growth, 2007-2011	0.37	0.47	0.37	0.49	0.37	0.24
Lending growth, 2007-2011	0.10	0.28	0.11	0.28	0.06	0.35
Total assets ('000,000s)	425.84	2,577.90	42.47	61.71	5,920.80	9,062.00
Equity-to-assets ratio	0.15	0.06	0.16	0.06	0.05	0.01
Loans-to-assets ratio	0.63	0.15	0.64	0.15	0.51	0.11
Number of >750,000 DKK accounts	67.62	244.11	21.12	26.07	734.17	708.98
Number of accounts	7,129.76	27,126.42	2,156.91	2,998.47	78,407.33	81,960.68
	Total		Total		Total	
Accounts > 750,000 DKK	6,221		1,816		4,405	
Accounts	655,938		185,494		470,444	
Observations	92		86		6	

Notes: All variables are recorded in 2007, unless stated otherwise. "Systemic banks" are the largest six banks by total assets in 2007.

TABLE 2 – REGRESSION RESULTS, DEPOSIT GROWTH AND CHANGES TO THE DEPOSIT INSURANCE LIMIT

	Log of deposits in 50,000 DKK ranges, from 500,000 – 1,000,000 DKK		Log of deposits in 50,000 DKK ranges, from 50,000 – 500,000 DKK	
	(1)	(2)	(3)	(4)
Above insurance limit	-0.497***	-0.567***	-1.139***	-1.144***
	(0.0283)	(0.0165)	(0.0262)	(0.0275)
After insurance change	0.316***	0.351***	0.110***	0.110***
	(0.0393)	(0.0385)	(0.0199)	(0.0204)
Above insurance limit x After insurance change	-0.373***	-0.399***	-0.0687***	-0.0766***
	(0.0520)	(0.0404)	(0.0227)	(0.0229)
Systemic bank	3.512***		3.513***	
	(0.557)		(0.592)	
Equity-to-debt ratio	-8.167***		-8.333***	
	(2.548)		(2.560)	
Loans-to-assets ratios	3.088***		3.371***	
	(0.909)		(0.902)	
Constant	12.96***	13.99***	14.42***	15.53***
	(0.839)	(0.0151)	(0.880)	(0.0153)
Bank fixed effects	No	Yes	No	Yes
Observations	4,376	4,376	1,832	1,832
R-squared	0.505	0.949	0.547	0.947
Sample period	2007:12 – 2011:12	2007:12 – 2011:12	2007:12 – 2008:12	2007:12 – 2008:12

Notes: This table reports the estimated coefficients and robust standard errors (in parentheses) clustered at the bank level from log-linear regressions using least squares. The dependent variable in Columns (1) and (2) is the natural logarithm of bank deposits in 50,000 DKK ranges for the interval 500,000 – 1,000,000 DKK, i.e., a 500,000 DKK interval around the post-2010 deposit insurance limit of 750,000 DKK. The dependent variable in Columns (3) and (4) is the natural logarithm of bank deposits in 50,000 DKK ranges for the interval 50,000 – 500,000 DKK, i.e., a 450,000 DKK interval around the pre-2008 deposit insurance limit of 300,000 DKK. Above insurance limit is an indicator variable that is 1 for all deposit ranges above the insurance limit (750,000 DKK and 300,000 DKK for Columns (1) – (2) and (3) – (4), respectively), and 0 otherwise. After insurance change is an indicator variable that is 1 in all periods after the insurance limit changes (2010 – 2011 and 2008 for Columns (1) – (2) and (3) – (4), respectively), and 0 otherwise. Variable definitions and summary statistics for the remaining bank controls are in Table 1. Bank fixed effects are included ("yes") or not included ("no"). *** Significance at the 1 percent level. ** Significance at the 5 percent level. * Significance at the 10 percent level.

TABLE 3 – REGRESSION RESULTS, DEPOSIT GROWTH AND CHANGES TO THE DEPOSIT INSURANCE LIMIT: TIMING OF EFFECTS

	Log of deposits in 50,000 DKK ranges, from 500,000 – 1,000,000 DKK				
	(1)	(2)	(3)	(4)	(5)
Above insurance limit	-0.497***	-0.567***	-0.494***	-0.569***	-0.559***
	(0.0283)	(0.0165)	(0.0305)	(0.0176)	(0.0534)
2010	0.276***	0.319***	0.279***	0.325***	0.180**
	(0.0396)	(0.0380)	(0.0422)	(0.0405)	(0.0793)
2011	0.357***	0.384***	0.358***	0.387***	0.248*
	(0.0441)	(0.0442)	(0.0470)	(0.0471)	(0.127)
Above insurance limit x 2010	-0.255***	-0.256***	-0.268***	-0.268***	-0.286***
	(0.0415)	(0.0339)	(0.0443)	(0.0360)	(0.0702)
Above insurance limit x 2011	-0.493***	-0.546***	-0.514***	-0.570***	-0.693***
	(0.0754)	(0.0542)	(0.0804)	(0.0572)	(0.187)
Above insurance limit x Systemic			-0.0441	0.0306	0.0206
			(0.0350)	(0.0244)	(0.0562)
Systemic bank x 2010			-0.0444	-0.0909	0.0543
			(0.0734)	(0.0729)	(0.101)
Systemic bank x 2011			-0.0256	-0.0546	0.0849
			(0.0858)	(0.0863)	(0.148)
Above insurance limit x Systemic bank x 2010			0.185***	0.185***	0.203**
			(0.0466)	(0.0389)	(0.0718)
Above insurance limit x Systemic bank x 2011			0.287***	0.343***	0.466**
			(0.0870)	(0.0663)	(0.190)
Systemic bank	3.513***		3.502***		
	(0.557)		(0.561)		
Equity-to-assets ratio	-8.162***		-8.160***		
	(2.550)		(2.552)		
Loans-to-assets ratio	3.089***		3.089***		
	(0.910)		(0.911)		
Constant	12.96***	13.99***	12.96***	13.99***	16.72***
	(0.840)	(0.0151)	(0.841)	(0.0151)	(0.0344)
Bank fixed effects	No	Yes	No	Yes	Yes
Observations	4,376	4,376	4,376	4,376	600
R-squared	0.506	0.950	0.506	0.950	0.957
Sample period	2007:12 – 2011:12	2007:12 – 2011:12	2007:12 – 2011:12	2007:12 – 2011:12	2007:12 – 2011:12
Bank sample	All	All	All	All	Largest 12

Notes: This table reports the estimated coefficients and robust standard errors (in parentheses) clustered at the bank level from log-linear regressions using least squares. The dependent variable is the natural logarithm of bank deposits in 50,000 DKK ranges for the interval 500,000 – 1,000,000 DKK, i.e., a 500,000 DKK interval around the post-2010 deposit insurance limit of 750,000 DKK. Above insurance limit is an indicator variable that is 1 for all deposit ranges above the insurance limit (750,000 DKK), and 0 otherwise. 2010 and 2011 are indicator variables equal to 1 in the years 2010 and 2011 respectivel, and 0 otherwise. Variable definitions and summary statistics for the remaining bank controls are in Table 1. Bank fixed effects are included ("yes") or not included ("no").

*** Significance at the 1 percent level.

** Significance at the 5 percent level.

* Significance at the 10 percent level.

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TABLE 4 – REGRESSION RESULTS, DEPOSIT GROWTH AND CHANGES TO THE DEPOSIT INSURANCE LIMIT: DECOMPOSING THE EFFECT FOR EXISTING AND NEW ACCOUNTS

	Panel A: Existing Accounts Log of deposits in 50,000 DKK ranges, from 500,000 – 1,000,000 DKK			*Panel B: New Accounts* Log of deposits in 50,000 DKK ranges, from 500,000 – 1,000,000 DKK		
	(1)	(2)	(3)	(4)	(5)	(6)
Above insurance limit	-0.554***	-0.557***	-0.535***	-0.615***	-0.615***	-0.630***
	(0.0182)	(0.0195)	(0.0587)	(0.0234)	(0.0252)	(0.0380)
2010	0.0922***	0.0965***	0.00966	0.431***	0.434***	0.365***
	(0.0280)	(0.0300)	(0.0803)	(0.0437)	(0.0468)	(0.0904)
2011	-0.125***	-0.126***	-0.214*	0.494***	0.495***	0.368**
	(0.0388)	(0.0417)	(0.118)	(0.0467)	(0.0500)	(0.142)
Above insurance limit x 2010	-0.120***	-0.123***	-0.217**	-0.263***	-0.276***	-0.282***
	(0.0267)	(0.0286)	(0.0918)	(0.0418)	(0.0447)	(0.0687)
Above insurance limit x 2011	-0.285***	-0.299***	-0.554**	-0.546***	-0.573***	-0.712***
	(0.0513)	(0.0551)	(0.206)	(0.0565)	(0.0600)	(0.161)
Above insurance limit x Systemic		0.0358	0.0140		0.00821	0.0230
		(0.0256)	(0.0612)		(0.0366)	(0.0470)
Systemic bank x 2010		-0.0635*	0.0234		-0.0514	0.0173
		(0.0371)	(0.0835)		(0.0660)	(0.103)
Systemic bank x 2011		0.00374	0.0918		-0.0165	0.110
		(0.0545)	(0.123)		(0.0718)	(0.152)
Above insurance limit x Systemic bank x 2010		0.0553	0.150		0.185***	0.190**
		(0.0361)	(0.0947)		(0.0497)	(0.0723)
Above insurance limit x Systemic bank x 2011		0.184***	0.439*		0.352***	0.492**
		(0.0675)	(0.210)		(0.0685)	(0.164)
Constant	13.77***	13.77***	16.39***	13.49***	13.49***	16.11***
	(0.0135)	(0.0134)	(0.0319)	(0.0183)	(0.0182)	(0.0351)
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,232	4,232	600	4,183	4,183	600
R-squared	0.928	0.928	0.924	0.922	0.922	0.944
Sample period	2007:12 – 2011:12	2007:12 – 2011:12	2007:12 – 2011:12	2007:12 – 2011:12	2007:12 – 2011:12	2007:12 – 2011:12
Bank sample	All	All	Largest 12	All	All	Largest 12

Notes: This table reports the estimated coefficients and robust standard errors (in parentheses) clustered at the bank level from log-linear regressions using least squares. The specification is analogous to the model in Table 3, but the sample of deposit accounts changes. Panel A contains the sample of accounts with balances above 500,000 DKKK in 2009, and tracks their supply in 50,000 DKK ranges around the insurance change. Panel A only considers new 500,000 DKK accounts each year. Bank fixed effects are included ("yes") in every regression.

*** Significance at the 1 percent level.

** Significance at the 5 percent level.

* Significance at the 10 percent level.

TABLE 5 – REGRESSION RESULTS, BANK DEPOSIT GROWTH, LENDING GROWTH AND EXPOSURE TO THE INSURANCE CHANGE

	Deposit growth, 2007-2011		Lending growth, 2007-2011			
	(1)	(2)	(3)	(4)	(5)	(6)
Instrumented deposit growth			0.381***	0.344**		
			(0.137)	(0.165)		
Share of deposits over 750,000 DKK	-1.415***	-1.496***			-0.540**	-0.514*
	(0.412)	(0.374)			(0.222)	(0.283)
Systemic bank		0.147		-0.00881		0.0416
		(0.181)		(0.126)		(0.157)
Equity-to-debt ratio		-0.278		0.802		0.706
		(0.989)		(0.598)		(0.615)
Loans-to-assets ratio		0.329		-0.398*		-0.285
		(0.301)		(0.224)		(0.257)
Constant	0.576***	0.413	-0.0396	0.105	0.180***	0.247
	(0.0764)	(0.341)	(0.0607)	(0.228)	(0.0377)	(0.221)
Observations	92	92	92	92	92	92
R-squared	0.094	0.112	0.027	0.149	0.039	0.091

Notes: This table reports the estimated coefficients and robust standard errors (in parentheses) from IV estimation (Columns (3) and (4)) and reduced-form estimation (Columns (5) and (6)) of the bank lending growth equation. Columns (1) and (2) are the results from the first-stage estimation. The dependent variable in Columns (1) – (2) is the change in log deposits, 2007-2011. The dependent variable in Columns (3) – (6) is the change in log lending, 2007-2011. Variable definitions and summary statistics for the variables are in Table 1.

*** Significance at the 1 percent level.

** Significance at the 5 percent level.

* Significance at the 10 percent level.

TABLE 6 – SUMMARY STATISTICS, INDIVIDUAL AND ACCOUNT-LEVEL CHARACTERISTICS

	Movers		Non-Movers	
	Mean	SD	Mean	SD
Panel A. Individual Characteristics				
Age	61.26	12.14	59.70	14.83
Female	0.43	0.50	0.40	0.49
Married	0.61	0.49	0.56	0.50
Education, short	0.13	0.34	0.11	0.31
Education, medium	0.37	0.48	0.35	0.48
Education, long	0.29	0.46	0.31	0.46
Retired	0.40	0.49	0.36	0.48
Self employed	0.15	0.36	0.20	0.40
Unemployment, 24m	23.07	116.54	15.77	93.96
Disposable income ('000s)	344.52	436.32	446.18	685.34
SD of disposable income ('000s)	102.49	268.43	154.17	386.84
Bank debt ('000s)	223.05	779.49	460.65	1,367.15
Total debt ('000s)	648.27	1,997.83	1,190.71	2,927.25
Debt-to-income ratio	1.66	3.62	2.51	4.56
Total assets ('000s)	3,608.28	4,655.30	4,897.96	6,687.02
Percentage change in assets	5.14	26.85	8.29	36.81
Stock market participation	0.64	0.48	0.62	0.49
Value of stock holdings ('000s)	268.30	795.02	363.32	1,096.74
Panel B. Account/relationship characteristics				
Loan linkage	0.29	0.45	0.39	0.49
Account age	3.80	0.81	3.76	0.88
Systemic bank	0.68	0.47	0.78	0.41
Panel C. Deposit holdings				
Account balance ('000s):				
2007	674.35	874.40	971.66	1,455.02
2008	786.26	723.99	1,146.87	1,408.82
2009	1,009.43	519.45	1,606.48	1,422.37
2010	769.69	570.81	1,175.73	1,454.65
2011	537.51	232.52	1,040.65	1,494.72
Total deposits ('000s):				
2007	1,718.74	6,609.00	1,867.70	6,731.13
2008	1,582.09	4,539.10	1,780.69	4,483.11
2009	1,692.78	3,909.95	2,179.34	3,959.29
2010	1,809.68	5,197.10	1,929.81	5,235.19
2011	2,019.59	5,754.60	1,751.32	4,976.02
Observations	988		6,704	

Notes: All variables are recorded in 2007, unless stated otherwise. The full sample is all accounts over 750,000 DKK in 2009, where the account-owner is over 25 years of age. A "mover" is defined as an individual account where the balance falls below 750,000 DKK and the value of the DKK fall, net of 275,000 DKK, is deposited into one, or across several, accounts of the same owner. The netting amount, 275,000 DKK, is the average year-on-year change in balance for the period 2003-2007. A "non-mover" is an individual account that falls below 750,000 DKK but without compensation in another account/other accounts, or remains over the 750,000 DKK insurance limit in 2011.

TABLE 7 – REGRESSION RESULTS, DETERMINANTS OF RESPONSE TO THE CHANGE OF THE DEPOSIT INSURANCE LIMIT

	Mover definition 1			Mover definition 2
	(1)	(2)	(3)	(4)
Age	0.000899**	0.000809**	0.000866**	0.000817**
	(0.000376)	(0.000378)	(0.000378)	(0.000416)
Female	0.00769	0.00649	0.00665	0.0129
	(0.00817)	(0.00820)	(0.00822)	(0.00885)
Married	0.0280***	0.0265***	0.0259***	0.0323***
	(0.00774)	(0.00793)	(0.00794)	(0.00856)
Education, short	0.0608***	0.0616***	0.0577***	0.0451***
	(0.0148)	(0.0149)	(0.0149)	(0.0160)
Education, medium	0.0383***	0.0354***	0.0346***	0.0265**
	(0.0109)	(0.0111)	(0.0112)	(0.0121)
Education, long	0.0460***	0.0478***	0.0471***	0.0448***
	(0.0115)	(0.0119)	(0.0120)	(0.0131)
Retired	0.0051	0.1350	-0.0099	-0.7010
	(1.2600)	(1.2700)	(1.2700)	(1.3600)
Self-employed	0.0203*	0.0169	0.0181*	0.0148
	(0.0107)	(0.0109)	(0.0108)	(0.0117)
Unemployment, 24m	0.0822*	0.0904**	0.0826*	0.1170**
	(-0.0446)	(-0.0447)	(-0.0447)	(-0.0485)
Debt-to-income ratio	-0.00265***	-0.00264***	-0.00267***	-0.00245**
	(0.000879)	(0.000876)	(0.000867)	(0.000982)
Disposable income	0.00141	0.00114	0.00122	0.000160
	(0.00227)	(0.00224)	(0.00226)	(0.00262)
SD of disposable income	0.0300***	0.0307***	0.0293***	0.0354***
	(0.0103)	(0.0103)	(0.0103)	(0.0114)
Log of total assets	-0.00151	-0.000618	-0.00148	-0.00122
	(0.00420)	(0.00422)	(0.00424)	(0.00477)
Percentage change in assets	-0.0157*	-0.0131	-0.0131	-0.0212**
	(0.0090)	(0.00923)	(0.0093)	(0.00985)
Stock market participation	0.0264	0.0246	0.0189	0.0385
	(0.0307)	(0.0310)	(0.0311)	(0.0336)
Value of stock holdings	-0.00124	-0.00110	-0.000900	-0.00231
	(0.00260)	(0.00261)	(0.00262)	(0.00284)
Loan linkage	-0.0254***	-0.0260***	-0.0244***	-0.0283***
	(0.00865)	(0.00871)	(0.00877)	(0.00952)

Account age	-0.2000	-0.0529	0.0033	-0.0388
	(0.4210)	(0.4280)	(0.4450)	(0.4660)
Account balance	-0.129***	-0.127***	-0.126***	-0.154***
	(0.00667)	(0.00674)	(0.00674)	(0.00747)
Systemic bank	-0.0583***	-0.0549***		-0.0537***
	(0.00982)	(0.0109)		(0.0117)
Constant	1.894***	1.866***	1.837***	2.294***
	(0.104)	(0.106)	(0.112)	(0.118)
Municipality fixed effects	No	Yes	Yes	Yes
Bank fixed effects	No	No	Yes	No
Observations	7,692	7,692	7,692	7,692
R-squared	0.059	0.078	0.099	0.083

Notes: This table reports the estimated coefficients and robust standard errors (in parentheses) from linear probability models using least squares. The dependent variable in Columns (1) – (3) and Column (4) is an indicator variable that is equal to 1 for an individual account where the balance falls below 750,000 DKK and the value of the DKK fall, net of 275,000 DKK and 360,000 DKK respectively, is deposited into one, or across several, accounts of the same owner, and 0 otherwise. The sample is all accounts with balances over 750,000 DKK in 2009, where the account-owner is older then 25. Municipality and bank fixed effects are included ("yes") or not included ("no"). The reported coefficients on *Retired, Percentage change in assets* and *Account age* are scaled by 100. The reported coefficient on *Unemployment, 24m* is scaled by 1,000. *SD of disposable income* is measured 2003-2007. *Value of stock holdings* enters the regression in the natural logarithm plus unity. *Disposable income* is transformed by the natural logarithm. *Account balance* is the natural logarithm of the 2009 account balance. *Percentage change in assets* is recorded 2003-2009.

*** Significance at the 1 percent level. ** Significance at the 5 percent level. * Significance at the 10 percent level.

Appendix

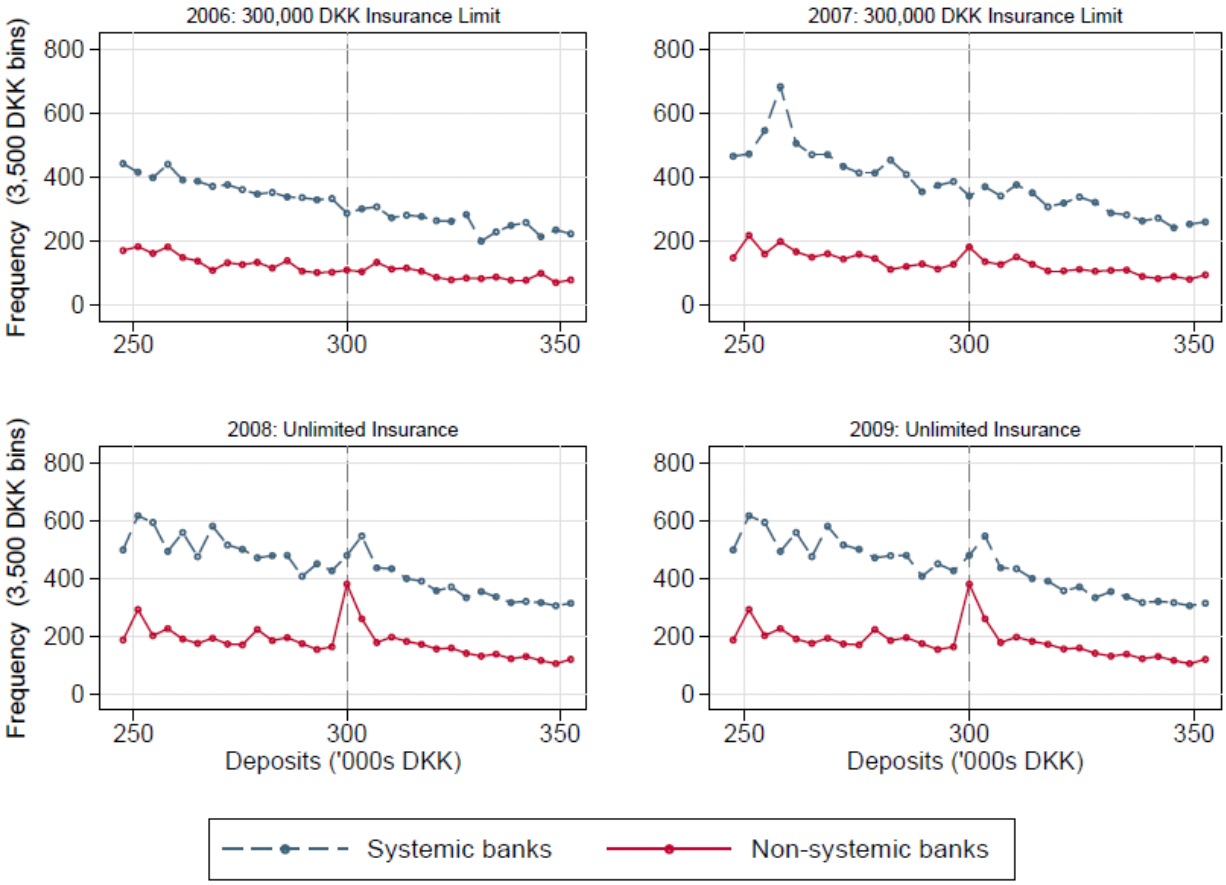

FIGURE A1 – BUNCHING IN THE DEPOSIT DISTRIBUTION AROUND 300,000 DKK

Notes: Figure 1 plots the empirical distribution of deposits for a 100,000 DKK range around 750,000 DKK for the years 2008 – 2011. The empirical distribution is presented as frequency plots, where the sample of deposit accounts is divided into 3,500 DKK bins and counts are recorded for each bin in a 50,000 DKK range above and below 750,000 DKK. Thus, each point on the frequency plot is the count of the number of deposit account with balances 1,250 DKK either side of that deposit balance.