

Iyer, Rajkamal; Jensen, Thais Lærkholm; Johannesen, Niels; Sheridan, Adam

**Working Paper**

## The run for safety: Financial fragility and deposit insurance

EPRU Working Paper Series, No. 2016-02

**Provided in Cooperation with:**

Economic Policy Research Unit (EPRU), University of Copenhagen

*Suggested Citation:* Iyer, Rajkamal; Jensen, Thais Lærkholm; Johannesen, Niels; Sheridan, Adam (2016) : The run for safety: Financial fragility and deposit insurance, EPRU Working Paper Series, No. 2016-02, University of Copenhagen, Economic Policy Research Unit (EPRU), Copenhagen

This Version is available at:

<https://hdl.handle.net/10419/175494>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

Economic Policy Research Unit  
Department of Economics  
University of Copenhagen  
Øster Farimagsgade 5, Building 26  
DK-1353 Copenhagen K  
DENMARK  
Tel: (+45) 3532 4411  
Fax: (+45) 3532 4444  
Web: <http://www.econ.ku.dk/epru/>

The Run for Safety:  
Financial Fragility and Deposit Insurance

Rajkamal Iyer, Thais Jensen, Niels Johannesen, Adam Sheridan

# The Run for Safety:

## Financial Fragility and Deposit Insurance

Rajkamal Iyer, Thais Jensen, Niels Johannesen and Adam Sheridan \*

April 2016

### Abstract

We study a run on uninsured deposits in Danish banks triggered by a reform that limited deposit insurance coverage. Using a unique dataset with information about all individual accounts in Danish banks, we show that the reform caused a 50% decrease in deposits above the insurance limit in non-systemic banks, but a much smaller decrease in systemic banks which experienced *less* withdrawals from uninsured accounts, but also *more* openings of new uninsured accounts. Our results highlight the significant risks from a differential reallocation of uninsured deposits across banks and, in turn, the need for high insurance limits during a crisis.

---

\* Rajkamal Iyer: MIT Sloan, 100 Main street, Cambridge, MA 02142. E-mail: riyer@mit.edu. Thais Jensen: Department of Economics, University of Copenhagen, Øster Farimagsgade 5, DK-1353 Copenhagen K and Danmarks Nationalbank, Havnegade 5, DK-1093 Copenhagen K. E-mail: tlj@econ.ku.dk. Niels Johannesen: Department of Economics, University of Copenhagen, Øster Farimagsgade 5, DK-1353 Copenhagen K. E-mail: niels.johannesen@econ.ku.dk. Adam Sheridan: Department of Economics, University of Copenhagen, Øster Farimagsgade 5, DK-1353. Email: adam.sheridan@econ.ku.dk. We thank Puriya Abbassi, Nittai Bergman, Doug Diamond, Antoinette Schoar, Andrei Shleifer, Jeremy Stein and Phil Strahan, Haluk Unal and seminar participants at University of Maryland, Wharton, HEC Paris, University of Zurich, University of Oxford, NUS, Imperial College, UCLA, Federal Reserve Board and FDIC for comments.

## 1. Introduction

An important concern in most crises is that uninsured depositors, fearing for the safety of their deposits, might run on banks and destabilize the financial system. Governments often respond to this risk by extending more generous guarantees to depositors; for instance, the United States, all members of the European Union and many other countries around the globe raised their deposit insurance limits during the 2007-2008 financial crisis (IMF, 2013). While increasing the deposit insurance limit reduces the incentives for depositors to run, it also distorts the incentives for banks to take risk and it is therefore often questioned whether this is the right policy response.<sup>1</sup> To evaluate the necessity of raising the deposit insurance limit in times of financial turmoil, one needs a thorough understanding of its impact on the behavior of depositors.

In this paper, we study the risks that arise in the banking system due to depositor concerns about safety by examining how the deposit insurance limit shapes the allocation of deposits in a crisis. Our laboratory is Denmark where salient changes to the insurance limit provide a useful source of variation. While deposit 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 new limit, decided by the European Union and thus exogenous to the Danish banking system, left almost one fifth of retail deposits uninsured at a time when Denmark was in the midst of an economic crisis with frequent bank failures. By estimating the reallocation of deposits induced by the shift from full insurance to limited insurance, we can clearly identify the benefits of deposit insurance in terms of protection against bank runs.

For the purposes of the analysis, we have access to a unique dataset with annual balances for every bank account in Danish banks held by individuals during the period 2003-2011. To this dataset, we add detailed information about banks and account holders. We thus observe how individual depositors allocate funds in the banking system; how this allocation changes in response to the insurance limit; and how the magnitude of the responses depends on bank and depositor characteristics.

In a first step of the analysis, we plot the distribution of account balances and show that significant excess mass emerges at DKK 750,000 exactly when this becomes the deposit insurance limit

---

<sup>1</sup> 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.

in 2010. The sudden bunching at the threshold represents compelling evidence that depositors drew down account balances to the insurance limit to reduce exposure to bank failures and, more broadly, that the deposit insurance limit plays an important role in determining the allocation of deposits within the banking system during a crisis.

To extend the analysis beyond the narrow window of account balances where bunching is discernable by visual inspection, we employ a regression framework. Our difference-in-difference estimator effectively compares the bank-level growth in deposits above and below the insurance limit at DKK 750,000 while considering only the deposit range DKK 500,000 - DKK 1,000,000. Thus, the identification derives from a comparison of similarly-sized accounts affected differently by the limit. We find that deposits above the limit decreased by 40% relative to deposits below when comparing the pre-reform years 2008-2009 to the last post-reform year 2011. The finding is not driven by differential underlying trends: deposits above and below the threshold evolved very similarly before 2010 and then diverged sharply.

Exploring the heterogeneity of this result, we show that the intensity of the run on uninsured deposits correlates strongly with banks' systemic importance. While deposits *below* the limit followed similar trends in systemic and non-systemic banks through 2011, deposits *above* the limit decreased by almost 50% in non-systemic banks relative to this trend but only by 20% in systemic banks. The stark difference is suggestive of depositor beliefs that systemic banks were more likely to be bailed out in case of failure and thus points to implicit government guarantees as an important determinant of depositor behavior. 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.

We find evidence that the relatively small loss of deposits above the insurance limit suffered by systemic banks reflects two types of depositor behavior. First, depositors with *existing accounts* above the limit in systemic banks were less likely to split them into multiple accounts. Second, depositors opening *new accounts* above the limit were more likely to open them in systemic banks. The latter finding suggests that depositors may choose to transfer their entire deposits to banks that are perceived as safe rather

than splitting the uninsured part of their deposits across new accounts.<sup>2</sup> A likely explanation is that managing multiple accounts in different banks involves significant transaction costs.

Further, we investigate whether the reallocation of deposits was associated with real effects outside the banking sector and demonstrate that banks suffering adverse liquidity shocks were induced to slash lending. Specifically, we first show that the share of deposits above DKK 750,000 in 2007 is a strong predictor of banks' overall deposit growth over the period 2007-2011 even when controlling for other bank characteristics. Next, 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 suggest that a 1% decrease in deposits induced by the reallocation of deposits reduced lending by 0.35%.

While the above results highlight the risks that arise from a reallocation of deposits during a crisis, we also investigate why some depositors choose to reallocate uninsured deposits and others do not. Identifying the deep determinants of depositor behavior is useful for establishing the circumstances under which a crisis is more likely to trigger a run on bank deposits. The analysis also informs current policy discussions about how regulatory tools like liquidity coverage ratios can account for depositor characteristics when measuring liquidity risk.

Our results indicate that depositors with higher education levels are more likely to reallocate deposits across accounts in response to the insurance limit, suggesting that *financial sophistication* is associated with stronger responses. Likewise, depositors with more volatile income, depositors with higher past unemployment rates and self-employed depositors are 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. Lastly, depositors with larger uninsured balances are more likely to reallocate funds, but also more frequently open accounts in excess of the insurance limit, which suggests an important role for *transaction costs* in balancing the incentive to split accounts.

---

<sup>2</sup> During the current financial crisis, FDIC provided unlimited insurance to non-interest bearing transaction accounts in banks (IAGP) due to concerns that large transaction accounts might move from non-systemic banks to systemic banks because of implicit too-big-to-fail guarantees. Note that the risks posed to the banking system from reallocation of uninsured deposits may be higher if depositors could easily access other safe asset classes like treasury, postal savings or money market funds that solely invest in government bonds.

The results have important implications for the appropriate policy response to a financial crisis. Our key estimate indicates that non-systemic banks may lose as much as 50% of their uninsured deposits in a crisis. Even if all funds stay within the banking system, the reallocation of deposits to systemic banks can create significant liquidity shocks to non-systemic banks. In fact, the effective exposure to liquidity shocks goes beyond the size of *uninsured* deposits because the costs of managing multiple accounts can induce uninsured depositors to also move the *insured* part of their deposits to systemic banks. In effect, if the insurance limit is low when a crisis hits, and the resulting fraction of uninsured deposits is high, behavioral responses of the magnitude we are estimating pose a significant risk to non-systemic banks. Thus, our results suggest that a relatively high insurance limit is required to ensure the stability of the banking system during a crisis. Further, our estimates raise the concern that current liquidity requirements, put in place under Basel III, will not suffice to protect banks in future crises. The rules require banks to hold liquidity buffers that reflect a 10% runoff rate for uninsured deposits; our estimates suggest that the runoff rate may in fact be more than five times higher.

The paper contributes to the literature studying the role of deposit insurance in mitigating financial fragility (Diamond and Dybvig, 1983; Egan et al., 2015). While most empirical studies make inference from cross-country variation in insurance limits and the prevalence of financial crisis (e.g. Demirgüç-Kunt and Detragiache, 2002; Demirgüç-Kunt et al, 2008), our analysis exploits quasi-experimental variation in the Danish insurance limit and account-level information on the allocation of deposits. We are thus able to provide relatively clean evidence on how the deposit insurance limit shapes the allocation of deposits in the banking system and on the risks that arise from the reallocation of uninsured deposits in a crisis. At the same time, the paper highlights 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; Brown et al., 2015). A unique feature of our analysis is that we study responses of individual depositors during a systemic crisis. 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 resonate with the notion that bank runs do not happen randomly but occur when the fundamentals of the banking system are weak in combination with impaired balance sheets of depositors. Thus, the

results highlight the need to incorporate heterogeneity in depositor balance sheets in theoretical models of bank runs.<sup>3</sup>

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 limit 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 intermediaries during crises (Gorton and Pennachi, 1990; Dang et al, 2013) as well as models of neglected risk (Gennaioli et al, 2012, 2014).<sup>4</sup>

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. Furthermore, our results suggest that officially designating certain banks as systemically important could significantly alter the allocation of deposits and in turn pose a threat to the stability of non-systemic banks during crises.

The rest of the paper proceeds as follows. Section 2 presents the institutional environment. Section 3 describes the data. Section 4 presents the 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

---

<sup>3</sup> See Bryant (1980), Postlewaite and Vives (1987), Rochet and Vives (2005) and Goldstein and Pauzner, 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.

<sup>4</sup> Deposits above the insurance threshold are akin to privately issued demandable debt backed by banks assets. See also Morrison and White, 2011; Gorton and Ordóñez, 2014.



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; Iyer et al., 2014). At the same time, the Danish housing market was deteriorating 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. 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.

## 2.2 Deposit Guarantees

In Denmark, 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. Thus, the system is similar to that practiced in the U.S.

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. Normally, other commercial banks or the central bank would 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 harmonize the minimum level of protection of the ordinary deposit insurance schemes across the EU member states. The European Commission proposal was in response to the concerns that differing levels of deposit insurance could lead to flight of deposits across borders and threaten the stability of the banking system in countries

with relatively low insurance limits. Thus, compliance with the proposal required that Denmark reduce its coverage to a threshold set by the European Commission. A Danish law adopted in Spring 2009 implemented the new European rules by setting the threshold of the deposit insurance to EUR 100,000 (approximately DKK 750,000) as from 1 October 2010. Note that 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, at the point when the deposit insurance was limited to DKK 750,000, the Danish banking sector was still in a serious crisis. 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 and even more banks voluntarily went out of business (Rangvid et al., 2013). The sovereign debt crisis that hit Europe in 2010 further weakened Danish banks and raised the risk of new failures.

An important event that may have changed perceptions about the implicit guarantee enjoyed by depositors not covered by an explicit guarantee occurred in February 2011 when Amagerbanken, the 11th largest bank in Denmark, failed. In sharp contrast to previous failures, 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).<sup>5</sup>

In sum, the explicit deposit guarantee was 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. The perception of implicit deposit guarantees likely changed in February 2011 at the resolution of Amagerbanken.

### **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-

---

<sup>5</sup> 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.

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 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.<sup>6</sup>

Table 1 reports summary statistics for our key bank-level variables. The first columns concern the full sample of banks whereas the subsequent columns report 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.<sup>7</sup> Second, when the financial regulator explicitly named the systemically important financial institutions in 2014, the list comprised precisely 6 institutions. Furthermore, the main results of the paper are robust to the use of alternative definitions of systemic banks. As shown in the 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 around 6,200 accounts had a balance above DKK 750,000 with a similar distribution across systemic and non-systemic banks. Thus, before the crisis slightly less than 1% of all accounts exceeded the insurance threshold to be introduced in 2010.

To measure the significance of these 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.

---

<sup>6</sup> For confidentiality reasons, we are not allowed to disclose bank names. We are also not allowed to report estimates or statistics for groups of less than four banks.

<sup>7</sup> 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 Erhvervsbank of 113 billion (6th largest) and Bank DnB Nord of 69 billion (7th largest) at the end of 2007 (Finanstilsynet, 2007).

The simple average across all banks was slightly above 12% (because systemic banks are few in numbers relative to non-systemic banks).

By tracking how this measure evolved over time, we get a sense of the magnitude of the run on uninsured deposits around the introduction of the DKK 750,000 insurance limit in 2010 and the failure of Amagerbanken in 2011. As shown in Figure 1, there was a sharp drop in account balances above DKK 750,000 in non-systemic banks between 2009 and 2011, but a small increase in systemic banks over the same period.<sup>8</sup> At the end of 2011, the share of deposits over the threshold in systemic banks was not much below the level in 2007 whereas it had dropped by almost 50% in non-systemic banks. These patterns suggest that there was a quantitatively important run on uninsured deposits in non-systemic banks in the course of 2010 and 2011, which led to an overall reallocation of deposits toward systemic banks. It is interesting to note that in 2009, when unlimited insurance was in place, non-systemic banks experienced an increase in deposits above DKK 750,000.

We also emphasize that there was significant cross-sectional variation in reliance on deposits above DKK 750,000 before the crisis so that non-systemic 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 growth in deposits and growth in lending. 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: 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 is somewhat lower for systemic than for non-systemic banks.

#### 4. Results

The results are reported in the following four subsections. Section 4.1 provides evidence on bunching of account balances at the deposit insurance threshold. Section 4.2 investigates the change in the wider distribution of account balances induced by the deposit insurance reforms and ultimately

---

<sup>8</sup> Figure A1 in the Appendix shows that a similar pattern prevails when deposits above the deposit insurance are not normalized by total deposits

estimates the responsiveness of bank deposits to insurance coverage. Section 4.3 studies the real effects of the deposit insurance reforms in terms of lending. Section 4.4 uses 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 limit

Figure 2 illustrates the allocation of deposits in a series of histograms of raw account balances in a narrow window around 750,000 DKK for all banks. 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. This represents strong evidence that depositors drew down account balances to the insurance limit to reduce exposure to bank failures and, more broadly, that the deposit insurance limit plays an important role in determining the allocation of deposits within the banking system during a crisis.

Figure 3 reports analogous evidence for the DKK 300,000 insurance threshold that was effective until 2008 when the government introduced the unlimited guarantee. In 2006-2007, there are no signs of bunching at DKK 300,000. Excess mass at the threshold emerges in 2008, but largely disappears again in 2009. 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 limit.<sup>9</sup>

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.<sup>10</sup> The striking difference between systemic and non-systemic banks points to 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 systemic banks to be safer because they are more likely to be bailed out in case of distress.

---

<sup>9</sup> 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.

<sup>10</sup> Figure A2 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 allocation of deposits

The emergence of bunching at the deposit insurance threshold coinciding with the financial crisis in 2008 and with 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:

$$\log(\text{deposits})_{itk} = \alpha + \beta_1 \text{Above}_k + \beta_2 \text{After}_t + \beta_3 \text{Above}_k \times \text{After}_t + \gamma X_i + \varepsilon_{itk}$$

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.<sup>11</sup> The deposit 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% when comparing the periods 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.<sup>12</sup> The coefficient on *After*  $\times$  *Above* shows that deposits above DKK 750,000 decreased by 31% relative to this trend. 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

---

<sup>11</sup> We also use other ranges and find the results are robust to these choices.

<sup>12</sup> Note that  $\exp(0.316)-1=37\%$ .

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

To further investigate the role of depositor beliefs about implicit bailout guarantees, we exploit the timing of the failure of Amagerbanken, the 11<sup>th</sup> largest bank in Denmark, where uninsured depositors were not bailed out. As described above, 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 bank failures occurring during the period 2008-2010. When Amagerbanken failed in February 2011, however, uninsured depositors suffered a large 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. 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 Amagerbanken, which plausibly lowered expectations about implicit guarantees, 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*  $\times$  *2010* and *Above*  $\times$  *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. However, the positive and significant coefficients on *Above*  $\times$  *Systemic*  $\times$  *2010* and *Above*  $\times$  *Systemic*  $\times$  *2011* show that the relative decrease in deposits above the threshold was much smaller in systemic banks: around 8% in 2010 and 20% in 2011. 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 ones 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 about implicit guarantees, 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). 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 contrast, 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 similar to those for the full sample. On the one hand, deposits below the threshold increased at a rapid pace in both systemic and non-systemic large 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. These results are consistent with the notion that the relatively modest responses by uninsured 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*  $\times$  *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*  $\times$  *Year*  $\times$  *Non-Systemic* in a specification that is analogous to Column (3) in Table 3: the trend in deposits above relative to 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 types.

While the results above provide strong evidence that depositors responded to the reduction of insurance coverage in 2010, it is not immediately clear whether the estimated coefficients on *Above*  $\times$  *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*  $\times$  *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 magnitude 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. 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. 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.

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  $t-1$ . While Columns (1)-(3) exclusively use variation in pre-existing large accounts, Columns (4)-(7) rely entirely on variation in new large accounts and pre-existing small accounts. 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. It is striking that the two approaches often yields almost identical results given that they exploit completely different variation in the data.

Specifically, Column (4) shows a significant decrease in new deposits above the threshold relative to new deposits below the threshold around the deposit insurance reform: 23% in 2010 and 42% in 2011. 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. Finally, in Column (7), we limit the sample further to depositors who only held accounts in non-systemic banks in  $t-1$ . Also within this subsample of depositors, there is a strong increase in the relative proclivity to deposit sums above the insurance limit in systemic banks in 2010-2011. This reassures us that our main results are not driven by systematic differences in depositor characteristics across systemic and non-systemic banks.

Intuitively, our main finding that systemic banks lost significantly less deposits above the insurance limit than non-systemic banks, can reflect two distinct types of depositor behavior. First, depositors with *existing accounts* above the limit may have been less likely to split them into multiple accounts if they were customers in systemic banks. Second, depositors opening *new accounts* above the limit may have been more likely to do so in systemic banks. While evidence of the former is shown in the depositor-level analysis below, Figure 6 addresses the latter by displaying the (cumulated) mass of deposits associated with account openings in different deposit ranges. In ranges below DKK 750,000, systemic and non-systemic banks exhibit roughly the same trend through the whole sample period suggesting that they were equally successful at attracting new accounts, however, above the threshold, there is clearly a steeper increase in systemic banks. This is notably true in 2010 when the deposit insurance coverage was limited.

While, in the absence of frictions, all depositors should be expected to split deposits across banks to remain fully insured, the above results show that some depositors preferred to open uninsured accounts in systemic banks. This is suggestive that depositors' transaction costs are increasing in the number of accounts, which makes it attractive to consolidate deposits in banks that are perceived as safe even when the account balance exceeds the insurance limit. This points to an important source of risk that can arise when deposits are reallocated during a crisis: non-systemic banks could face very significant liquidity shocks because uninsured depositors might choose to move not only the uninsured part, but also the insured part of their deposits to systemic banks.

Finally, a few robustness tests are reported in the Appendix. Table A1 shows a summary of depositor characteristics for different ranges of accounts balances. Reassuringly, owners of accounts in the range DKK 500,000-750,000 are very similar to owners of accounts in the range DKK 750,000-1,000,000 suggesting that the sharp divergence between deposits above and below the limit in 2010 is not driven by depositor heterogeneity. Table A2 shows in a regression framework that the differential growth in deposits above the insurance limit was not driven by interest rate differentials. Note that it is also difficult to explain this pattern with heterogeneity in the size of branch networks or advertising efforts, which should both be expected to affect deposits above and below the threshold similarly.

#### 4.3 Real effects at the bank-level

Beyond the differential allocation of large deposits to systemic banks, we should expect the funding shock to be highly heterogeneous with banks having a large share of deposits above the insurance threshold being more adversely affected. To test this formally, 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%).<sup>13</sup> This is suggestive that deposit reallocations had a very significant impact on bank funding.

This framework naturally lends itself to an analysis of 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 estimated effect on lending is 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 a serious 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.

#### 4.4 Mover characteristics

While the previous results highlighted the bank-level risks that arise from the reallocation of deposits during a crisis, we now turn to an analysis of depositor-level behavior. Ultimately, we would like to understand why some depositors choose to reallocate uninsured deposits and others do not because the deep determinants of depositor behavior can help to establish the circumstances under which a crisis is more likely to trigger a run on bank deposits. The analysis is also relevant for current

---

<sup>13</sup> 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.

policy discussions about how regulatory tools, such as liquidity coverage ratios, can account for depositor characteristics when measuring liquidity risk.

We start by providing evidence on the splitting of deposits across banks by plotting the average number of accounts held by individuals as a function of their total deposits in the banking system. As shown in Figure 7 - Panel A, there is a notable increase in the average number of accounts at the onset of the crisis in 2008 and at the introduction of the insurance limit in 2010-2011, but only among individuals with total deposits above DKK 750,000. Interestingly, the increase in the number of accounts is growing monotonically in the total deposit balance; for instance, individuals with total deposits in the range DKK 1,500,000 - DKK 2,000,000 increased the average number of accounts by around 40% over the period 2007-2011 whereas the corresponding increase for individuals with total deposits in the range DKK 750,000 - DKK 1,000,000 is only around 10%. This is consistent with depositors splitting accounts across banks to increase the effective insurance coverage because the insurance gain from splitting is increasing in the total value of the deposit: an individual with a DKK 1,500,000 deposit can increase the insurance coverage by DKK 750,000 by splitting and should therefore be more likely to do so than an individual with a DKK 1,000,000 deposit for whom splitting can only increase the insurance coverage by DKK 250,000.

Figure 7 - Panel B shows an even starker picture by plotting the fraction of individuals who increases the number of accounts in a given year. The fraction is strikingly high in 2008 and 2010-2011 among individuals with total deposits above the insurance limit, but close to the 2007 baseline for others. In the highest deposit ranges, the likelihood of increasing the number of accounts is around twice as high in 2011 as in 2007. Note that individuals with total deposits in the range DKK 500,000 - DKK 750,000 were likely to increase the number of accounts in 2008 where the insurance limit was DKK 300,000, but not in 2010-2011 where the insurance limit was DKK 750,000.

These figures are strongly suggestive of individuals relocating deposits across accounts to avail of the deposit insurance. To examine the depositor characteristics associated with relocation, we begin by restricting the analysis to the roughly 9,700 accounts with a balance above DKK 750,000 in 2009. These are the accounts from which depositors might have relocated funds to other accounts in 2010-2011 in response to the new insurance limit. We define a *mover* (someone who reallocates funds) 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 reduced 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 note that our sample of *movers* surely includes some individuals who did not move funds across accounts 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 annual average of 476 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 depositors 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 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. These results imply that the true liquidity risk that arises from uninsured deposits far exceeds the amount that is held in excess of the deposit insurance limit.

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 whose relationship with the bank has a longer duration are less likely to be movers. Note that the effect of loan linkages is not driven by the presence of netting of loans and deposits in case of failure. Even if we rerun the regressions only considering net deposits (after subtracting loans outstanding) we find similar results. The results suggest that strong bank relationships attenuate concerns about safety and are in line with the new liquidity requirements in Basel III that categorize “stable deposits” as those where there is an established lending relationship. Finally, consistent with depositor beliefs about implicit guarantees, we also find that depositors in systemic banks are less likely to move.

Having examined the depositor characteristics associated with the moving of deposits away from *existing* accounts above the insurance limit, we now turn to the factors that increase the likelihood of opening *new* accounts above the limit. This is important given our previous bank-level results that the overall reallocation of deposits from non-systemic to systemic banks was partly driven by an increase in the creation of new uninsured accounts in systemic banks.

Table A3 in the Appendix reports the summary statistics of characteristics associated with depositors that open accounts over DKK 750,000 and contrasts them to those that open accounts in the range DKK 500,000 – 750,000. It is noteworthy that there was a substantial *increase* in the creation of new accounts over DKK 750,000 in 2010 suggesting that some depositors responded to the insurance limit by opening uninsured accounts. Interestingly, the education variables are very balanced across individuals opening accounts above and below the insurance limit suggesting that the opening of new uninsured accounts cannot be explained by a lack of sophistication. The most striking difference between the two groups is the size of their total deposit balance with individuals opening accounts above the limit having much larger balances than individuals opening accounts below the limit. All these findings are consistent with the notion that individuals, when choosing their deposit allocation in a crisis, trade off the benefits of full insurance with the transaction costs of managing multiple accounts: for individuals with higher total deposit balances, more accounts are necessary to obtain full insurance, so moving entire deposits to systemic banks or splitting deposits across fewer accounts above the insurance limit may be optimal.

Figure 8 provides further evidence that the opening of new accounts above DKK 750,000 in 2010 can be rationalized as a response to the reduced insurance coverage. Panel A shows that among depositors who opened an account above DKK 750,000, the fraction who increased their number of accounts by *more than one* increased sharply in 2010 and reached 20% in 2011. Hence, for an unusually large fraction of the individuals opening a new uninsured account in 2010-2011, this was part of a broader restructuring of their deposits. Further, Panel B shows that for around 30% of the individuals opening a new uninsured account in 2010-2011, this actually *reduced* the average account balance across all their accounts; and Panel C shows that for a similar fraction, it *reduced* their total uninsured balances. These findings plausibly reflect that some depositors with very large accounts responded to the tradeoff between insurance and transaction costs by engaging in imperfect splitting of deposits; for instance, the owner of a single DKK 3,000,000 account may have split it into three DKK 1,000,000 accounts, thereby increasing the number of accounts by two, reducing the average account balance by DKK 2,000,000 and reducing the total uninsured balance by DKK 1,500,000. This interpretation is supported by regressions reported in Table 8. Among individuals who opened uninsured accounts in 2010 and 2011, those with larger total deposit balances were more likely to open more than one new account and to reduce the average account balance and the total uninsured balance in the process.

While the bank-level results showed that the creation of uninsured accounts in 2010-2011 contributed to the overall reallocation of deposits toward systemic banks, the depositor-level results thus suggest that these account openings did not reflect a panic among unsophisticated depositors, but were to a large extent undertaken in the context of broader account restructurings that reduced depositors' exposure to bank failures. These results have important implications for the role of government policy in a crisis. The fact that deposit reallocations respond so strongly to incentives suggests that the deposit insurance limit, which shapes these incentives, is a powerful policy instrument.

#### **4. Conclusion**

We study the risks to the financial system posed by reallocations of deposits in the time of crisis. Our key result is that non-systemic banks lose almost half of their uninsured deposits during a crisis while the losses suffered by systemic banks are much smaller, presumably because of depositor beliefs that these banks are more likely to be bailed out in case of failure. Hence, government guarantees of systemic banks in combination with low deposit insurance limits may trigger large reallocations of deposits within the banking sector that can potentially threaten the stability of non-



systemic banks.<sup>14</sup> In countries with developed markets for alternative safe assets like treasury bonds, postal savings or money market funds, the threat to the banking system may be even larger than what we have found in Denmark since savings could migrate from the banking sector, including systemic banks, to these other safe assets.<sup>15</sup>

Our results speak to the design of recently implemented regulatory measures that aim to make banks more resilient to financial crisis and thus reduce the role of government guarantees. For instance, Basel III requires banks to hold liquidity buffers while assuming a runoff rate of 10% of uninsured deposits. Our estimates suggest that actual runoff rates in non-systemic banks are much higher, which raises concerns that the current regulatory framework would not suffice to protect the stability of the banking system in future crises.

Our main conclusion is that a relatively high deposit insurance limit is necessary in a financial crisis. This raises the question as to what can be done about the non-trivial moral hazard costs associated with these guarantees. One possible solution could be to provide explicit guarantees that are voluntary, but are accompanied by stricter regulation for the banks that opt in. However, this mechanism comes with the difficulties inherent to regulation of systemically important banks and the risk of political capture by these institutions. Alternative solutions are narrow banking (Pennacchi, 2012) and the breaking up of large banks. The important question that arises with these policies is whether illiquid assets such as loans can be financed with a less fragile form of funding, e.g. long-term bonds or equity, without significantly raising the cost of capital. Put 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 liquidity creation.

---

<sup>14</sup> A large number of small banks in the aggregate are systemically significant.

<sup>15</sup> In the 2008 financial crisis, after the failure of Lehman Brothers, there were significant inflows into money market funds that solely invested in government bonds. These inflows tapered at the end of September 2008 coinciding with the provision of unlimited insurance for transaction accounts (TAGP). A part of these inflows into money market funds has been argued by some to be a result of reallocation of large deposits from the banking sector before the passage of TAGP, when money market funds had unlimited insurance as against banks that had a more limited coverage.

## Bibliography

Allen, F., Carletti, E., Goldstein, I. and Leonello, A. (2014). Governments Guarantees and Financial Stability. Unpublished working paper.

Brown, M., Morkotter, S., and Guin, B. (2015). Switching Costs, Deposit Insurance and Deposit Withdrawals from Distressed Banks. *Mimeo*, University of St. Gallen.

Bryant, J. (1980). A model of reserves, bank runs, and deposit insurance. *Journal of Banking and Finance*, 4(4), 335–344.

Calomiris, C. W. and Kahn, C. M. (1991). The role of demandable debt in structuring optimal banking arrangements. *American Economic Review*, 497–513.

Chari, V. V. and Jagannathan, R. (1988). Banking panics, information, and rational expectations equilibrium. *The Journal of Finance*, 43(3), 749–761.

Chen, Y. (1999). Banking Panics: The Role of the First-Come, First-Served Rule and Information Externalities. *Journal of Political Economy*, 107(5), 946–968.

Dang, T. V., Gorton, G., and Holmström, B. (2013). Ignorance, debt and financial crises. Unpublished working Paper.

Davenport, A. M. and McDill, K. M. (2006). The depositor behind the discipline: A micro-level case study of Hamilton Bank. *Journal of Financial Services Research*, 30(1), 93–109.

Demirgüç-Kunt, A., and Detragiache, E. (2002). Does deposit insurance increase banking system stability? An empirical investigation. *Journal of Monetary Economics*, 49(7), 1373–1406.

Demirgüç-Kunt, A., Kane, E. J. and Laeven, L. (2008). Determinants of Deposit-Insurance Adoption and Design. *Journal of Financial Intermediation*, 17(3), 407-438.

Diamond, D., and Dybvig, P. (1983). Bank Runs, Deposit Insurance, and Liquidity. *Journal of Political Economy*, 91(3), 401–419.

Diamond, D., and Rajan, R. (2001). Liquidity risk, liquidity creation and financial fragility: A theory of banking. *Journal of Political Economy*, 109(2), 287–327.

Egan, M., Hortaçsu, A. and Matvos, G. (2015). Deposit Competition and Financial Fragility: Evidence from the US Banking Sector. working paper.

Flannery, M. J. (2010). What to do about TBTF? Unpublished working paper.

Flannery, M. J. and Sorescu, S. M. (1996). Evidence of bank market discipline in subordinated debenture yields: 1983–1991. *The Journal of Finance*, 51(4), 1347–1377.

Gatev, E. and Strahan, P. (2006). Banks' Advantage in Hedging Liquidity Risk: Theory and Evidence from the Commercial Paper Market. *The Journal of Finance*, 61(2), 867–892.

Gennaioli, N., Alberto, M. and Rossi, S. (2014). Sovereign Default, Domestic Banks, and Financial Institutions. *The Journal of Finance*, 69(2), 819–866.

Gennaioli, N., Shleifer, A. and Vishny, R. (2012). Neglected risks, financial innovation, and financial fragility. *Journal of Financial Economics*, 104(3), 452–468.

Goldstein, I. and Pauzner, A. (2005). Demand-deposit contracts and the probability of bank runs. *The Journal of Finance*, 60(3), 1293–1327.

Gorton, G. (1988). Banking Panics and Business Cycles. *Oxford Economic Papers*, 40(4), 751–781.

Gorton, G. and Pennacchi, G. (1990). Financial Intermediaries and Liquidity Creation. *The Journal of Finance*, 45(1), 49–71.

Gorton, G., and Ordoñez, G. (2014). Collateral Crises. *American Economic Review*, 104(2): 343–78.

Gorton, G., Lewellen, S., Metrick, A. (2012). The Safe-Asset Share. *American Economic Review*, 2012, 102(3), 101–106.

International Monetary Fund (2013). Deposit Insurance Technical Note. Financial Sector Assessment Program: European Union. Country Report No. 13/66.

Iyer, R. and Peydro, J.-L. (2011). Interbank Contagion at Work: Evidence from a Natural Experiment. *Review of Financial Studies*, 24(4), 1337–77.

Iyer, R. and Puri, M. (2012). Understanding Bank Runs: The Importance of Depositor-Bank Relationships and Networks. *American Economic Review*, 102(4), 1414–1445.

Iyer, R., Puri, M. and Ryan, N. (2015) Tale of Two Runs: Depositor Responses to Bank Solvency Risk. *Forthcoming Journal of Finance* .

Jacklin, C., and Bhattacharya, S. (1988). Distinguishing Panics and Information-Based Bank Runs: Welfare and Policy Implications. *Journal of Political Economy*, 96(3), 568–592.

Kelly, M. and Gráda, C. Ó. (2000). Market Contagion: Evidence from the Panics of 1854 and 1857. *American Economic Review*, 90(5), 1110–1124.

Moody's (2011). Moody's downgrades five Danish banks' senior ratings following reduction of systemic support. Global Credit Research.

Morrison, A. D. and White, L. (2011). Deposit insurance and subsidized recapitalizations. *Journal of Banking and Finance*, 35(12), 3400–3416.

New York Times (2010). FDIC to ask to insure greater amounts for U.S. deposits, by Edmund L. Andrews. October 1<sup>st</sup>, 2008.

Postlewaite, A. and Vives, X. (1987). Bank Runs as an Equilibrium Phenomenon. *Journal of Political Economy*, 95(3), 485–491.

Rangvid, J., Grosen, A., Østrup, F., Nielsen-Hansen, P., Schütze, P. and Jens Thomsen, J. (2013). Den Finansielle Krise i Danmark - årsager, konsekvenser og læring. Erhvervs- og Vækstministeriets.

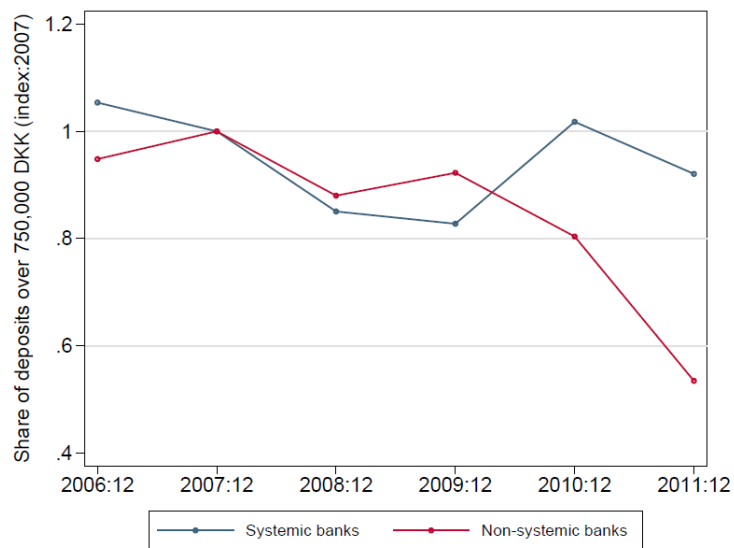
Rochet, J. C. and Vives, X. (2004). Coordination failures and the lender of last resort: was Bagehot right after all?. *Journal of the European Economic Association*, 2(6), 1116–1147.

Shin, H. (2009). Reflections on Northern Rock: The Bank Run that Heralded the Global Financial Crisis. *Journal of Economic Perspectives*, 23(1), 101-120.

Song, F. and Thakor, A. (2007). Relationship Banking, Fragility, and the Asset-Liability Matching Problem. *Review of Financial Studies*, 34(12), 2129–2177.

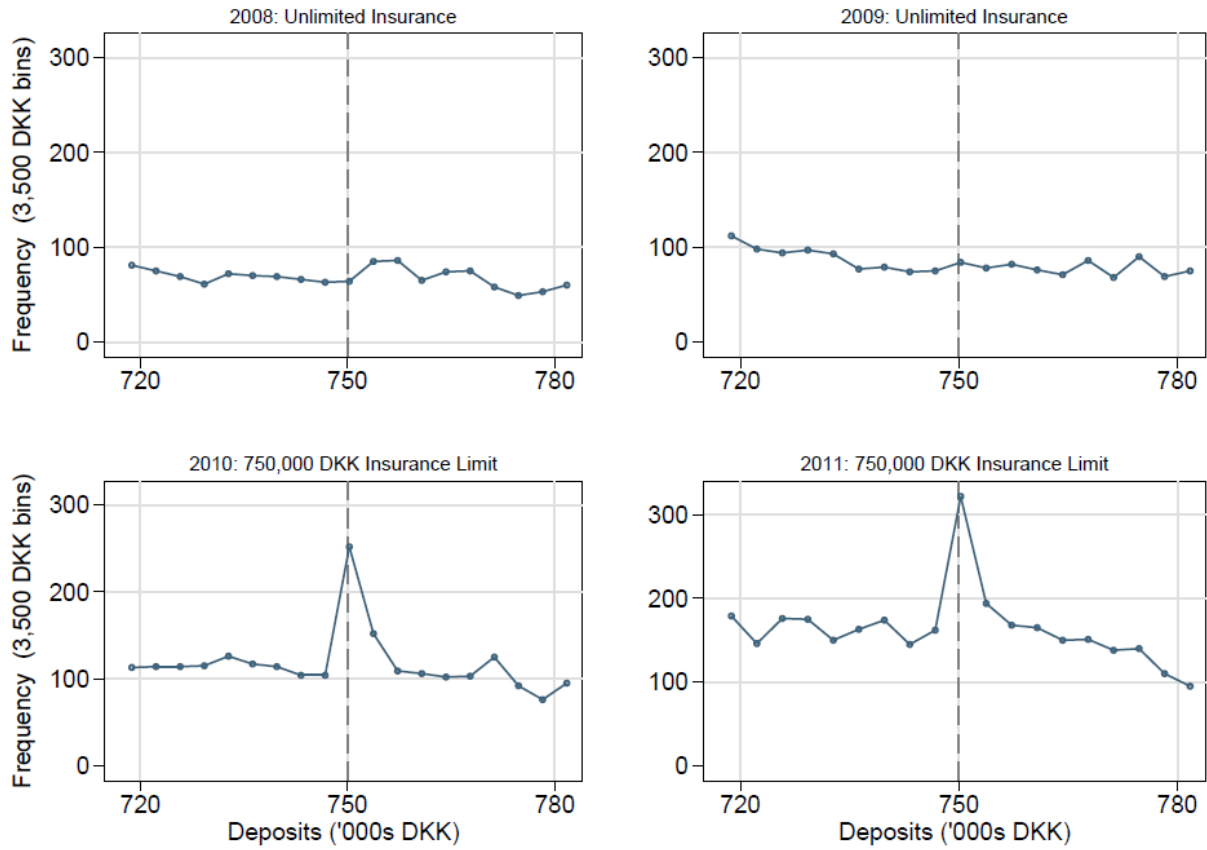
Strahan, P. (2013). Too Big to Fail: Causes, Consequences, and Policy Responses. *Annual Review of Financial Economics*, 5, 43–61.

FIGURE 1 – TREND IN THE SHARE OF DEPOSITS OVER DKK 750,000, BY SYSTEMIC IMPORTANCE



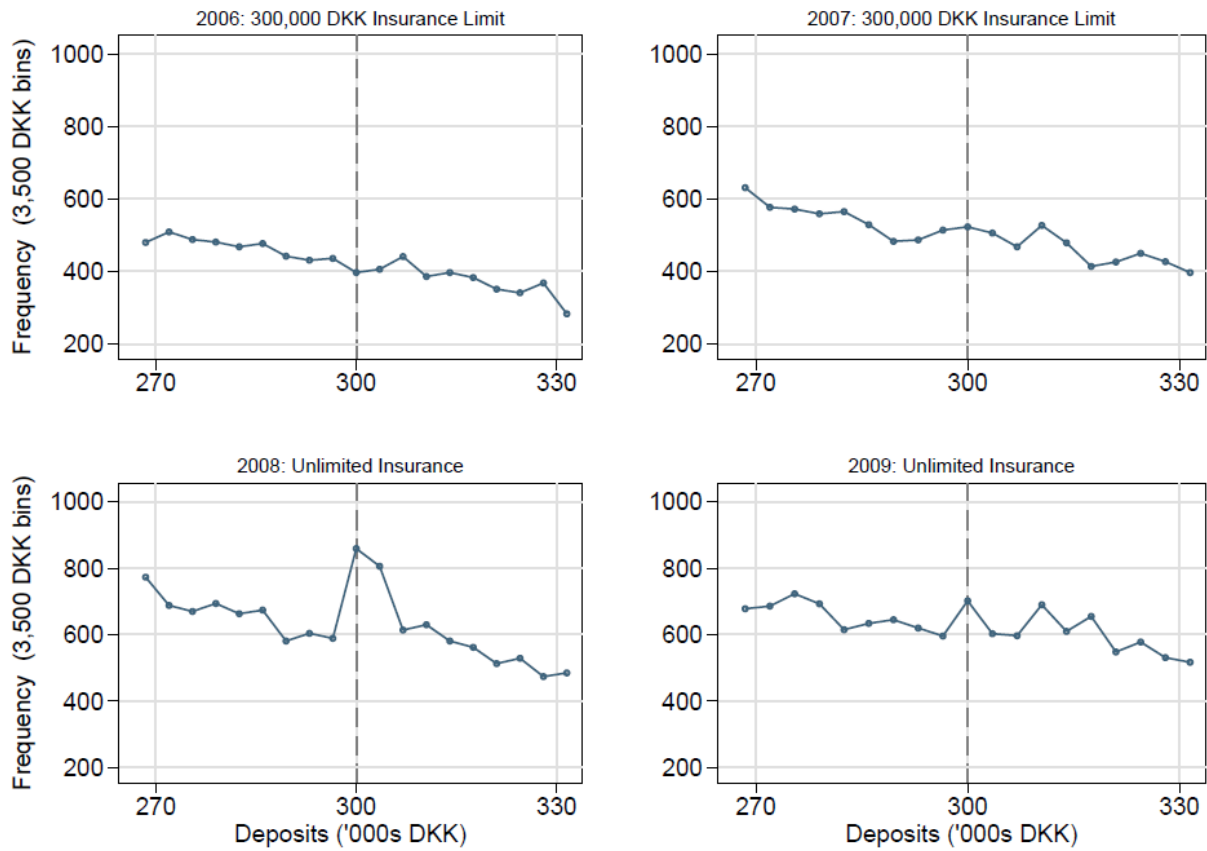
*Notes:* The figure shows the trend in the share of deposits coming from balances over DKK 750,000 in systemic banks (blue line) and non-systemic banks (red line) over the period 2006-2011. Systemic banks are the 6 largest banks by total assets in 2007. Non-systemic banks are the remaining 86 banks in the sample. The share of deposits over DKK 750,000 is calculated as deposit mass coming from balances over DKK 750,000 (e.g. DKK 150,000 for a deposit with a balance of DKK 900,000) divided by total deposits. For ease of comparison, the shares are normalized at the 2007-level.

FIGURE 2 – BUNCHING IN THE DEPOSIT DISTRIBUTION AROUND DKK 750,000



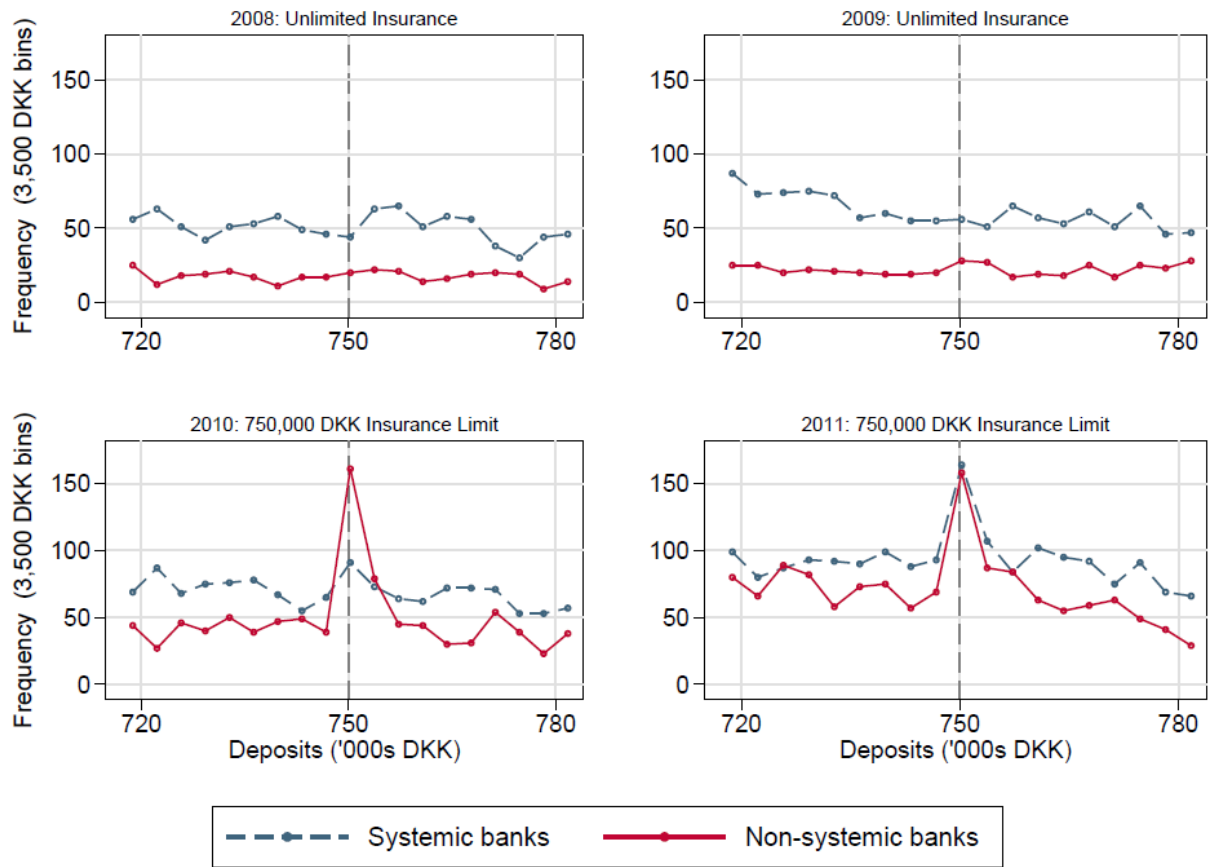
*Notes:* The figure illustrates the empirical distribution of account balances in a narrow window around DKK 750,000 for each of the years 2008-2009 (where all deposits were guaranteed by the government) and for 2010-2011 (where the insurance limit was DKK 750,000). The sample of deposit accounts is divided into DKK 3,500 (approximately USD 500) bins and counts of account balances are recorded for each bin. Thus, each point indicates the number of deposit accounts with balances within DKK 1,750 of the stated amount.

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



Notes: The figure illustrates the empirical distribution of account balances in a narrow window around DKK 300,000 for each of the years 2006-2007 (where the insurance limit was 300,000 DKK) and for 2008-2009 (where all deposits were guaranteed by the government). The sample of deposit accounts is divided into DKK 3,500 (approximately USD 500) bins and counts of account balances are recorded for each bin. Thus, each point indicates the number of deposit accounts with balances within DKK 1,750 of the stated amount.

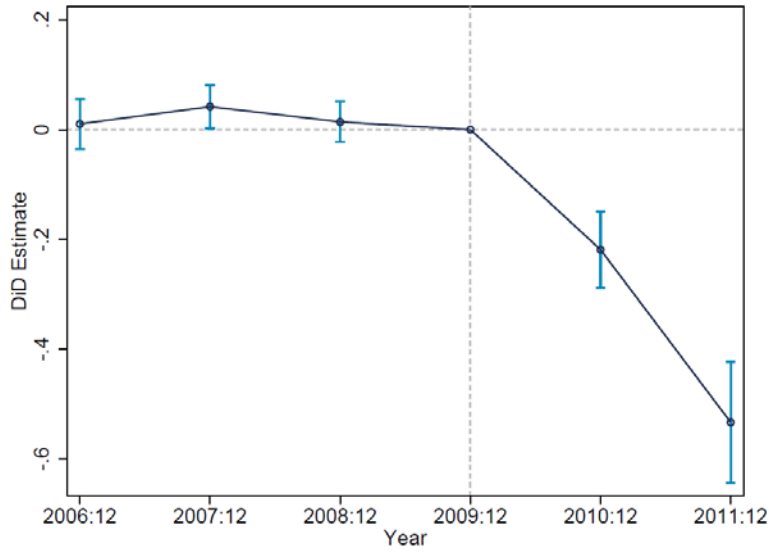
FIGURE 4 – BUNCHING AROUND DKK 750,000, BY SYSTEMIC IMPORTANCE



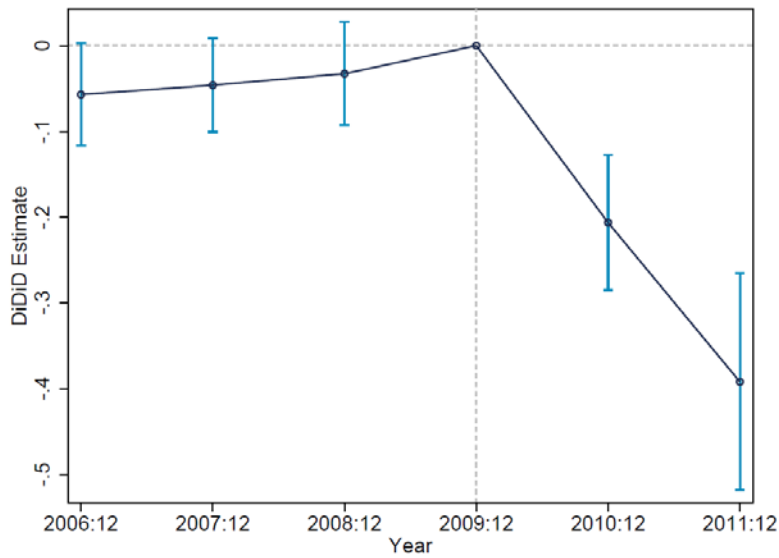
*Notes:* The figure illustrates the empirical distribution of account balances in a narrow window around DKK 750,000 for each of the years 2008-2009 (where all deposits were guaranteed by the government) and for 2010-2011 (where the insurance limit was DKK 750,000) for systemic and non-systemic banks separately. Systemic banks are the 6 largest banks by total assets in 2007. Non-systemic banks are the remaining 86 banks in the sample. The sample of deposit accounts is divided into DKK 3,500 (approximately USD 500) bins and counts of account balances are recorded for each bin. Thus, each point indicates the number of deposit accounts with balances within DKK 1,750 of the stated amount.



FIGURE 5 – DIFFERENTIAL TRENDS IN DEPOSITS, BY ACCOUNT SIZE AND SYSTEMIC IMPORTANCE



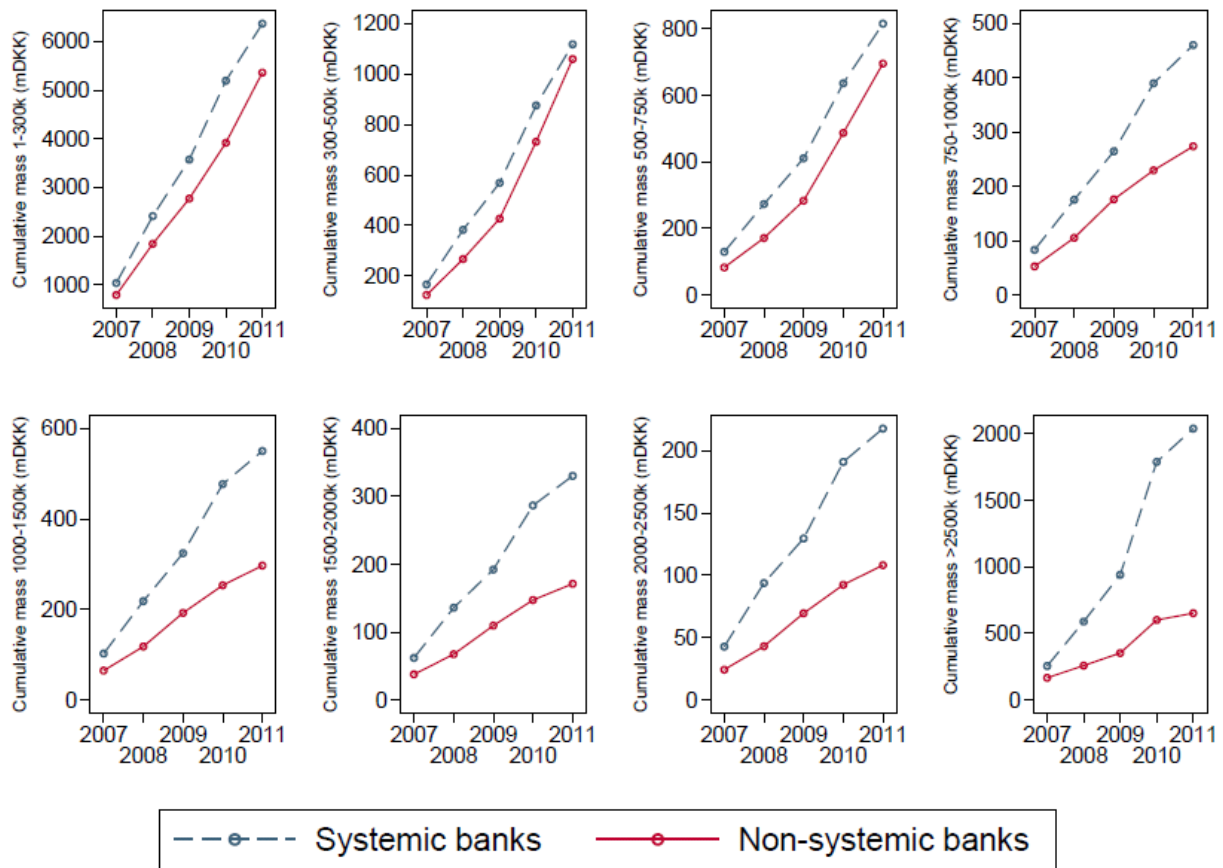
Panel A – Differential trend in deposits above DKK 750,000



Panel B – Differential trend in deposits above DKK 750,000 in non-systemic relative to systemic banks

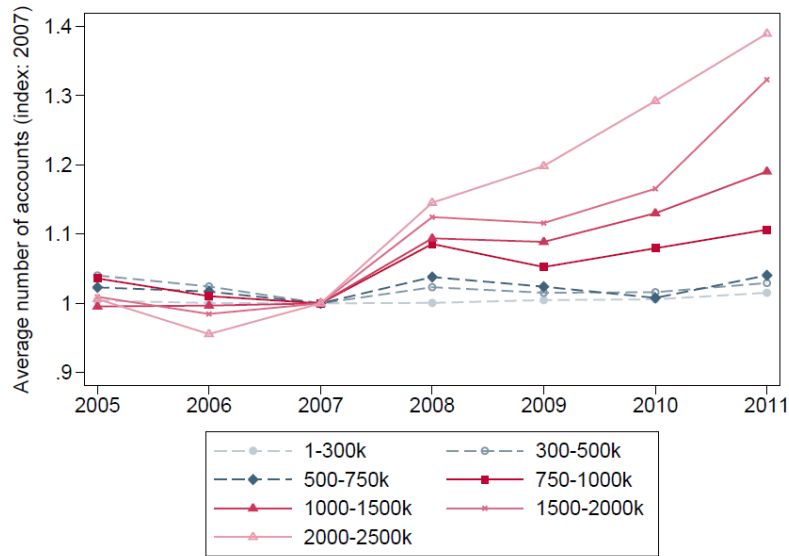
Notes: The figure illustrates the differential trend in deposits above DKK 750,000 relative to deposits below DKK 750,000 (Panel A) and the difference in this differential trend between systemic and non-systemic banks (Panel B). In Panel A, the points represent the coefficients on *Above*  $\times$  *Year* obtained from a variant of the regression model presented in Table 2, column 2 where *Above* is interacted with a full vector of year dummies. In Panel B, the points represent the coefficients on *Above*  $\times$  *Non-systemic*  $\times$  *Year* obtained from a variant of the regression model presented in Table 3, column 4 where *Above*  $\times$  *Non-systemic* is interacted with a full vector of year dummies. The omitted year is 2009. Vertical lines represent 95 percent confidence intervals for the estimates.

FIGURE 6 – DEPOSITS ON NEW ACCOUNTS, BY ACCOUNT SIZE AND SYSTEMIC IMPORTANCE

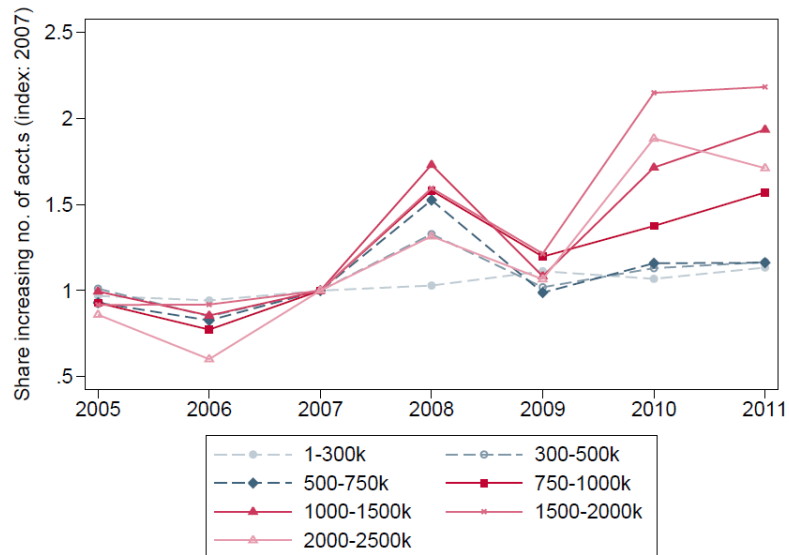


Notes: The figure shows the cumulative mass of deposits placed on new accounts in systemic banks (dashed line) and non-systemic banks (solid line) over the period 2007-2011 in eight ranges of deposit size. Systemic banks are the 6 largest banks by total assets in 2007. Non-systemic banks are the remaining 86 banks in the sample.

FIGURE 7 –TRENDS IN ACCOUNT FORMATION, BY TOTAL DEPOSIT HOLDINGS



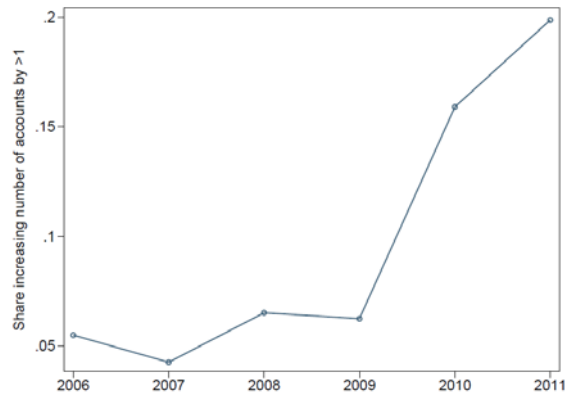
Panel A – Average number of accounts



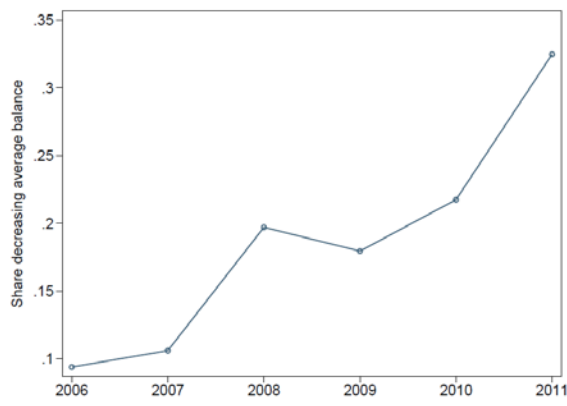
Panel B – Share increasing number of accounts

Notes: The figure illustrates the differential trends in account formation across depositors with different total deposit holdings. Panel A shows the average number of accounts for individuals with different total deposit balances. Panel B shows the fraction of individuals who increase their number of accounts year-to-year. Progressively darker dashed lines show ranges of total deposit holdings approaching the deposit insurance limit of DKK 750,000 introduced in 2010: these individuals require only 1 account to be fully insured from 2010. Progressively darker solid lines show ranges of total deposit holdings increasing above DKK 750,000: these individuals require more than 1 account to be fully insured from 2010. For ease of comparison, all variables are normalized at their 2007-level.

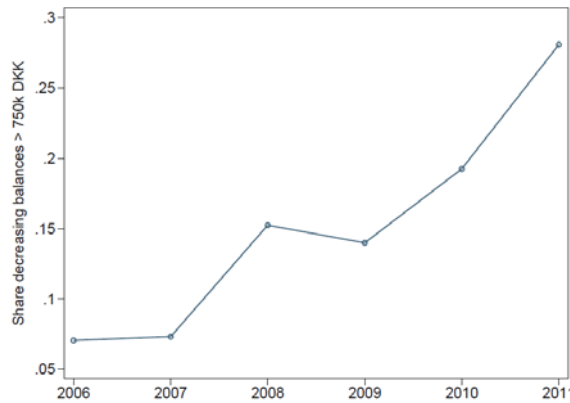
FIGURE 8 – INDIVIDUALS CREATING ACCOUNTS ABOVE DKK 750,000



*Panel A – Share opening more than 1 accounts*



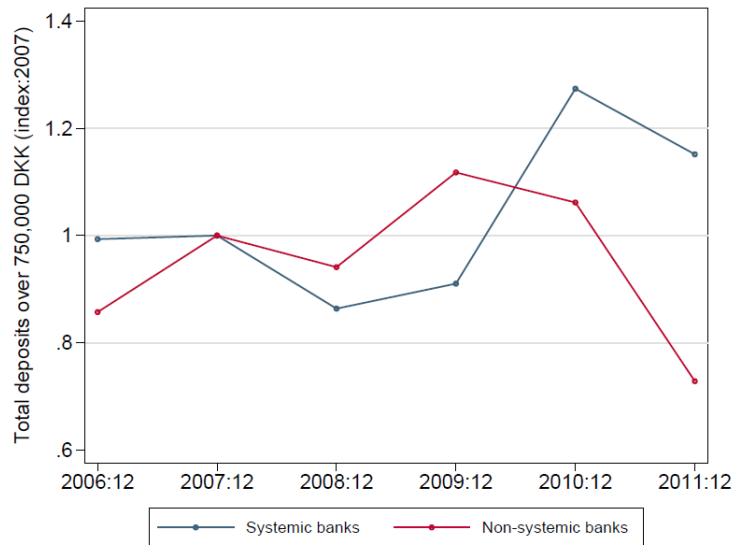
*Panel B – Share reducing average balance*



*Panel C- Share reducing exposure*

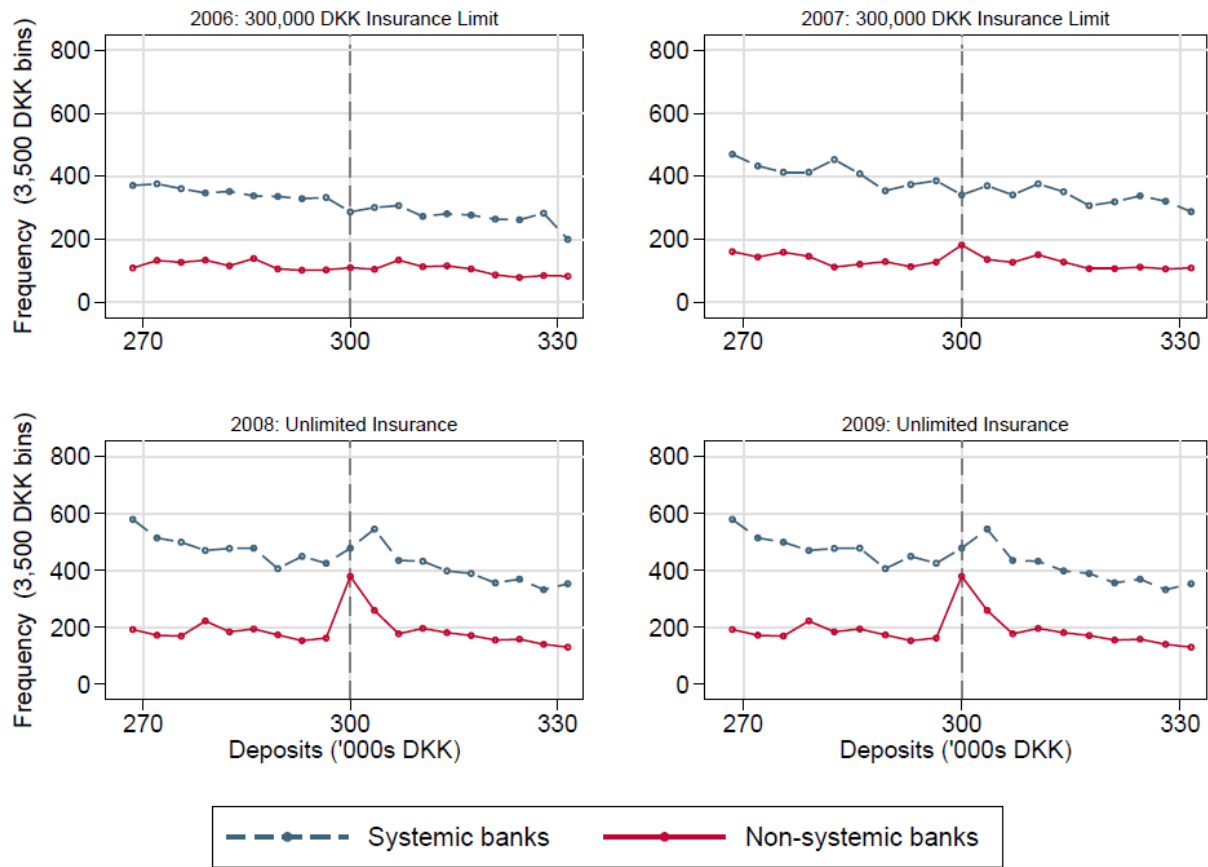
*Notes:* The figure analyses the sample of individuals who open new accounts with a balance above DKK 750,000 in the period 2006-2011. A new account is a positive deposit balance in a bank in year  $t$  where no relationship existed in year  $t-1$ . Panel A shows the share of these depositors who increase their total number of accounts by more than 1. Panel B shows the share of these depositors who reduce the average deposit balance across all their accounts. Panel C shows the share of these depositors who decrease total balances above DKK 750,000 across all accounts.

FIGURE A1 – TREND IN DEPOSITS OVER 750,000 DKK, BY SYSTEMIC IMPORTANCE



*Notes:* The figure shows the trend in deposits coming from balances over DKK 750,000 in systemic banks (blue line) and non-systemic banks (red line) over the period 2006-2011. Systemic banks are the 6 largest banks by total assets in 2007. Non-systemic banks are the remaining 86 banks in the sample. Deposits over DKK 750,000 are calculated as deposit mass coming from balances over DKK 750,000 (e.g. DKK 150,000 for a deposit with a balance of DKK 900,000). For ease of comparison, the figures are normalized at the 2007-level.

FIGURE A2 – BUNCHING AROUND DKK 300,000, BY SYSTEMIC IMPORTANCE



*Notes:* The figure illustrates the empirical distribution of account balances in a narrow window around DKK 300,000 for each of the years 2006-2007 (where the insurance limit was DKK 300,000) and for 2008-2009 (where all deposits were guaranteed by the government) for systemic and non-systemic banks separately. Systemic banks are the 6 largest banks by total assets in 2007. Non-systemic banks are the remaining 86 banks in the sample. The sample of deposit accounts is divided into DKK 3,500 (approximately USD 500) bins and counts of account balances are recorded for each bin. Thus, each point indicates the number of deposit accounts with balances within DKK 1,750 of the stated amount.

TABLE 1 – SUMMARY STATISTICS, BANK-LEVEL VARIABLES

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

*Notes:* *Systemic banks* are the six largest banks by total assets in 2007. *Non-systemic banks* are all other banks. *Share of total deposits > DKK 750,000* is deposit mass coming from balances over DKK 750,000 (e.g. DKK 150,000 for a deposit with a balance of DKK 900,000) divided by total deposits. *Deposit growth, 2007-2011* is the percentage change in total bank-level deposits from 2007-2011. *Lending growth, 2007-2011* is the percentage change in total bank-level lending from 2007-2011. *Total assets* is total bank-level assets. *Equity-asset ratio* is the ratio of total equity to total assets. *Loans-assets ratio* is the ratio of total lending to total assets. *Number of accounts > DKK 750,000* is the number of accounts with a balance exceeding DKK 750,000. *Number of accounts* is the number of accounts with any balance. All variables are recorded in 2007, unless stated otherwise.

TABLE 2 – DEPOSIT GROWTH AND THE INSURANCE LIMIT - MAIN RESULTS

	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*** (0.0283)	-0.567*** (0.0165)	-1.139*** (0.0262)	-1.144*** (0.0275)
After insurance change	0.316*** (0.0393)	0.351*** (0.0385)	0.110*** (0.0199)	0.110*** (0.0204)
Above insurance limit x After insurance change	-0.373*** (0.0520)	-0.399*** (0.0404)	-0.0687*** (0.0227)	-0.0766*** (0.0229)
Systemic bank	3.512*** (0.557)		3.513*** (0.592)	
Equity-assets ratio	-8.167*** (2.548)		-8.333*** (2.560)	
Loans-assets ratio	3.088*** (0.909)		3.371*** (0.902)	
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 from ordinary least squares regressions as well as robust standard errors clustered at the bank-level (in parentheses). The dependent variable in Columns (1) and (2) is the natural logarithm of bank deposits in 50,000 DKK ranges of the interval 500,000 – 1,000,000 DKK. The dependent variable in Columns (3) and (4) is the natural logarithm of bank deposits in 50,000 DKK ranges of the interval 50,000 – 500,000 DKK. *Above insurance limit* is an indicator variable for deposit ranges above DKK 750,000 in Columns (1) – (2) and above 300,000 DKK in Columns (3) – (4). *After insurance change* is an indicator for the years 2010 – 2011 in Columns (1) – (2) and for the year 2008 in Columns (3) – (4). *Systemic bank* is an indicator for the six largest banks by total assets measured in 2007. *Equity-asset ratio* is the ratio of total equity to total assets. *Loans-asset ratio* is the ratio of total lending to total assets. All regressions contain a constant (unreported). Statistical significance at the 1, 5 and 10 percent levels are indicated by \*\*\*, \*\* and \* respectively.



TABLE 3 – DEPOSIT GROWTH AND THE INSURANCE LIMIT - BY SYSTEMIC IMPORTANCE

	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*** (0.0283)	-0.567*** (0.0165)	-0.494*** (0.0305)	-0.569*** (0.0176)	-0.559*** (0.0534)
2010	0.276*** (0.0396)	0.319*** (0.0380)	0.279*** (0.0422)	0.325*** (0.0405)	0.180** (0.0793)
2011	0.357*** (0.0441)	0.384*** (0.0442)	0.358*** (0.0470)	0.387*** (0.0471)	0.248* (0.127)
Above insurance limit x 2010	-0.255*** (0.0415)	-0.256*** (0.0339)	-0.268*** (0.0443)	-0.268*** (0.0360)	-0.286*** (0.0702)
Above insurance limit x 2011	-0.493*** (0.0754)	-0.546*** (0.0542)	-0.514*** (0.0804)	-0.570*** (0.0572)	-0.693*** (0.187)
Above insurance limit x Systemic			-0.0441 (0.0350)	0.0306 (0.0244)	0.0206 (0.0562)
Systemic bank x 2010			-0.0444 (0.0734)	-0.0909 (0.0729)	0.0543 (0.101)
Systemic bank x 2011			-0.0256 (0.0858)	-0.0546 (0.0863)	0.0849 (0.148)
Above insurance limit x Systemic bank x 2010			0.185*** (0.0466)	0.185*** (0.0389)	0.203** (0.0718)
Above insurance limit x Systemic bank x 2011			0.287*** (0.0870)	0.343*** (0.0663)	0.466** (0.190)
Systemic bank	3.513*** (0.557)		3.502*** (0.561)		
Equity-assets ratio	-8.162*** (2.550)		-8.160*** (2.552)		
Loans-assets ratio	3.089*** (0.910)		3.089*** (0.911)		
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 from ordinary least squares regressions as well as robust standard errors clustered at the bank-level (in parentheses). The dependent variable is the natural logarithm of bank deposits in 50,000 DKK ranges of the interval 500,000 – 1,000,000 DKK. *Above insurance limit* is an indicator for deposit ranges above DKK 750,000. *2010* and *2011* are indicators for the years 2010 and 2011 respectively. *Systemic bank* is an indicator for the six largest banks by total assets measured in 2007. *Equity-asset ratio* is the ratio of total equity to total assets. *Loans-asset ratio* is the ratio of total lending to total assets. The sample consists of all 92 banks in Columns (1)-(6) and the largest 12 banks in Column (7). All regressions contain a constant (unreported). Statistical significance at the 1, 5 and 10 percent levels are indicated by \*\*\*, \*\* and \* respectively.

TABLE 4 – DEPOSIT GROWTH AND THE INSURANCE LIMIT - ROBUSTNESS

	<i>Panel A: Existing Accounts</i>			<i>Panel B: New Accounts</i>			
	Log of deposits in 50,000 DKK ranges, from 500,000 – 1,000,000 DKK			Log of deposits in 50,000 DKK ranges, from 500,000 – 1,000,000 DKK			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Above insurance limit	-0.554*** (0.0182)	-0.557*** (0.0195)	-0.535*** (0.0587)	-0.602*** (0.0234)	-0.603*** (0.0253)	-0.633*** (0.0311)	-0.569*** (0.0290)
2010	0.0922*** (0.0280)	0.0965*** (0.0300)	0.00966 (0.0803)	0.0787 (0.0615)	0.0783 (0.0659)	-0.0616 (0.145)	0.0898 (0.0658)
2011	-0.125*** (0.0388)	-0.126*** (0.0417)	-0.214* (0.118)	-0.127*** (0.0478)	-0.131** (0.0512)	-0.369* (0.179)	-0.0991* (0.0540)
Above insurance limit x 2010	-0.120*** (0.0267)	-0.123*** (0.0286)	-0.217** (0.0918)	-0.253*** (0.0553)	-0.268*** (0.0594)	-0.337*** (0.102)	-0.215*** (0.0689)
Above insurance limit x 2011	-0.285*** (0.0513)	-0.299*** (0.0551)	-0.554** (0.206)	-0.467*** (0.0631)	-0.490*** (0.0688)	-0.748*** (0.141)	-0.502*** (0.0744)
Above insurance limit x Systemic		0.0358 (0.0256)	0.0140 (0.0612)		0.00467 (0.0349)	0.0347 (0.0400)	0.00847 (0.0430)
Systemic bank x 2010		-0.0635* (0.0371)	0.0234 (0.0835)		0.00358 (0.114)	0.143 (0.174)	0.313 (0.272)
Systemic bank x 2011		0.00374 (0.0545)	0.0918 (0.123)		0.0480 (0.0832)	0.286 (0.192)	0.119 (0.159)
Above insurance limit x Systemic bank x 2010		0.0553 (0.0361)	0.150 (0.0947)		0.188** (0.0726)	0.256** (0.111)	-0.0497 (0.127)
Above insurance limit x Systemic bank x 2011		0.184*** (0.0675)	0.439* (0.210)		0.235*** (0.0818)	0.493*** (0.148)	0.333** (0.143)
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,232	4,232	600	3,949	3,949	600	3,588
R-squared	0.928	0.928	0.924	0.890	0.890	0.946	0.783
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	2007:12 – 2011:12
Bank sample	All	All	Largest 12	All	All	Largest 12	All

*Notes:* This table reports the estimated coefficients from ordinary least squares regressions as well as robust standard errors clustered at the bank-level (in parentheses). The dependent variable is the natural logarithm of bank deposits in DKK 50,000 ranges of the interval DKK 500,000 – 1,000,000. *Above insurance limit* is an indicator for deposit ranges above DKK 750,000. *2010* and *2011* are indicators for the years 2010 and 2011 respectively. *Systemic bank* is an indicator for the six largest banks by total assets measured in 2007. Panel A only includes accounts with balances above DKK 500,000 in 2009. Panel B only includes accounts in year  $t$  belonging to individuals who had no accounts above DKK 500,000 in year  $t-1$ . The sample consists of all 92 banks in Columns (1)-(2), (4)-(5) and (7) and the largest 12 banks in Columns (3) and (6). Column (7) only includes accounts in year  $t$  that are owned by individuals with only non-systemic bank accounts in  $t-1$ . All regressions contain a constant (unreported). Statistical significance at the 1, 5 and 10 percent levels are indicated by \*\*\*, \*\* and \* respectively.

TABLE 5 – EXPOSURE TO THE DEPOSIT INSURANCE LIMIT AND LENDING GROWTH

	Change in log deposits, 2007-2011		Change in log lending, 2007-2011			
	(1)	(2)	(3)	(4)	(5)	(6)
Instrumented change in log deposit, 2007-2011			0.381*** (0.137)	0.344** (0.165)		
Share of total deposits > DKK 750,000	-1.415*** (0.412)	-1.496*** (0.374)			-0.540** (0.222)	-0.514* (0.283)
Systemic bank		0.147 (0.181)		-0.00881 (0.126)		0.0416 (0.157)
Equity-debt ratio		-0.278 (0.989)		0.802 (0.598)		0.706 (0.615)
Loans-assets ratio		0.329 (0.301)		-0.398* (0.224)		-0.285 (0.257)
Constant	0.576*** (0.0764)	0.413 (0.341)	-0.0396 (0.0607)	0.105 (0.228)	0.180*** (0.0377)	0.247 (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 from an IV estimation aiming to capture the effect of the deposit insurance reform on bank lending. Columns (1)-(2) present the results from the first stage. The dependent variable is the *change in the log of total deposits over the period 2007-2011* and the instrument is the *share of total deposits > DKK 750,000* in 2007. Columns (3)-(4) present the results from the second stage. The dependent variable is the *change in the log of total lending over the period 2007-2011*. Columns (5)-(6) show the results of the reduced-form estimation. *Systemic bank* is an indicator for the six largest banks by total assets measured in 2007. *Equity-asset ratio* is the ratio of total equity to total assets. *Loans-asset ratio* is the ratio of total lending to total assets. All regressions contain a constant (unreported). Statistical significance at the 1, 5 and 10 percent levels are indicated by \*\*\*, \*\* and \* respectively.

TABLE 6 – INDIVIDUAL AND ACCOUNT-LEVEL CHARACTERISTICS OF MOVERS AND NON-MOVERS

	Movers		Non-Movers	
	Mean	SD	Mean	SD
<i>Panel A. Individual Characteristics</i>				
Age	60.21	12.68	58.56	15.31
Female	0.43	0.50	0.41	0.49
Married	0.60	0.49	0.55	0.50
Education, short	0.12	0.32	0.11	0.32
Education, medium	0.37	0.48	0.35	0.48
Education, long	0.30	0.46	0.30	0.46
Retired	0.38	0.48	0.33	0.47
Self employed	0.16	0.36	0.20	0.40
Unemployment, 24m	25.64	122.10	17.28	97.53
After-tax income ('000s)	331.96	486.15	459.60	762.98
Standard dev. of income ('000s)	103.03	261.72	155.95	387.90
Bank debt ('000s)	228.91	889.88	478.39	1,402.12
Total debt ('000s)	691.97	2,231.84	1,293.32	3,087.03
Debt-income ratio	0.18	0.41	0.30	0.59
Total assets ('000s)	3,624.63	4,936.82	4,892.72	6,775.75
Percentage change in assets	0.38	0.41	0.42	0.41
Stock market participation	0.62	0.49	0.60	0.49
Value of stock holdings ('000s)	254.69	800.68	352.42	1,080.22
<i>Panel B. Account/relationship characteristics</i>				
Loan linkage	0.26	0.44	0.36	0.48
Account age	4.03	1.82	4.20	1.67
Systemic bank	0.61	0.49	0.75	0.43
<i>Panel C. Deposit holdings</i>				
Account balance ('000s):				
2007	605.56	865.65	865.48	1,408.44
2008	747.88	757.50	1,065.97	1,384.80
2009	1,027.36	543.45	1,609.77	1,409.57
2010	751.25	589.64	1,119.59	1,429.61
2011	517.86	248.59	974.95	1,446.78
Total deposits ('000s):				
2007	1,520.56	5,915.75	1,658.89	6,178.13
2008	1,437.02	4,033.88	1,648.14	4,184.09
2009	1,606.18	3,480.52	2,115.44	3,696.42
2010	1,711.33	4,690.55	1,812.60	4,953.47
2011	1,917.60	5,245.69	1,630.45	4,712.62
Observations		1,280		8,405

*Notes:* All variables are recorded in 2007, unless stated otherwise. The full sample is all accounts over DKK 750,000 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 DKK 750,000 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 DKK 750,000 but without compensation in another account/other accounts, or remains over the DKK 750,000 insurance limit in 2011. *Age* is the age in years of the account-holder. *Female* is an indicator that the account-holder is female. *Married* is an indicator that the account-holder is married. *Education, short* is an indicator that the highest qualification is a high-school diploma. *Education, medium* is an indicator that the highest qualification is a bachelor degree or equivalent. *Education, long* is an indicator that the highest qualification is a master degree or higher. *Retired* is an indicator that the account-holder is retired. *Self-employed* is an indicator that the account-holder is self-employed. *Unemployment, 24m* indicates the proportion of the previous 24 months (measured per 1000) that the account-holder has been unemployed. *After-tax income* indicates the total earned income after deduction of tax. *Standard dev. of income* indicates the standard deviation of the account-holders after-tax income over the period 2003-2007. *Bank debt* indicates total value of bank debt (excluding debt to mortgage institutions but including all other bank-granted secured and unsecured credit). *Total debt* indicates the total value of the bank debt (including debt to mortgage institutions and banks). *Debt-income ratio* indicates the ratio of total debt to after-tax income. *Total assets* indicates the total value of assets (including properties, bank deposits, shares, bonds and mortgage-deeds, but

---

excluding pension accounts). *Percentage change in assets* indicates the change in total assets over the period 2003-2009. *Stock market participation* is an indicator that the account-holder owns shares. *Value of stock holdings* indicates the market value of the account-holder's portfolio of shares. *Loan linkage* indicates whether the account-holder borrows from the same bank at which it deposits. Account age indicates the number of years the account has had a positive balance. *Account balance* indicates the account balance. *Total deposits* indicates the total deposit holdings of the account-holder.

TABLE 7 – DETERMINANTS OF DEPOSITOR DECISION TO SPLIT UNINSURED ACCOUNTS

	Mover definition 1			Mover definition 2
	(1)	(2)	(3)	(4)
Age	0.00119*** (0.000363)	0.00111*** (0.000366)	0.00117*** (0.000365)	0.00112*** (0.000397)
Female	0.00146 (0.00772)	0.000546 (0.00775)	0.00218 (0.00775)	0.00474 (0.00827)
Married	0.0229*** (0.00724)	0.0207*** (0.00740)	0.0202*** (0.00741)	0.0264*** (0.00794)
Education, short	0.0496*** (0.0137)	0.0511*** (0.0138)	0.0491*** (0.0138)	0.0379** (0.0147)
Education, medium	0.0395*** (0.0104)	0.0374*** (0.0106)	0.0370*** (0.0106)	0.0281** (0.0114)
Education, long	0.0492*** (0.0111)	0.0526*** (0.0115)	0.0546*** (0.0115)	0.0458*** (0.0125)
Retired	-0.00303 (0.0121)	-0.000499 (0.0121)	-0.00226 (0.0121)	-0.00577 (0.0129)
Self-employed	0.0211** (0.00998)	0.0184* (0.0101)	0.0198* (0.0102)	0.0176 (0.0108)
Unemployment, 24m	0.0860** (0.0401)	0.0920** (0.0403)	0.0845* (0.0401)	0.1070** (0.0428)
Debt-to-income ratio	-0.0358*** (0.00632)	-0.0348*** (0.00641)	-0.0345*** (0.00654)	-0.0353*** (0.00720)
After-tax income	0.000268 (0.00489)	-0.000342 (0.00490)	-0.000318 (0.00480)	0.00234 (0.00520)
Standard dev. of income	0.00920*** (0.00285)	0.00951*** (0.00285)	0.00908*** (0.00285)	0.00848*** (0.00302)
Total assets	-0.00919** (0.00396)	-0.00811** (0.00398)	-0.00803** (0.00402)	-0.00833* (0.00436)
Percentage change in assets	-0.00397 (0.00977)	-0.00173 (0.00980)	-0.000162 (0.00984)	-0.00365 (0.0105)
Stock market participation	0.0389 (0.0282)	0.0382 (0.0284)	0.0378 (0.0284)	0.0476 (0.0306)
Value of stock holdings	-0.00212 (0.00239)	-0.00200 (0.00240)	-0.00238 (0.00240)	-0.00251 (0.00259)
Loan linkage	-0.0196** (0.00811)	-0.0204** (0.00818)	-0.0192** (0.00824)	-0.0230*** (0.00889)
Account age	-0.00743*** (0.00247)	-0.00812*** (0.00249)	-0.00753*** (0.00261)	-0.00655** (0.00262)
Account balance	-0.147*** (0.00641)	-0.146*** (0.00647)	-0.145*** (0.00649)	-0.177*** (0.00696)
Systemic bank	-0.0655***	-0.0618***		-0.0646***

	(0.00875)	(0.00960)		(0.0102)
Municipality fixed effects	No	Yes	Yes	Yes
Bank fixed effects	No	No	Yes	No
Observations	9,113	9,113	9,113	9,113
R-squared	0.068	0.083	0.102	0.091

---

*Notes:* This table reports the estimated coefficients from linear probability models as well as robust standard errors (in parentheses). The sample is all accounts with balances over DKK 750,000 in 2009, where the account-owner is older than 25. The dependent variable in Columns (1) – (3) is an indicator variable that is equal to 1 for an individual account where the balance falls below DKK 750,000 and the value of the DKK fall, net of 275,000 DKK, is deposited into one, or across several, accounts of the same owner, and 0 otherwise. The netting amount, 275,000 DKK, is the average year-on-year change in balance for the period 2003-2007. The reported coefficient on *Unemployment, 24m* is scaled by 1000. The variables *After-tax income*, *Total assets*, *Value of stock holdings* and *Account balance* enter in their logarithm. *Standard dev. of income* is standardised and is measured over the period 2003-2009. *Percentage change in assets* is measured over the period 2003-2009. All regressions contain a constant (unreported). Precise definitions of all variables can be found in the notes to Table 6. Statistical significance at the 1, 5 and 10 percent levels are indicated by \*\*\*, \*\* and \* respectively.

TABLE 8 – DETERMINANTS OF DEPOSITOR DECISION TO OPEN NEW UNINSURED ACCOUNT

	Increase number of accounts by more than 1			Decrease average balance	Decrease total balances over 750k
	(1)	(2)	(3)	(4)	(5)
Lag total deposits	0.0185*** (0.00483)	0.0111** (0.00528)	0.0127** (0.00582)	0.103*** (0.00533)	0.0900*** (0.00540)
Age		-0.0032 (0.0111)	-0.0014 (0.0116)	-0.0062 (0.0115)	-0.0030 (0.0114)
Female		0.0465 (0.244)	-0.0004 (0.255)	-0.0806 (0.245)	-0.1210 (0.238)
Married		0.469** (0.232)	0.486** (0.247)	-0.0191 (0.24)	-0.0380 (0.239)
Education, short		-0.6060 (0.425)	-0.3110 (0.426)	0.3390 (0.446)	0.6450 (0.439)
Education, medium		-0.1460 (0.358)	0.0484 (0.356)	-0.2510 (0.36)	-0.1120 (0.359)
Education, long		0.0503 (0.371)	0.0736 (0.383)	-0.0903 (0.385)	-0.2290 (0.387)
Retired		-0.3680 (0.425)	-0.2290 (0.437)	0.0386 (0.429)	-0.1010 (0.422)
Self-employed		-0.2840 (0.361)	-0.1380 (0.374)	0.5190 (0.358)	0.5030 (0.354)
Unemployment, 24m		-0.0007 (0.0007)	-0.0005 (0.0007)	0.0011 (0.0008)	0.0002 (0.0008)
Debt-to-income ratio		-0.0473 (0.0323)	-0.0415 (0.0355)	-0.0423 (0.0282)	-0.0260 (0.0277)
After-tax income		0.2510 (0.246)	0.2910 (0.249)	-0.364* (0.214)	-0.362* (0.214)
Standard dev. of income		0.1260 (0.095)	0.0969 (0.093)	-0.0432 (0.1)	-0.1220 (0.0984)
Total assets		0.158* (0.092)	0.164* (0.0964)	0.1650 (0.0892)	0.2810 (0.0864)
Percentage change in assets		-0.2970 (0.196)	-0.2200 (0.212)	-0.0757 (0.136)	-0.1970 (0.143)
Stock market participation		0.1950 (0.923)	-0.1490 (0.992)	-0.4150 (0.904)	-1.1300 (0.861)
Value of stock holdings		-0.0273 (0.0805)	0.0005 (0.0869)	0.0195 (0.0788)	0.0841 (0.0755)
Municipality fixed effects	No	No	Yes	Yes	Yes
Observations	1,126	1,126	1,126	1,126	1,126
R-squared	0.015	0.046	0.164	0.411	0.378

*Notes:* This table reports the estimated coefficients from linear probability models as well as robust standard errors (in



---

parentheses). The sample are the individuals who open new accounts with balances above DKK 750,000 in years 2010 and 2011. The dependent variable in Columns (1) – (3) is an indicator for individuals whose total number of accounts increases by more than 1. The dependent variable in Column (4) is an indicator for individuals who reduces their average balance across all accounts. The dependent variable in Column (5) is an indicator variable for individuals who reduce their total deposit holdings in excess of DKK 750,000. The key explanatory variable is *Lag total deposits*: individual-level total deposit holdings in the previous year. Precise definitions of all variables can be found in the notes to Table 6. The variables *After-tax income*, *Total assets*, *Value of stock holdings* and *Account balance* enter in their logarithm. *Standard dev. of income* is standardised and is measured over the period 2003-2009. *Percentage change in assets* is measured over the period 2003-2009. Only individuals older than 25 are included in the regression. The reported coefficient and standard error on all variables except *Lag total deposits* are scaled up by 10. Statistical significance at the 1, 5 and 10 percent levels are indicated by \*\*\*, \*\* and \* respectively.

TABLE A1 –ACCOUNT-LEVEL AND DEPOSITOR-LEVEL CHARACTERISTICS OF ACCOUNTS, BY DEPOSIT SIZE IN 2009

<i>Deposit range:</i>	1-300k	300k-500k	500k-750k	750k-1000k	1000k+
	Mean				
<i>Panel A. Individual Characteristics</i>					
Age	40.95	57.92	58.33	58.59	58.03
Female	0.5	0.49	0.46	0.44	0.39
Married	0.52	0.59	0.58	0.54	0.56
Education, short	0.19	0.13	0.12	0.12	0.12
Education, medium	0.29	0.37	0.37	0.37	0.34
Education, long	0.17	0.26	0.26	0.28	0.31
Retired	0.16	0.37	0.37	0.36	0.32
Self employed	0.04	0.07	0.1	0.12	0.23
Unemployment, 24m	41.31	27.36	25.66	24.28	15.07
After-tax income ('000s)	169.94	219.71	250.74	289.16	546.25
Bank debt ('000s)	103.64	120.60	171.10	241.17	578.94
Total debt ('000s)	406.83	431.14	540.56	708.73	1,559.99
Total assets ('000s)	856.10	1,978.81	2,505.85	3,257.39	5,705.13
Stock market participation	0.25	0.51	0.54	0.57	0.6
Value of stock holdings ('000s)	26.46	100.58	146.62	219.15	418.25
<i>Panel B. Account/relationship characteristics</i>					
Loan linkage	0.43	0.41	0.43	0.44	0.47
Account age	3.75	4.23	4.25	4.24	4.12
Systemic bank	0.72	0.72	0.74	0.73	0.73
<i>Panel C. Deposit holdings</i>					
Total deposits ('000s):					
2007	62.96	332.34	467.04	597.48	2,508.33
2009	69.52	463.55	699.98	957.20	2,780.75
2011	86.52	449.36	610.51	753.95	2,919.78
Deposits-to-assets:					
2007	0.47	0.36	0.35	0.34	0.66
2009	0.51	0.47	0.5	0.52	0.76
2011	0.53	0.43	0.44	0.43	0.68
Observations	520,062	20,614	9,681	3,906	5,914

*Notes:* The table reports account-level and depositor-level characteristics by size of the deposit balance in 2009. All statistics are reported as averages at the account-level and all variables are recorded in 2007, unless stated otherwise. Precise definitions of all variables can be found in the notes to Table 6. The sample includes all individuals above 25 years of age.

TABLE A2 – INTEREST RATES AND CHANGES TO THE DEPOSIT INSURANCE LIMIT

	Imputed interest rate in 250,000 DKK ranges, from 500,000 – 1,000,000 DKK	
	(1)	(2)
Above insurance limit	-0.0093 (0.0519)	-0.0173 (0.0597)
2010	-1.2000*** (0.0992)	-1.2000*** (0.1120)
2011	-1.3800*** (0.0803)	-1.3600*** (0.0905)
Above insurance limit x 2010	0.0790 (0.0842)	0.09410 (0.0968)
Above insurance limit x 2011	0.1730** (0.0785)	0.1940** (0.0884)
Above insurance limit x Systemic bank		0.0614 (0.0663)
Systemic bank x 2010		0.0192 (0.2060)
Systemic bank x 2011		-0.0912 (0.1580)
Above insurance limit x Systemic bank x 2010		-0.1160 (0.1090)
Above insurance limit x Systemic bank x 2011		-0.1650 (0.1460)
Bank fixed effects	Yes	Yes
Observations	552	552
R-squared	0.435	0.436
Sample period	2007:12 – 2011:12	2007:12 – 2011:12

*Notes:* This table reports the estimated coefficients from ordinary least squares regressions as well as robust standard errors (in parentheses). The dependent variable is the average imputed interest rate on bank deposits in 250,000 DKK ranges of the interval 500,000 – 1,000,000 DKK. Imputed interest rates are first calculated at the account-level as accrued interest over the year divided by the average of the account balance at the beginning and the end of the year. To reduce noise, only accounts experiencing less than 20% growth over the year are included when interest rates are averaged at the bank-range-level. *Above insurance limit* is an indicator for deposit ranges above DKK 750,000. *2010* and *2011* are indicators for the years 2010 and 2011 respectively. *Systemic bank* is an indicator for the six largest banks by total assets measured in 2007. All coefficients are scaled up by a factor 100. Statistical significance at the 1, 5 and 10 percent levels are indicated by \*\*\*, \*\* and \* respectively.