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Fear, deposit insurance schemes, and deposit reallocation in the German banking system

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Non-technical summary

Research Question
In order to break the vicious interrelation between sovereign debt crises and bank crises, also known as the 'doom loop', recent regulatory initiatives such as the European Deposit Insurance Scheme propose a change in the coverage and backing of deposit insurances. An assessment of these proposals requires a thorough understanding of what drives depositors' withdrawal decisions. For example, it remains unclear whether deposit reallocations during the Euro area sovereign debt crisis were a result of depositors' worries about the backing of the domestic deposit insurance or whether the deposit shift was predominantly driven by the elevated redenomination risk, i.e. fears of a breakup of the Euro. In this paper we answer the question whether in the absence of a redenomination risk, a heterogeneous governmental backing of deposit insurance schemes indeed induces depositors to shift their deposits to better insured banks when worries about bank defaults increase.

Contribution
We exploit particularities of the German banking system that provide an excellent setup to test for the role of governmental deposit guarantees in investors' withdrawal decisions. We show that Google searches for 'deposit insurance' and related strings reflect depositors' fears and help to predict deposit shifts in the German banking sector from private banks to fully guaranteed public banks. At the wake of the Irish banking crisis, also German depositors became anxious about the stability of their bank which induced the German government to introduce in October 2008 a blanket guarantee for deposits at all German banks. The introduction of this blanket guarantee provided a level playing field which stopped the fear-driven reallocation of deposits.

Results
Our results show that Google searches for 'deposit insurance' and related strings can serve as an early warning indicator for deposit shifts from local private banks to governmentally guaranteed public banks. Furthermore, even within a country (i.e., in absence of redenomination risks) a heterogeneous governmental backing of the deposit insurance leads to a sudden and destabilizing reallocation of deposits between differently backed banking groups if investors are concerned about the soundness of the banking system. These findings show that the resilience of banks to investors' fears of bank failures is severely impaired by asymmetries in the deposit insurance coverage. When banks' liquidity is questioned, these asymmetries can lead to a reallocation of funds leaving some banks in a liquidity shortage while others are awash with liquidity.

Nichttechnische Zusammenfassung

Fragestellung
Um das Zusammenspiel von Staatsschulden- und Bankenkrisen – oftmals auch als "Doom Loop" bezeichnet – aufzubrechen, setzen neuere regulatorische Initiativen wie die Europäische Einlagensicherung auf einen Wechsel im Umfang und der Deckung der Einlagensicherungssysteme. Eine Bewertung dieser Vorschläge erfordert ein tiefgehendes Verständnis der Allokationsentscheidungen der Einlagen von Bankkunden. Bis heute ist es unklar, ob Umschichtungen von Einlagen während der europäischen Staatsschuldenkrise durch die Angst der Einleger über ihre nationalen Einlagensicherungssysteme oder durch Redenominierungsrisiken, also die Sorge vor einem Auseinanderbrechen des Euro, begründet waren. In dieser Studie untersuchen wir die Frage, ob in Abwesenheit eines Redenominierungsrisikos heterogene staatliche Garantien der Einlagensicherungssysteme tatsächlich Bankkunden dazu veranlassen, ihre Einlagen zu Banken mit umfangreicheren Sicherungen umzuschichten, wenn die Besorgnis über die Resilienz von Banken ansteigt.

Beitrag
Wir nutzen die besondere Struktur des deutschen Bankensystems um die Rolle einer staatlichen Einlagensicherung auf Reallokationsentscheidungen von Investoren zu untersuchen. Wir können zeigen, dass Google-Suchanfragen nach „Einlagensicherung" sowie ähnliche Suchbegriffe zum einen die Besorgnis von Bankkunden über die Resillienz von Banken widerspiegeln und zum anderen dabei helfen können, Umschichtungen von Einlagen im deutschen Bankensektor von privaten zu staatlich garantierten Instituten vorherzusagen. Nach dem Ausbruch der irischen Bankenkrise hinterfragten auch deutsche Bankkunden vermehrt die Stabilität der Banken in Deutschland was schließlich dazu führte, dass die deutsche Regierung im Oktober 2008 eine staatliche Garantie auf Spareinlagen aussprach. Wir zeigen, dass die Einführung dieser staatlichen Garantie für alle Banken zu gleichen Wettbewerbsbedingungen im deutschen Bankensektor führte, der schließlich die angstgetriebenen Umschichtungen von Einlagen stoppte.

Ergebnisse
Unsere Ergebnisse zeigen, dass Google-Suchanfragen nach „Einlagensicherung" sowie ähnliche Suchbegriffe als Frühwarnindikator für Einlagenumschichtungen von privaten Banken hin zu staatlich garantierten öffentlichen Banken dienen können. Wir können darüber hinaus zeigen, dass sogar innerhalb eines Landes (also in Abwesenheit eines Redenominierungsrisikos) eine heterogene staatliche Absicherung der Einlagen zu einer plötzlichen und destabilisierenden Reallokation von Einlagen zwischen den unterschiedlich abgesicherten Bankengruppen führen kann, sobald Bankkunden anfangen, an der Stabilität ihrer Banken zu zweifeln. Unsere Ergebnisse zeigen, dass die Widerstandsfähigkeit der Banken in Bezug auf die Sorgen ihrer Kunden stark von Asymmetrien im Einlagensicherungssystem beeinflusst wird. Sobald an der Liquiditätslage der Banken Zweifel aufkommen, können diese Asymmetrien zu einer Reallokation von Einlagen führen, die bei einzelnen Banken zu Liquiditätsverknappungen führt, während andere Banken im Gegenzug deutliche Liquiditätszuflüsse erhalten.

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Abstract

Recent regulatory initiatives such as the European Deposit Insurance Scheme propose a change in the coverage and backing of deposit insurances. An assessment of these proposals requires a thorough understanding of what drives depositors' withdrawal decisions. We show that Google searches for 'deposit insurance' and related strings reflect depositors' fears and help to predict deposit shifts in the German banking sector from private banks to fully guaranteed public banks. After the introduction of blanket state guarantees for all deposits in the German banking system this fear driven reallocation of deposits stopped. Our findings highlight that a heterogeneous insurance of deposits can lead to a sudden, fear induced reallocation of deposits endangering the stability of the banking sector even in absence of redenomination risks.

Keywords: Depositor expectations, Google, Deposit insurance, Competition for depositors, Bank runs

JEL Classification: G01, G10, G20

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1 Introduction

The sovereign debt crisis in the Euro area has highlighted the vicious interrelation between sovereign debt crises and bank crises known as the 'doom loop'. A major channel contributing to the doom loop is that worries about the government's ability to back the domestic bank deposit insurance induced depositors to shift their funds to better protected financial institutions, in particular to those banks in Euro area countries where the sovereign is considered more stable (see Bénassy-Quéré et al. (2018)). In order to shut this channel, the European Commission proposed in November 2015 a transition to a common European Deposit Scheme until 2024 (see European Commission (2015)).[2] But it remains unclear whether depositors reallocated their deposits due to worries about the backing of the domestic deposit insurance or whether the deposit shift was not predominantly driven by the elevated redenomintation risk, i.e. fears of a breakup of the Euro. If the latter was the main driver of depositors' withdrawals, the proposed common European Deposit Scheme might be an insufficient mechanism to mitigate runs (see Garcia Pascual et al. (2012)).

In this paper we investigate whether in the absence of a redenomination risk, a heterogeneous governmental backing of deposit insurance schemes indeed induces depositors to shift their deposits to better insured banks when worries about bank defaults increase. We exploit particularities of the German banking system that provide an excellent setup to test for the role of governmental deposit guarantees in investors' withdrawal decisions. German savings banks are typically jointly owned by the municipality and backed by the regional association of savings banks which means that they are de facto government guaranteed.[3] Savings banks compete at the local level mostly with credit cooperatives, which are only backed by the association of cooperative banks. At the wake of the Irish banking crisis, also German depositors became anxious about the stability of their bank which induced the German government to introduce in October 2008 a blanket guarantee for deposits at all German banks. Hence, this set-up allows to use both the cross-sectional and the intertemporal difference in depositors' insurance to assess the drivers of investors' decision to shift funds from cooperative to savings banks and vice versa. To exploit local heterogeneity in depositors' fear of a bank run we use the fre-

[2] Melkadze (2019) shows in a calibrated macro model under which circumstances a multinational deposit insurance can eliminate the doom loop.

[3] See Deutsche Bundesbank (2000) for a detailed description of the prevailing deposit insurance schemes at the beginning of our sample period.

quency of Google searches for "deposit insurance" and related strings at the federal state level. This permits us to assess whether differences in the deposit shift between local savings and cooperative banks are indeed related to local investors' concerns about deposit guarantees.[4]

Our analysis provides the following key results. Google searches for "deposit insurance" and related strings can serve as an early warning indicator for deposit shifts from local private cooperative banks to governmentally guaranteed local savings banks. In regions in which the fear of a bank run was more prevalent (as measured by Google searches) depositors shifted more deposits from local cooperative banks to savings banks. The introduction of the blanket guarantee in October 2008 provided a level playing field and muted the effect that local fears of a bank failure had on the reallocations of deposits from private to public retail banks. Our results show that even within a country (i.e., in absence of redenomination risks) a heterogeneous governmental backing of the deposit insurance leads to a sudden and destabilizing reallocation of deposits between differently backed banking groups if investors are concerned about the soundness of the banking system.

These findings have important implications: They show that the resilience of banks to investors' fears of bank failures is severely impaired by asymmetries in the deposit insurance coverage. When banks' liquidity is questioned, these asymmetries can lead to a reallocation of funds leaving some banks in a liquidity shortage while others are awash with liquidity. Thus our results are in line with Pennacchi (2006) and Acharya and Mora (2015). While they also argue that the banking sector can only serve as a liquidity provider in crises times when deposits are largely insured, we show that these findings also hold in the cross-section when comparing very similar banking groups that only differ in their deposit insurance coverage. Our findings therefore also indicate that the different ability of financial institutions to serve as a liquidity provider is not only a mere result of a difference in access to lender of last resort facilities.

Our empirical analysis proceeds in three steps: First, we use country level data to provide evidence that Google searches for "deposit insurance" and related strings are a good proxy for investors' fears of imminent bank failures. Using a VAR approach and Granger causality tests, we show that the searches have predictive power for the

[4] Karas et al. (2013) use a similar regulatory change in Russia to identify market discipline in the retail deposit market.

subsequent shift of deposits from cooperative banks to savings banks and that they 'cause' a reallocation of deposits in the banking system.

Second, we use federal state level data and analyze in a panel approach whether the shift of deposits from cooperative to savings banks was more pronounced prior to the blanket guarantee in states in which retail investors were more worried about bank failures and whether this effect vanishes after the provision of the blanket guarantee. The panel structure permits us to control for the time varying regional spreads between savings and cooperative banks' interest rates on deposits and for time-varying unobserved country-level factors using time fixed effects. We find the following consistent results: Before the blanket guarantee, depositors shifted deposits from cooperative to savings banks especially in states in which depositors were more worried about imminent bank failures (as measured by the Google searches). After the government also explicitly guaranteed deposits at cooperative banks, depositors across all states stopped shifting their deposits irrespective whether the fear of a failure was elevated in their region.

In a third step we zoom in even further and use bank level data from the Bundesbank's MFI interest rate statistics. This approach allows us to include a variety of time-varying bank characteristics and to include also time-varying state fixed effects. The results we obtain with this quite different approach are consistent with the state level panel: We find that before the blanket guarantees savings banks experience a deposit inflow in particular in states with elevated fear of a banking crises, while cooperative banks suffered from a deposit outflow that was more severe in states with more anxious investors. After the blanket guarantees the sensitivity of deposit flows to investors worries about an imminent banking crises was not significantly different for the two groups of banks. Interestingly, we find in these regressions also that rates paid on deposits only mattered for cooperative banks while the deposit flow of savings banks was not sensitive to the rate that these banks paid. After the introduction of the blanket guarantees this changed and for both banking groups we find that a higher rate also increases the deposit inflows, suggesting that the blanket guarantees also established a level playing field in retail bank's competition for deposits.

Our paper contributes to several strands of the literature. It is particularly closely related to Acharya and Mora (2015) who find for the United States that due to a lack of government guarantee at the outset of the financial crisis banks did not generally serve as a safe haven and a liquidity backstop to the financial system. Only after Lehman when

banks obtained a more explicit government support deposit inflow offset the liquidity outflow from drawn down credit commitments. Also Pennacchi (2006) argues that banks can only benefit from synergies in liquidity provision through demand deposits and credit lines as proposed by Kashyap et al. (2002) and Gatev and Strahan (2006) when bank deposits are backed by a deposit insurance. Our results support their findings and show that concerns about banks' stability matter for the reallocation of funds in a crisis and that even within the banking sector differences in the governmental guarantees matter for deposit flows and for banks' ability to provide liquidity insurance.[5]

The results of our analysis are also closely in line with those presented by Martin et al. (2018). Using daily account level data for one US bank they find that investors were less likely to withdraw those deposits that were covered by regular or temporary deposit insurance.

Our findings also add to the debate about the role of self-fulfilling panics in banking crises.[6] A key problem in empirically assessing the extent to which panics contribute to banking failures is that shifts in depositors' expectations about the behavior of others are hard to identify. We draw on the fast growing literature following Da et al. (2014) and use local Google searches as a proxy for investors' sentiment capturing particularly their fear of a local bank run.

Our analysis also contributes to the vast literature analyzing the distorting effects of public banks on competition and stability in the banking sector (See, for instance, Gropp et al. (2010) and Gropp et al. (2015)). It adds an interesting dimension to this discussion by showing that indeed equal governmental guarantees for all banks provide a level playing field, make deposit flows more price sensitive and, hence, foster banking competition, while at the same time presumably undermining market discipline as heterogeneous bank default risks become irrelevant for depositors' investment decision.[7]

It is important to note, though, that our analysis is agnostic about the reason why depositors reallocate their funds - whether it is because they are concerned about elevated fundamental weaknesses of their bank or whether they merely withdraw because they expect others to withdraw. Both fundamental and panic driven concerns are presumably reflected in depositors' Google searches for deposit insurance. To that end our

[5] Bruche and Suarez (2010) argue that the differences in the backing of the deposit insurance also impede other financial markets in providing an efficient reallocation of funds across regions.

[6] See Section 2 in Goldstein (2013) for a detailed discussion of the latest stance of this literature.

[7] See Matutes and Vives (1996) and Matutes and Vives (2000) for a thorough theoretical analysis of the risk taking effects of deposit insurances given different market structures in the deposit market.

paper does not take a stance on whether deposit insurance undermines market discipline or only eliminates purely self-fulfilling bank runs at no costs (for a detailed summary of this discussion see Calomiris and Carlson (2017)). Martinez Peria and Schmukler (2001) provide empirical evidence that deposit insurance does not undermine market discipline in the deposit market, while Berger and Turk-Ariss (2015) argue that prevailing market discipline before the financial crisis was largely undermined in the crisis period. Lambert et al. (2014) show that an exogenous increase in deposit insurance coverage of a bank's deposits increases the bank's risk taking. Our paper shows that differences in the coverage of the deposit insurance and a change in the deposit insurance coverage create itself deposit flows which might undermine financial stability and market discipline.

The remainder of the paper is organized as follows. The next section describes our data set and the construction of our main variables. Section 3 presents our analysis at the aggregate national level, presenting evidence that Google searches for "deposit insurance" and related terms are a good indicator for subsequent reallocations of deposits from cooperative to savings banks. Section 4 builds on these findings and studies at the state levels how the depositor worries (as captured by the Google searches) lead to a deposit shift from cooperative to savings banks in the respective state and how this shift was affected by the blanket guarantees. Section 5 presents our analysis at the bank level while Section 6 summarizes our finds and main conclusion.

2 Data and variables

For our empirical analysis, we obtain for the period June 2005 to June 2016 data from three different sources: First and foremost, we gathered from Google internet search queries presumably capturing depositors' fear of a bank failure. Second, we obtain data at the bank level on the amount of outstanding overnight deposits from the Bundesbank's Monetary Financial Institutions Balance Sheet Items (BSI) statistics and corresponding interest rates from the Bundesbank's Monetary Financial Institutions Interest Rate (MIR) statistics.

2.1 Capturing depositors' expectations

Data on Google internet searches are available on a weekly basis from Google Trends. For every search string Google Trends reports the relative share of the search volume,

which is the searches for the particular search term over the total Google search volume in the respective week scaled between 0 to 100. In Germany, Google's market share has been estimated to be on average well above 90%.

The key search terms that we use are "Einlagensicherung", the German equivalent for "deposit insurance", and "Bankenkrise", German for "banking crisis". They reasonably proxy retail investors' fear of loosing their deposits. At the same time these two search terms had a sufficient volume not only for Germany but also for six federal states that together account for approximately 83% of the overnight deposit volumes across all German savings banks and credit cooperatives.[8] Data drawn for other search terms were available for Germany only at the country but not on the federal state level. Since data drawn from Google Trends are always based on a random sample from Google's actual search data, we downloaded for each search term 30 different samples to decrease the risk of obtaining a biased sample. The variables used for our analysis are calculated based on the average of these 30 samples.

Since deposit volume and interest rate data are available on a monthly basis, we transform the weekly time series to a monthly time series by taking $Google_{g,j,t}$ to be the average value of the Google searches in month t for search term g in state j.

The time series of the search terms feature extreme values around the government's announcement of the blanket guarantee in October 2008. To avoid that these data points bias our results, we winsorize the Google Trends series by removing the September-November 2008 values and substituting them with the maximum value observed in the remaining respective time series. This should also control for increases in Google searches for "deposit insurance" resulting only from the public announcement of the guarantee.

2.2 Measuring deposit flows

From the Bundesbank's Monetary Financial Institutions Balance Sheet Items (BSI) statistics we obtain bank level data on the outstanding amounts of German depositors' overnight deposits and the total balance sheet size. Overnight deposits are deposits that are convertible into currency or are transferable on demand without significant delay or restriction. Overnight deposits constitute by far the largest deposit category for both households and non-financial corporations.

[8] These include: Baden-Wuerttemberg, Bavaria, Hesse, Lower Saxony, North Rhine-Westphalia, Rhineland-Palatinate. The relative Google search volume for "deposit insurance" across the different sates is depicted in Figure 2 in the Appendix.

In our analysis we focus solely on savings banks and credit cooperatives for several reasons. First, in contrast to other banks these financial institutions are only active in their respective home region. This means that we can locate their depositors reasonably well and match them with state level Google searches to derive a panel. Second, these two groups of banks are focused on retail banking and cater the same type of customers at the regional level. This means that savings banks are an excellent control group when studying the implication of changes in the deposit insurance in the respective region.

For the different levels of analysis, we construct two different dependent variables from the BSI. When taking the more aggregate view in the VAR analysis and in the state level panel analysis, we focus on the market share in the deposit market. This means for the VAR analysis we use the ratio of the aggregate overnight deposits at German savings banks relative to the aggregate overnight deposits at German cooperative banks.

For the state level panel regressions we construct the variable "Market Share$_{jt}$" which measures the total overnight deposit volume at savings banks in the respective state j relative to the total overnight deposit volume at credit cooperatives in j in month t.

$$\text{Market Share}_{j,t} = \frac{\text{Overnight volume savings banks}_{j,t}}{\text{Overnight volume cooperative banks}_{j,t}}. \tag{1}$$

As we are not interested in explaining the level of this variable, but rather its change from period to period, we take the difference of the *Market Share* variable. Since this variable is highly volatile, we use the change over the last three months for the regressions:[9]

$$\Delta^{qtly}(\text{Market Share})_{j,t} = \text{Market Share}_{j,t} - \text{Market Share}_{j,t-3}. \tag{2}$$

For the bank level panel regressions we need to construct an alternative bank level measure. Here we use as dependent variable the percentage share of overnight deposits of bank i in relation to its total balance sheet size (*Deposit Share*$_{i,t}$) and calculate the the change over the last three months:

$$\Delta^{qtly}(\text{Deposit Share}_{i,t}) = \text{Deposit Share}_{i,t} - \text{Deposit Share}_{i,t-3}. \tag{3}$$

[9] Figure 4 in the Appendix depicts the evolution of this measure for the different states.

2.3 Control variables

The deposit flows should be determined by the interest rate a bank pays on deposits. To control for this we construct the variable *Interest margin* which measures the spread between the interest rate paid to depositors by savings banks relative to the interest rate paid on overnight deposits by cooperative banks. For the aggregate VAR analysis we simply use the volume weighted rates according to the MIR statistic. For the federal state level panel analysis we use the volume weighted rates of savings banks minus the respective rates for cooperative banks for each state j and month t to derive the monthly state level interest rate margin:

$$\begin{aligned}\text{Interest margin}_{j,t} = \text{Interest rate savings banks}_{j,t} \\ -\text{Interest rate cooperative banks}_{j,t}.\end{aligned} \tag{4}$$

Similar to the *Market Share* variable, we use the changes over the last three months as key variable in our regressions.

$$\Delta^{qtly}\text{Interest margin}_{j,t} = \text{Interest margin}_{j,t} - \text{Interest margin}_{j,t-3}. \tag{5}$$

For the bank level panel analysis, we consider as control variable for the deposit rate the change over the last three months in the interest rate paid by bank i on its overnight deposit,

$$\Delta^{qtly}\text{Interest rate}_{i,t} = \text{Interest rate}_{i,t} - \text{Interest rate}_{i,t-3}. \tag{6}$$

At the bank level we can include in our panel analysis further time varying control variables: First, as to control that well capitalized banks may witness a lower outflow of overnight deposits if fear of depositors increase, we construct the measure *Equity ratio* for bank i at time t as

$$\text{Equity ratio}_{i,t} = \frac{\text{Equity capital}_{i,t}}{\text{Total balance sheet size}_{i,t}}. \tag{7}$$

Some banks may rely on a significant amount of capital market funding and may

therefore be less affected by a run of retail depositors. We thus construct the measure *Capital Markets Funding* for bank i at time t as

$$\text{Capital markets funding}_{i,t} = \frac{\text{Securitized liabilities}_{i,t}}{\text{Total balance sheet size}_{i,t}}. \tag{8}$$

Finally, as a measure for the potential illiquidity of a bank, we consider bank i's *Share of loans* in relation to its balance sheet total at time t

$$\text{Share of loans}_{i,t} = \frac{\text{Total loans outstanding}_{i,t}}{\text{Total balance sheet size}_{i,t}}. \tag{9}$$

2.4 Descriptive statistics

A description of all variables can be found in Table 1.

Table 2 reports the descriptive statistics for the time period June 2005 to June 2016. It highlights several interesting observations: it shows that both savings banks' aggregate market share as well as their mean market share across states declined before and after the government guarantees were introduced. Interestingly, the figures also reveal that the decline was more pronounced when all deposits were equally guaranteed. The variation across the different states was much larger before the guarantees. At the same time savings banks paid on average a lower interest rate on deposits before equal guarantees were introduced, while afterwards there was no aggregate interest rate difference between savings and cooperative banks. The mean across states even shows a negative interest rate difference. Also with regards to the difference in deposit rates paid be savings banks and cooperative banks we see that the variation, in particular in the cross section, was lower after the blanket guarantees were announced.

Interestingly, the descriptive statistics also show that Google searches for 'deposit insurance' and related search terms did not drop with the introduction of the government guarantees. In facts, the searches for those terms increased after October 2008 both for the German aggregate as well as in the mean for the different states. This is probably due to the fact that the financial crisis attracted more and more public interest, while at the same time Germans were presumably less worried about their own deposits due to the guarantees. In addition to winsorizing the Google data in our further analysis we take care of changing motives for the particular Googles searches by using time fixed

effects in our panel regression.

3 Aggregate Time Series Perspective

In this section we provide evidence that Google searches for "deposit insurance" and "banking crisis" capture retail investors' concerns about the stability of the banking sector that induce them to subsequently consider reallocating their deposits to better insured financial institutions. In particular, we show that the Google searches are not a reaction to the withdrawal of funds from less insured financial institutions but indeed rather reflect worries that drive depositors' subsequent investment decision.

3.1 Univariate Analysis

Figure 1 provides first visual evidence. The graph shows the ratio of aggregate overnight deposits at savings banks relative to the aggregate sight deposits at cooperative banks as a solid line. The dashed red line represents the winsorized Google searches for "deposit insurance" lagged by 5 months. The visual comparison of the two lines already highlights the strong correlation of the two variables.

3.2 VAR Analysis

In order to provide further evidence that the Google searches indeed reflect investors' fears that are followed by a reallocation of deposits we apply a VAR model of the general form:

$$\begin{aligned} Y_t = \pi + A_1 Y_{t-1} + A_2 Y_{t-2} + ... + A_p Y_{t-p} + \\ B_1 X_{t-1} + B_2 X_{t-2} + ... + B_p X_{t-p} + \epsilon_t \end{aligned} \tag{10}$$

where π is a vector of constants, X_t is a vector of exogenous variables, p is the lag order, and ϵ is a vector of error terms.

We order the variables based on their exogeneity: $Y_t = (\text{Google}_t, \text{Interest margin}_t, \text{Market Share}_t)'$ and define X as a binary indicator which is equal to 1 after the announcement of the public guarantee in October 2008 and zero before.

Table 3 shows the results of the unit root tests. Since the null hypothesis of non-stationarity cannot be rejected for both *Market share* and *Interest margin*, we use the

first difference of these variables. Google search terms are stationary by definition.

Figures 6 and 7 show the results of our VAR analysis where the introduction of the government guarantee is included as an exogenous factor. The results shown were calculated using a lag length of 6 months. Results are, however, robust to alternative IC-based lag-length specifications. Note that our results are also robust to changes in the ordering of the variables *Google*, *Market share*, and *Interest margin*, the inclusion of time trend and/or constant, use of quarterly changes instead of first differences and different lag-selection specifications.

Starting with the impulse response graphs in Figure 6 where the Google search term is related to "deposit insurance", we find that a sudden increase in the level of Google searches, and thus depositors' fears, leads to an increase in the market share of public banks in the third and fifth month, where the strongest increase is seen from month 2 to month 3. This is broadly in line with the observations in Figure 1, namely that the *Market share* time series follow the Google time series with a five months lag. At the same time we also observe that a higher level of fear leads to a reduction in the *Interest margin* in the second period. This could imply that savings banks - aware of their status as better insured financial institutions - are cutting interest rates in anticipation of deposit inflows from investors seeking safety for their overnight deposits.

Figure 7 shows the impulse response graphs for different Google search terms: banking crisis and deposit insurance fund. The peak in the fifth period is the strongest and there is some evidence of a significant effect also for the third period. Hence, we find evidence that alternative Google searches that proxy the fear of economic agents regarding the safety of their deposits can also be used in an analysis of depositor runs.

3.3 Granger Causality Test

The impulse response graphs already provide first evidence that the Google searches are leading both, the market share measure as well as the interest margin. In the next step, we are interested in whether Google searches actually have a predictive causality for these two measures. We thus apply a pairwise Granger causality test to analyze whether there is a causal relationship between the Google searches for 'deposit insurance' and the shifts in overnight deposits between cooperative and savings banks. Using the following equation , the Google searches Granger-cause the *Market share* time series (but not the other way around) if $\beta_1 \neq 0$ and $\delta_1 = 0$:

$$\text{Market Share}_t = \pi_0 + \sum_{i=1}^{p} \alpha_i \text{Market Share}_t + \sum_{i=1}^{p} \beta_i \text{Google}_t + \varepsilon_t \quad (11)$$

$$\text{Google}_t = \pi_1 + \sum_{i=1}^{p} \gamma_i \text{Google}_t + \sum_{i=1}^{p} \delta_i \text{Market Share}_t + \nu_t \quad (12)$$

where p is the lag order, π is the constant and ε and ν are the respective error terms. In addition, for the multivariate analysis we add as exogenous variable the same binary indicator as in the VAR analysis.

Looking at the results from the bivariate causality analysis in Table 4, we find that we can reject the null hypothesis that Google searches do not Granger-cause the *Market Share* measure but not the other way around. We therefore conclude that there is an uni-directional causal relationship from the Google search time series to the *Market share* measure. Moreover, we find that Google searches have predictive causality also for the *Interest margin*. These results also hold for a multivariate Granger Causality test.

4 State level panel analysis

Both Figure 1 and Table 2 indicate that the Google searches for 'deposit insurance' remained elevated even after the government granted the blanket guarantees for all deposits. Thus, while initially the searches were likely reflecting worries about the safety of deposits at German banks, after October 2008 they probably resulted more from a general interest in the financial crisis. In order to account for such changes over time in the motives underlying Google searches for 'deposit insurance', we disaggregate our data in the next two sections. This permits us to apply panel estimates with time-varying fixed effects and focus on the cross-sectional variations in depositors' worries (as reflected by the regional Google searches) to identify the effect of the government guarantees on deposit reallocations between cooperative and savings banks.

In this section we use the disaggregate data at the state level and estimate the quarterly change in the aggregate market share of all savings banks relative to the cooperative banks operating in state j and reporting to the Bundesbank's MIR statistic. We estimate the following panel regression:

$$\begin{aligned}\Delta^{qtly}(\text{Market Share})_{j,t} = \alpha_j + \alpha_t + \beta_1(\Delta^{qtly}\text{Interest margin}_{j,t-1}) + \\ +\beta_2(\Delta^{qtly}\text{Interest margin}_{j,t-1} \times \text{Guarantee}_t) + \gamma_1(\text{Google}_{j,t}) \\ +\gamma_2(\text{Google}_{j,t} \times \text{Guarantee}_t) + u_{j,t}\end{aligned} \tag{13}$$

where α_j is a state fixed effect and α_t as a monthly time fixed effect.[10] In order to mitigate reversed causality concerns we use the rate change with a lag of one month. The Google searches for all these specifications are also disaggregate at the state level, i.e. they captures the Google searches for "deposit insurance" from devices located in state j. This permits us to explicitly account for the regional heterogeneity in investors' fear. The dummy variable 'Guarantee$_t$' is zero before October 2008 and one afterwards.

Our key variables of interest are the Google searches and the interaction term between the Google searches and the dummy variable, '*Guarantee$_t$*'. We would expect that before the government guarantees in states with an elevated fear of depositors (as measured by the Google searches), investors shifted more deposits from cooperative to savings banks ($\gamma_1 > 0$). The introduction of the guarantees should have muted or even stopped this reallocation of deposits. Thus we would expect that $\gamma_2 < 0$. Note that β_2 and γ_2 is the interaction effect and that β_1 and γ_1 are the main effects.

Table 5 shows the main results from the baseline regressions and provides four robustness checks. Focusing on the fully specified Model 4 which includes monthly time fixed effects to control for unobserved time-varying effects (like a general level shift of the Google searches due to a changed motivation to look for information about 'deposit insurance'), we find the *Interest margin*, our key control measure, to be highly significant with the expected positive sign. A small 10 basis points increase in the deposit rates paid by savings banks compared to cooperative banks increases the share of savings bank deposits relative to cooperative bank deposits in the respective state by 0.61 percentage points (the unconditional, average change in the *Market share* is 0.003 units).The introduction of the public guarantee per se in October 2008 did not significantly alter the reallocation of deposits from cooperative to savings banks. Moreover, the guarantees also did not change significantly the sensitivity of depositors reallocation decision to the

[10]We test the appropriate specification of the panel model using the Hausmann specification test. Since we cannot reject the null hypothesis that a random effects (RE) specification is both consistent and efficient for any of the state level models, we show the empirical results only for the RE specification. Our results do also hold if a fixed effects specification is estimated.

interest margin (the add-on effect is statistically insignificant).

Looking at our key variable of interest, the Google searches for 'deposit insurance', we find in Model 3 that there is no effect of a higher level of Google searches for the shift in the market share between private and public banks when including monthly time fixed effects. However, this model neglects that Google searches and therefore the fear of overnight depositors may have a significantly different effect on the market share before and after the announcement of the government to guarantee all deposits at German banks. In Model 4, we explicitly estimate this effect and find a highly significant positive effect of Google searches for the deposit shifts from private to public banks before the guarantee in October 2008. Already a medium level of Google searches for "deposit insurance" (11 points) leads to a 1.5 percentage point increase in the market share of savings banks relative to cooperative banks. In 2008, when the Google measure reached its high at 26 points (winsorized) in the federal state *Rhineland-Palatinate*, the model predicted a 3.5 percentage point increase in the market share of public banks in this region which is nine-times as large as the unconditional change in the average market share measure. This implies that in states where depositors had a high level of anxiety about loosing their overnight deposits, a significant reallocation of deposits in the banking system took place in favor of public banks before the blanket guarantees were introduced. Once the government announced to back all deposits at German banks alike, a higher level of fear is no longer associated with a shift of deposits from private to public banks. In fact, the net effect of an increase in Google searches related to "deposit insurance" is negative and significant for the period after October 2008, which might also simply reflect that depositors shifted their deposits back to their cooperative banks. The net magnitude of this effect is however relatively small: for the fully specified Model 4, the effect of a one unit increase in Google searches on the *Market share* after October 2008 is 0.09101 compared to 0.1357 for the pre-guarantee period.

In the first robustness check (RC 1), we include only the deposits of private households in the construction of our dependent variable and we used the respective overnight interest rate paid to those customers. In all other models we include all overnight deposits from both, private households and non-financial firms. Whereas the coefficients and the significance largely resemble those of our main Model 4, we find that the overall fit of the model improves significantly by five percentage points. This might reflect that Google searches more likely measure households' concerns rather than the worries and

information needs of the relatively few decision makers in non-financial firms.

In RC 2, we only winsorize the Google searches related to "deposit insurance" for the peak month of October 2008. For RC 3, we use completely non-winsorized Google searches for 'deposit insurance'. In both cases our key results closely resemble the ones of Model 4: Before the introduction of the government guarantees in states with an elevated fear of a bank default, deposits were shifted from cooperative to savings banks, while this effect reversed with the introduction of the guarantees.

There is, however, one noteworthy difference in the results of our robustness checks from those of Model 2: In those specifications we find that after also deposits at cooperative banks enjoyed a backing of the government, the interest rate sensitivity of the market share significantly declined. This shows that the additional rate that cooperative banks had to pay in order to attract deposits from savings banks, was substantially higher before the guarantees. So also with regards to the competitive pricing of deposits our results suggest that the guarantees introduced a more level playing field.

This finding also prevails in RC 4, were we used the Google searches for "banking crisis" instead of 'deposit insurance': The *Interest margin* coefficients have the same significance and even similar size. However, in this case the cross-sectional variations in the level of Google searches across states do not significantly explain differences in the changes of public banks' market share in the deposit market neither before in the introduction of the guarantees nor thereafter.

5 Bank level panel analysis

The results in our previous section already provide first evidence that indeed before the blanket guarantees deposits were reallocated from cooperative banks to savings banks especially in states in which depositors were particularly anxious about banking failures while the government guarantees largely stopped this deposit shift. However, this state level analysis did not allow to control for confounding factors at the bank level, such as a heterogeneous development of banks' equity ratio, that might induce depositors to switch. Moreover, the market share of savings banks relative to cooperative banks in the deposit market at the state level, which we estimated in the previous section, might also simply increase as deposits from other banking groups, for instance, large commercial or foreign banks, were moved to the supposedly better protected savings banks.

Hence, in this section we use a panel approach at bank level data. In particular, we focus on the changes in an individual bank's share of deposits to its balance sheet total to capture how the bank's ability to finance its balance sheet through deposits varies over time. Besides the changes in the interest rate which the bank pays on deposits, we also include the bank's equity ratio, its lagged ratio of capital market fundings and its share of loans to total assets as time-varying bank controls. In addition, we also allow for a bank fixed effect to capture further unobserved heterogeneity at the bank level.

Contrary to the state level analysis in section 4, where we used the deposit volume for the whole population of savings and cooperative banks and combined them with the representative interest rate for savings and cooperative banks that report to the MIR statistic, the analysis in this section is naturally restricted to those 111 banks that report interest rates data to the MIR statistics.[11] More precisely, we estimate the following regression

$$
\begin{aligned}
\Delta^{qtly}\text{Deposit Share}_{i,t} \quad = \quad & \beta_1(\Delta^{qtly}\text{Interest rate}_{i,t-1} \times (1 - Guarantee_t) \times Coop_i) \\
& + \beta_2(\Delta^{qtly}\text{Interest rate}_{i,t-1} \times (1 - Guarantee_t) \times Sav_i) \\
& + \beta_3(\Delta^{qtly}\text{Interest rate}_{i,t-1} \times Guarantee_t \times Coop_i) \\
& + \beta_4(\Delta^{qtly}\text{Interest rate}_{i,t-1} \times Guarantee_t \times Sav_i) \\
& + \gamma_1(Google_{j,t} \times (1 - Guarantee_t) \times Coop_i) \\
& + \gamma_2(Google_{j,t} \times (1 - Guarantee_t) \times Sav_i) \\
& + \gamma_3(Google_{j,t} \times Guarantee_t \times Coop_i) \\
& + \gamma_4(Google_{j,t} \times Guarantee_t \times Sav_i) \\
& + \alpha_i + \alpha_t + BSC_{i,t-1} + BSCSD_{i,t-1} + u_{i,t}
\end{aligned}
\tag{14}
$$

where $Guarantee_t$ is a dummy variable that is zero for the period before October 2008 and one starting October 2008, $Coop_i$ [Sav_i] is a dummy variable which is one for cooperative banks [savings banks] and zero otherwise, α_i is specified as bank i fixed effect and α_t as a monthly time fixed. BSC stands for three balance sheet characteristics, 1) equity ratio, 2) the share of capital market funding and 3) the loan to asset ratio (see

[11] Reporting institutions are selected based on a procedure that ensures representativity of the sample. Therefore, generally the biggest banks in each group are obliged to report interest rate data. For cooperative and savings banks, the reporting institutions cover approx. 35% and 50%, respectively, of their group's total volume.

subsection 2.3 and Table 1 for a detailed description), and $BSCSD$ are the balance sheet characteristics also interacted with the *Guarantee* dummy and the dummy for the banking group.[12] The variable $Google_{j,t}$ represents the Google searches for deposit insurance in the federal state in which the respective bank is located. More granular data on Google searches, for instance, at the level of municipalities is not available.

Table 6 reports the results of the bank level regressions[13]. In Model 1, we only include bank fixed effects to take care of unobserved heterogeneity across banks. For our key variable of interest we find that an elevated depositors' fear in the respective state led to an outflow of overnight deposits from both, savings and cooperative banks prior the state guarantees, while cooperative banks experienced an economically more severe outflow. After the guarantees were introduced both savings and cooperative banks benefited from similarly strong deposit inflows in states with more anxious depositors. Interestingly, without the inclusion of any time varying fixed effect or control variable we find that before the guarantees savings and cooperative banks' depositors had a positive interest rate sensitivity while after the introduction of the guarantees they both experienced larger outflows of deposits after offering a higher remuneration.

However, this specification does not account for any observed or unobserved time varying developments that impact the investment decision of depositors across the different banks. In Model 2 we include monthly time fixed effects and find that an increase in the fear leads to a highly significant loss of overnight deposits for cooperative banks, whereas savings banks are not affected from a withdrawal of deposits due to rising concerns of depositors. Once the government announced the guarantee, a higher level of fear was no longer associated with an outflow of deposits for cooperative banks (and for savings banks). We therefore conclude that the introduction of the guarantee successfully muted depositor's fear driven withdrawals of deposits from cooperative banks. At the same time the government guarantees had also an important effect on the interest sensitivity of deposit flows at the different banking groups. Before the guarantees the interest rate did not play a significant role for the deposit flow at cooperative banks. Only savings banks experienced a higher deposit inflow if they offered a higher interest rate. However, this changed substantially after the introduction of the guarantee: While

[12]The balance sheet characteristics include the Equity ratio, the Capital markets funding and the Loan share. All balance sheet measures have been lagged by one month.

[13]The standard errors are cluster on the bank level across all regressions. Clustering the standard errors on the state level, along the time dimension or bank-time dimension would not change the key conclusions.

the interest rate sensitivity of deposit flows at savings banks was largely not affected by the guarantees, the interest rate sensitivity of deposits at cooperative banks was equivalent to the one at savings banks after also cooperative banks' deposits enjoyed the governmental backing. We thus conclude that the introduction of the public guarantee not only muted the fear of overnight depositors but at the same time also established a level playing field in the German banking system.

In Model 3, we introduce the three balance sheet characteristics to control that (i) well capitalized banks (i.e. those with a higher *Equity ratio*) may witness a lower outflow of overnight deposits if the fears of depositors increase, (ii) banks that have a larger amount of *Capital Markets Funding* may be less affected by a run of retail depositors, and (iii) banks that have a higher potential to become illiquid (i.e. a higher *Share of loans*) may be more likely to experience a bank run. Introducing these measures does not change our results. In fact, the fear indicator becomes an economically even more significant factor for the deposit outflows at cooperative banks before the guarantees.

Model 4 includes the three bank characteristics interacted with both the banking group dummy (i.e. whether a bank belongs to savings banks or to cooperative banks) and the Guarantee dummy to allow for a differential effect of banks characteristics across banking groups and before and after the introduction of the government guarantee. Although, this specification should absorb a lot of the intertemporal as well as the cross-sectional variation our results do not change, neither qualitatively nor quantitatively.

In Model 5, we include a time-varying regional fixed effect on a monthly basis. Introducing this fixed effect absorbed the baseline effect for savings banks completely and only leaves the add-on effect for the cooperative banks. Specifying the model this way leaves all of our key result intact.

Finally, in Model 6, we substitute the Google search term "deposit insurance" with "banking crisis". Here we find that a higher level of this search term leads to no outflow from cooperative banks but to a significant inflow to savings banks before October 2008, which supports the view that savings banks were indeed considered as a safe haven.

6 Conclusions

In this paper we showed that Google searches for 'deposit insurance' and related strings are a good proxy for depositors' fears and help to explain the subsequent reallocation of

deposits from cooperative to governmentally guaranteed public savings banks.

In panel analyses both at the state level as well as at bank level we show that controlling for a number of observed and unobserved heterogeneity across states and banks, respectively, depositors shifted deposits from cooperative to savings banks especially in states in which depositors were more worried about imminent bank failures (as measured by the Google searches). After the government also explicitly guaranteed deposits at cooperative banks, depositors across all states stopped shifting their deposits irrespective whether the fear of a failure was elevated in their region.

Our results show that the resilience of banks to investors' fears is severely impaired by asymmetries in the deposit insurance coverage. When banks' stability is questioned, asymmetries lead to a sudden shift of deposits from one banking group to another. Thus, our findings indicate that the different ability of financial institutions to serve as a liquidity provider depend indeed on their deposit insurance scheme.

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Appendix

Table 1: Definition of the main variables

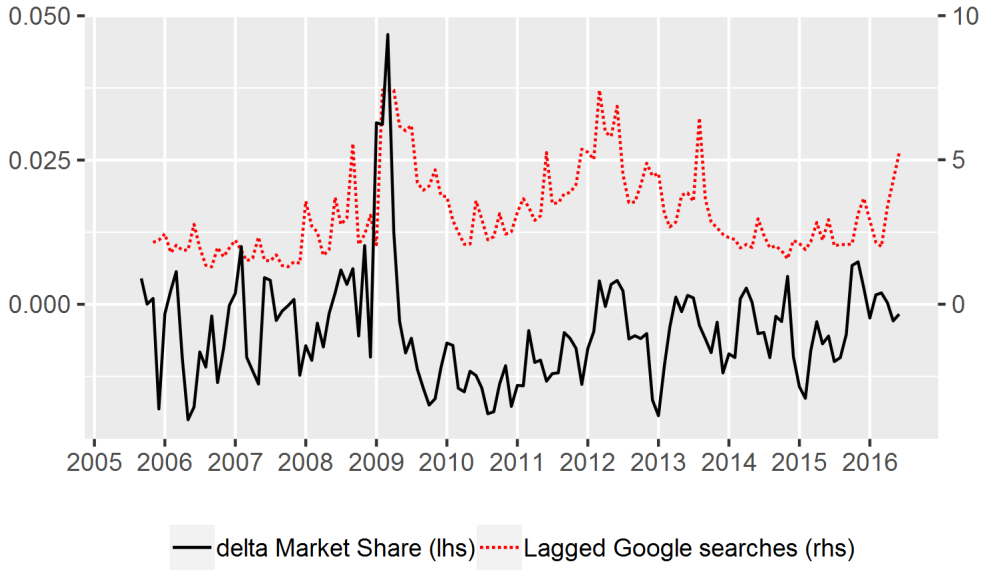
Dependent variables	
Market Share$_t$	VAR and causality analysis: Overnight volume at savings banks in relation to the overnight volume of cooperative banks at time t.
Δ^{qtly}(Market Share)$_{j,t}$	State level regression: Quarterly change in the market share of savings banks to cooperative banks in region j at time t.
Δ^{qtly}(Deposit Share)$_{i,t}$	Bank level regression: Quarterly change in the relative share of overnight deposits to the balance sheet size of bank i at time t.
Independent variables	
Interest margin$_t$	Overnight interest rate paid by savings banks minus overnight interest rate paid by cooperative banks at time t.
Δ^{qtly}(Interest margin)$_{j,t}$	Quarterly change in the overnight interest rate spread between savings banks and cooperative banks in region j at time t.
Δ^{qtly}(Interest rate)$_{i,t}$	Quarterly change in the interest rate paid by bank i on overnight deposits at time t.
Google$_{j,t}$	Relative share of the search volume for the search term "deposit insurance" and winsorized between September 2008 - November 2008 (main specification) for region j at time t.
Equity ratio$_{i,t}$	Measure for the solvency: Equity capital of bank i relative to its balance sheet size at time t.
Capital markets funding$_{i,t}$	Measure for alternative sources of funding: All outstanding securitized liabilities of bank i at time t.
Share of loans$_{i,t}$	Measure for the potential of illiquidity: All outstanding loans of bank i at time t in relation to its balance sheet size.
BGR$_i$	Dummy variable taking the value 1 if bank i belongs to the banking group "savings banks" and 0 if bank i belongs to the banking group "credit cooperative bank".
Region$_j$	Dummy variable taking the value 1 to 6 to indicate the federal state (i.e. Baden-Wuerttemberg, Bavaria, Hesse, Lower Saxony, North Rhine-Westphalia, Rhineland-Palatinate)
Guarantee$_t$	Dummy variable taking the value 1 after the announcement of the German government that it will guarantee the repayment of all deposits of German banks in October 2008 and 0 before.

Table 2: Descriptive statistics for the main variables

		Mean	S.D.	Min	Max	Obs
Main variables for time series analysis						
Before Guarantee	Δ^{1M}(Market Share)$_t$	-0.001	0.006	-0.014	0.011	40
	Δ^{1M}(Interest margin)$_t$	0.005	0.018	-0.039	0.048	40
	Deposit Insurance (avg, w3)	2.291	1.162	1.300	7.424	40
	Banking crisis (avg, w3)	0.946	1.072	0.000	4.318	40
	Deposit insurance banks (avg, w3)	3.096	3.209	0.000	11.80	40
	Government guarantee (avg, w3)	0.656	2.559	0.000	13.50	40
After Guarantee	Δ^{1M}(Market Share)$_t$	-0.002	0.006	-0.014	0.028	92
	Δ^{1M}(Interest margin)$_t$	0.000	0.015	-0.059	0.037	92
	Deposit Insurance (avg. w3)	3.446	1.380	1.576	7.424	92
	Banking crisis (avg. w3)	0.994	0.874	0.167	4.318	92
	Deposit insurance banks (avg. w3)	3.636	1.889	0.000	9.500	92
	Government guarantee (avg. w3)	4.204	5.849	0.000	23.50	92
Main variables for state level analysis						
Before Guarantee	Δ^{qtly}(Market Share)$_{j,t}$	-0.003	0.023	-0.126	0.059	222
	Δ^{qtly}(Interest margin)$_{j,t-1}$	0.008	0.080	-0.344	0.243	216
After Guarantee	Δ^{qtly}(Market Share)$_{j,t}$	-0.004	0.016	-0.063	0.112	558
	Δ^{qtly}(Interest margin)$_{j,t-1}$	-0.003	0.066	-0.571	0.373	558
Main variables for bank level analysis						
Before Guarantee	Δ^{qtly}(Deposit Share)$_{i,t}$	-0.0001	0.0009			2,580
	Δ^{qtly}(Interest rate)$_{i,t}$	0.0751	0.1452			2,494
	Equity ratio$_{i,t}$	0.0493	0.0097			2,494
	Capital markets funding$_{i,t}$	0.0058	0.0036			2,494
	Share of loans$_{i,t}$	0.6074	0.1011			2,494
After Guarantee	Δ^{qtly}(Deposit Share)$_{i,t}$	0.0007	0.0013			9,035
	Δ^{qtly}(Interest rate)$_{i,t}$	-0.0518	0.1333			9,019
	Equity ratio$_{i,t}$	0.0533	0.0111			9,019
	Capital markets funding$_{i,t}$	0.0054	0.0031			9,019
	Share of loans$_{i,t}$	0.6319	0.1166			9,019
Google searches for state and bank level analysis						
Before Guarantee	Deposit Insurance (avg, w3)	4.072	3.516	0.000	26.012	240
	Deposit Insurance (avg)	4.436	4.973	0.000	37.629	240
	Banking crisis (avg, w3)	1.487	2.579	0.000	14.539	240
After Guarantee	Deposit Insurance (avg, w3)	5.267	3.406	0.000	26.012	558
	Deposit Insurance (avg)	5.518	4.855	0.000	45.441	558
	Banking crisis (avg, w3)	1.905	2.175	0.000	14.539	558

Note - Bank level maximum and minimum values are confidential

Figure 1: Aggregate Correlation



Note - This figure shows the *Market share* variable against Google searches for "deposit insurance" in Germany, lagged by 5 months. Google series are the monthly average of the weekly original series and are winsorized by removing the extreme values in the months of September - November 2008.

Figure 2: Google Searches for "deposit insurance" across German states

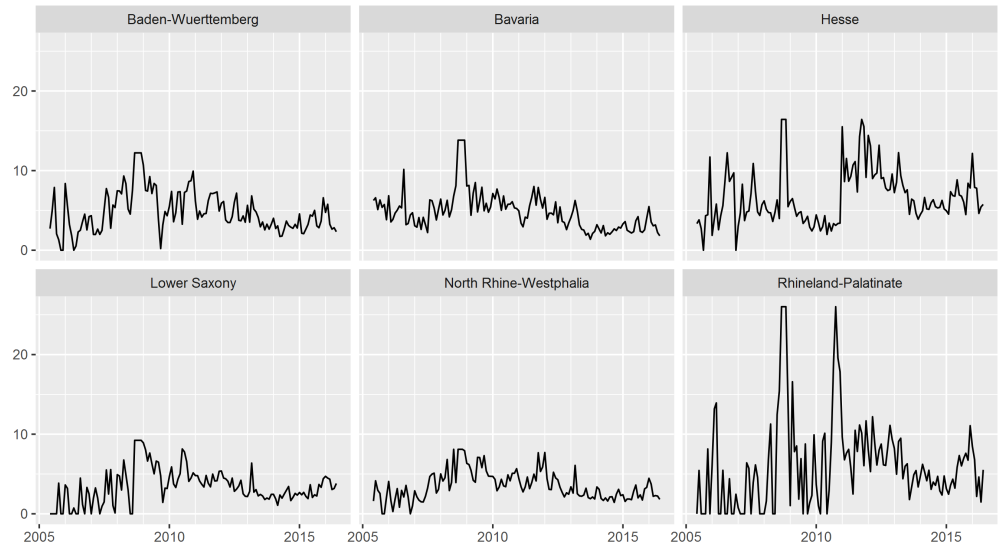


Figure 3: Google Searches for "banking crisis" across German states

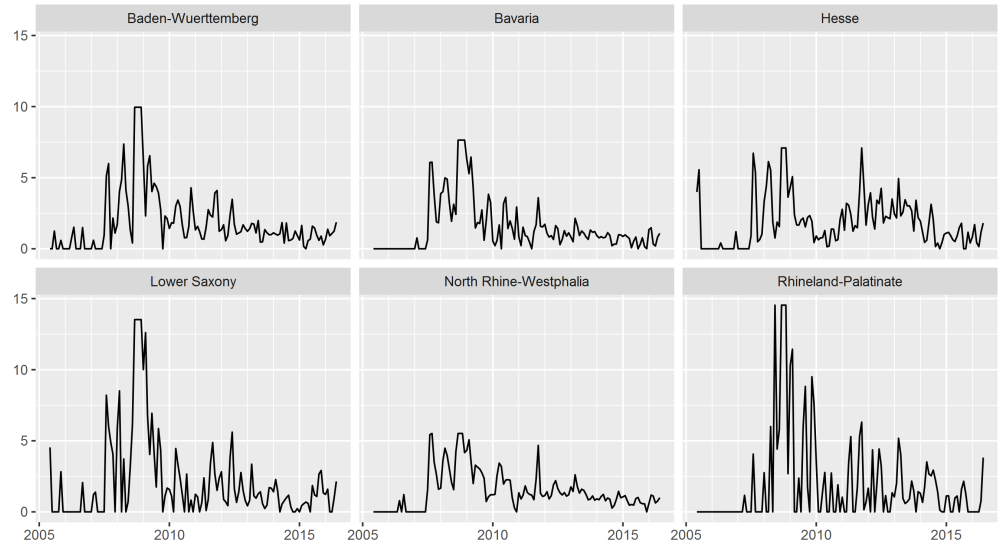


Figure 4: Market share variable across German states

Figure 5: Interest margin across German states

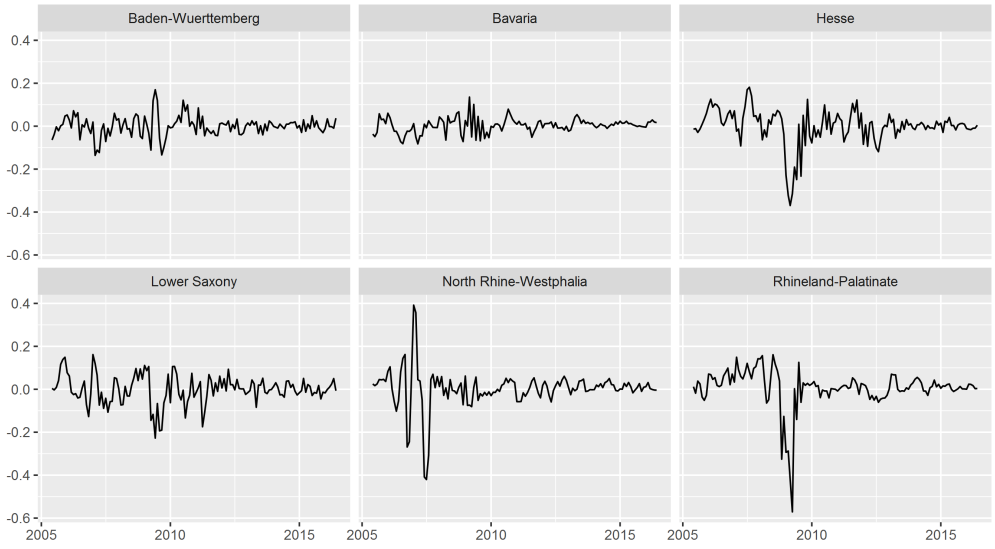


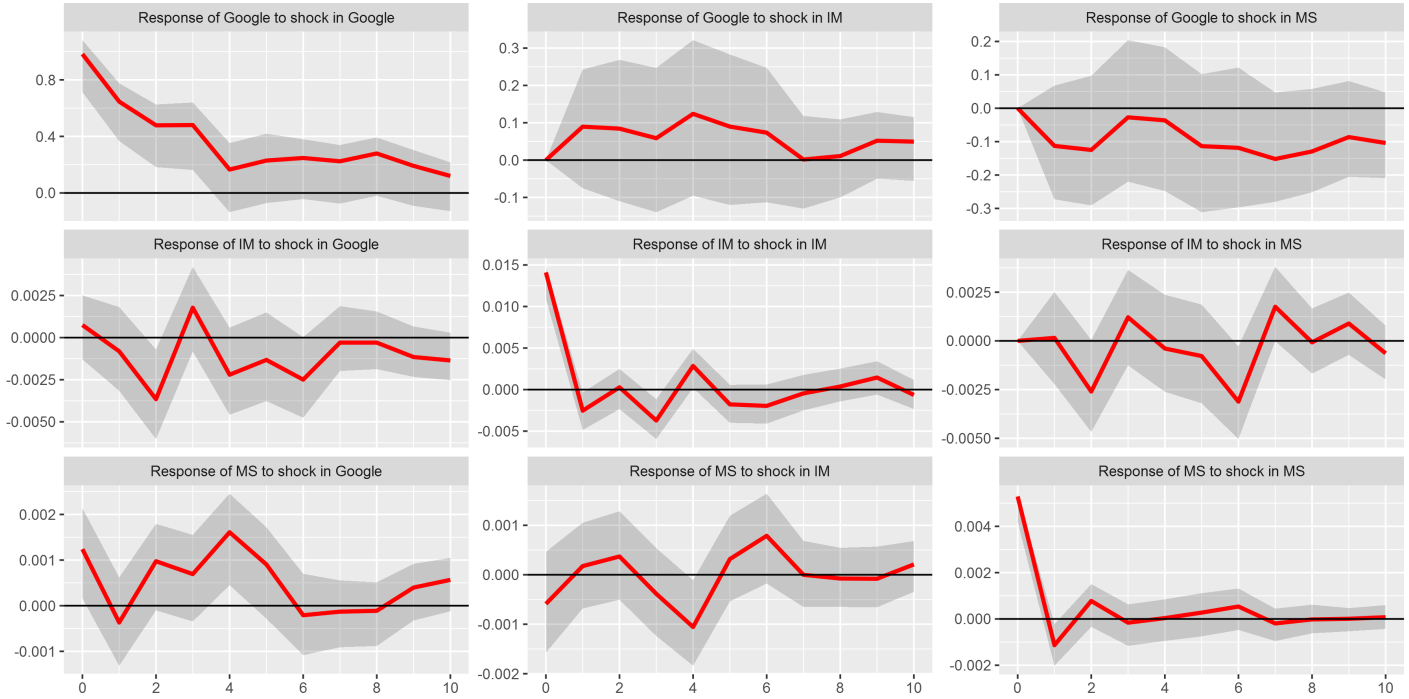
Table 3: Unit root tests

	ADF	**PP**
Market share	-1.86	-6.95
	(0.64)	(0.71)
Δ_1**Market share**	-12.91***	-160.83***
	(0.01)	(0.01)
Interest margin	-2.67	-10.34
	(0.30)	(0.52)
Δ_1**Interest margin**	-13.29***	-157.17***
	(0.01)	(0.01)
Google (*deposit insurance*)	-4.25***	-29.53***
	(0.01)	(0.01)
Google (*banking crisis*)	-4.09***	-26.56**
	(0.01)	(0.01)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

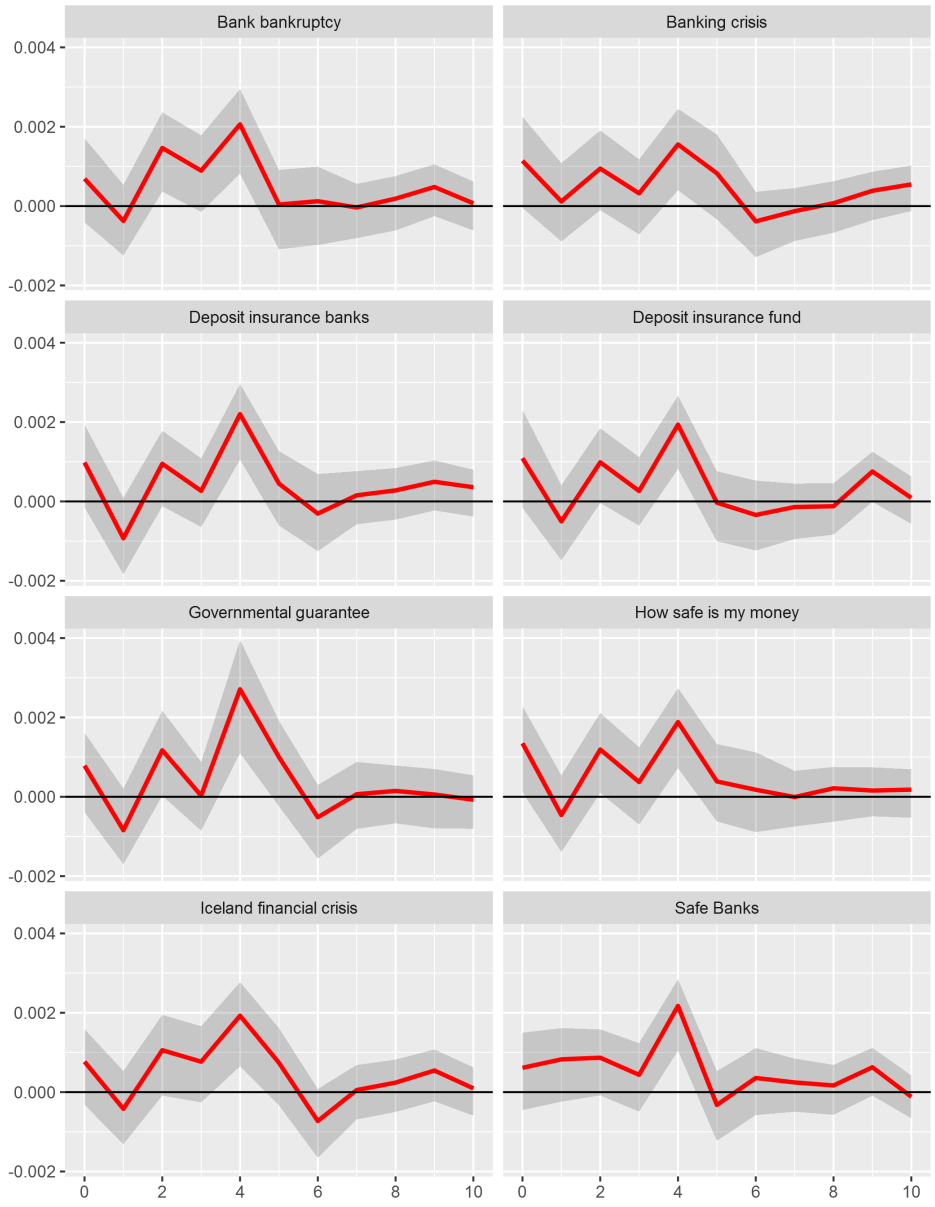
Note - This table depicts test statistics and corresponding p-values of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests.

Figure 6: Impulse response functions for search term 'deposit insurance'



Note - This figure shows the VAR analysis for German Google searches for "deposit insurance" and first differences of the variables *Market share* (MS) and *Interest margin* (IM). The error bands are shown in gray and were calculated using 95% confidence intervals and 1000 bootstrap iterations.

Figure 7: Impulse response functions for alternative search terms



Note - This figure shows impulse response functions for a set of alternative Google search terms. Plotted are the responses of first differences of the *Market share* variable on an impulse in the respective winsorized Google search term. The error bands are shown in gray and were calculated using 95% confidence intervals and 1000 bootstrap iterations.

Table 4: Granger results

Bivariate Analysis				
	Deposit insurance		*Banking crisis*	
	First difference	*Quarterly Change*	*First difference*	*Quarterly Change*
IM does not Granger-cause Google	0.43	0.60	2.21**	1.37
	(0.83)	(0.76)	(0.03)	(0.20)
IM does not Granger-cause MS	1.34	1.39	1.34	1.39
	(0.22)	(0.19)	(0.22)	(0.19)
MS does not Granger-cause Google	1.14	0.66	0.01	0.31
	(0.32)	(0.68)	(0.92)	(0.93)
MS does not Granger-cause IM	3.13***	3.82***	3.13***	3.82***
	(0.00)	(0.00)	(0.00)	(0.00)
Google does not Granger-cause IM	3.87***	2.68**	4.40***	3.57***
	(0.00)	(0.01)	(0.00)	(0.00)
Google does not Granger-cause MS	3.57**	3.37***	6.62**	3.60***
	(0.03)	(0.00)	(0.01)	(0.00)
Multivariate Analysis				
	Deposit insurance		*Banking crisis*	
	First difference	*Quarterly Change*	*First difference*	*Quarterly Change*
IM does not Granger-cause Google, MS	0.41	0.96	1.35	0.96
	(0.80)	(0.49)	(0.16)	(0.52)
MS does not Granger-cause Google, IM	1.33	1.67*	1.29	1.35
	(0.26)	(0.06)	(0.20)	(0.15)
Google does not Granger-cause IM, MS	4.08***	2.53***	2.56***	1.97***
	(0.00)	(0.00)	(0.00)	(0.01)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note - This table depicts F-test results and corresponding p-values of the bivariate and multivariate Granger causality test for two different specifications: H_0: "*X1* does not Granger-cause *X2*" for the bivariate case and "*X1* does not Granger-cause *X2, X3*" for the multivariate case. The multivariate model includes a Guarantee Dummy as exogenouos variable. Results are shown for serach terms *'deposit insucrance'* and *'banking crisis'*, as well as for first differences and quarterly changes of the variables *Market share* (MS) and *Interest margin* (IM). We obtain the same qualitative causality results as for the bivariate and multivariate analysis for other Google search terms as well as exclusion of the exogenous variable in the multivariate model.

Table 5: Results from the state-level data set

Δ^{qtly}(Market Share)$_{j,t}$	Model 1	Model 2	Model 3	Model 4	RC 1	RC 2	RC 3	RC 4
(Δ^{qtly} Interest margin)$_{j,t-1}$	0.037***	0.067***	0.066***	0.061***	0.116***	0.115***	0.115***	0.116***
	(4.28)	(7.00)	(6.82)	(4.25)	(7.89)	(7.83)	(7.83)	(7.76)
Google$_{j,t-5}$			-0.000	0.001***	0.001***	0.002***	0.001***	-0.001
			(-1.23)	(2.89)	(3.20)	(3.20)	(3.20)	(-0.73)
Guarantee=1				0.007	0.014	0.012	0.013	0.005
				(0.68)	(1.38)	(1.25)	(1.28)	(0.47)
Guarantee=1 × (Δ^{qtly} Interest margin)$_{j,t-1}$				0.004	-0.046**	-0.041**	-0.041**	-0.040**
				(0.23)	(-2.49)	(-2.22)	(-2.21)	(-2.11)
Guarantee=1 × Google$_{j,t-5}$				-0.002***	-0.002***	-0.002***	-0.002***	0.001
				(-4.24)	(-4.05)	(-3.70)	(-3.75)	(0.60)
Constant	-0.004***	0.003	-0.002	-0.006	-0.013*	-0.013*	-0.013*	-0.009
	(-2.83)	(0.43)	(-0.31)	(-0.83)	(-1.90)	(-1.90)	(-1.90)	(-1.21)
MTFE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hausman specification test (H0)	Not rejected	Not rejected	Not rejected	Not rejected	Not rejected	Not rejected	Not rejected	Not rejected
Observations	774	774	768	768	768	768	768	768
Degrees of freedom	1	129	129	131	131	131	131	131
R-squared	0.023	0.261	0.260	0.275	0.352	0.306	0.273	0.261

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note - This table reports the main results and robustness checks of regressions on the level of the six federal state for the time period June 2005 to June 2016. All regressions include a regional (i.e. state-level) fixed effect. Note that × denotes the add-on effect of the interaction and MTF indicates whether a monthly time fixed effect is specified in the regression. For **Models 1 to 4**, the Google search term related to "deposit insurance" is lagged by five months and winsorized between September 2008 - November 2008. In **RC 1**, the dependent variable is calculated only for overnight deposits stemming from private households, in **RC 2**, the five months lagged search term related to "deposit insurance" is winsorized only for the peak month of October 2008, in **RC 3** the non-winsorized and five months lagged search term related to "deposit insurance" is included. Finally, in **RC 4**, the Google search term is related to "banking crisis", lagged by five months and winsorized between September 2008 - November 2008.

Table 6: Results from the bank-level data set

Δ^{qtly}(Deposit Share)$_{i,t}$	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
$NG_t \times Coop_i \times$ Google$_{j,t-5}$	-0.012***	-0.005***	-0.006***	-0.006**	-0.004*	0.001
	(-12.73)	(-2.72)	(-2.92)	(-2.48)	(-1.81)	(0.61)
$NG_t \times Sav_i \times$ Google$_{j,t-5}$	-0.009***	-0.002	-0.002	-0.002		0.001
	(-9.82)	(-1.18)	(-0.93)	(-0.92)		(0.86)
$G_t \times Coop_i \times$ Google$_{j,t-5}$	0.006***	-0.000	-0.001	-0.001	-0.002	-0.001
	(10.26)	(-0.41)	(-0.58)	(-0.76)	(-1.27)	(-0.74)
$G_t \times Sav_i \times$ Google$_{j,t-5}$	0.005***	0.000	0.000	0.000		0.000
	(8.59)	(0.49)	(0.35)	(0.49)		(0.24)
$NG_t \times Coop_i \times (\Delta^{qtly}\text{Int})_{i,t-1}$	0.000***	0.001	0.001	0.001	0.001	0.001
	(2.80)	(1.22)	(1.19)	(1.17)	(1.22)	(1.20)
$NG_t \times Sav_i \times (\Delta^{qtly}\text{Int})_{i,t-1}$	0.001*	0.002***	0.002***	0.002***	0.002***	0.002***
	(1.91)	(3.69)	(3.92)	(4.14)	(4.33)	(4.04)
$G_t \times Coop_i \times (\Delta^{qtly}\text{Int})_{i,t-1}$	-0.001***	0.002***	0.002***	0.002***	0.002***	0.002***
	(-7.36)	(3.74)	(3.72)	(3.74)	(3.83)	(3.84)
$G_t \times Sav_i \times (\Delta^{qtly}\text{Int})_{i,t-1}$	-0.002***	0.002***	0.002***	0.002***	0.002***	0.002***
	(-14.19)	(5.17)	(5.00)	(5.01)	(4.84)	(4.92)
Constant	0.000***	-0.000	-0.000	-0.001	0.000	-0.001
	(12.80)	(-0.43)	(-1.01)	(-1.32)	(1.03)	(-1.61)
BankFE	Yes	Yes	Yes	Yes	Yes	Yes
MTFE	Yes	Yes	Yes	Yes	No	Yes
Regional MTFE	No	No	No	No	Yes	No
BSC	No	No	Yes	Yes	Yes	Yes
BSCSD	No	No	No	Yes	Yes	Yes
Hausman specification test (H0)	Rejected	Not rejected	Not rejected	Not rejected	Not rejected	Not rejected
Observations	12,344	12,344	12,344	12,344	12,344	12,455
Overall R-squared	0.098	0.237	0.217	0.213	0.133	0.215
Within R-squared	0.101	0.245	0.246	0.247	0.293	0.246

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note - This table reports the main results and robustness checks of regressions on the bank level for the time period June 2005 to June 2016. For readability of the table, the interaction effects and their significance are directly estimated and main effects are neglected and Google is divided by 100. All regressions include a bank fixed effect. Standard errors are robust and clustered on the bank level (111 clusters). Sav_i indicates that a bank belongs to the banking group "savings banks" and $Coop_i$ if it belongs to the banking group "credit cooperatives". G_t stand for the dummy $Guarantee_t$ being one and indicates the post Guarantee time (i.e. after October 2008) and NG_t" indicates the no guarantee time (i.e. before October 2008) and is an abbreviation for $(1 - Guarantee_t)$ being one. "Int" is the interest rate paid by bank i. *MTFE* is a monthly time fixed effect, *BSC* adds the three bank balance sheet characteristics and *BSCSD* adds bank characteristics interacted by the *guarantee dummy* and the banking group dummy (BGR). All balance sheet measures are lagged by one month. All balance sheet characteristics are lagged by one month. G is equal to 0 before October 2008 and 1 afterwards. In **Model 5**, regional monthly fixed effects are included. For **Models 1 to 5**, the Google search term related to "deposit insurance" is lagged by five months and winsorized between September 2008 - November 2008. In **Model 6**, the Google search term is related to "banking crisis", lagged by five months and winsorized between September 2008 - November 2008.