SONDERFORSCHUNGSBEREICH 504

Rationalitätskonzepte,
Entscheidungsverhalten und
ökonomische Modellierung

No. 03-11

The Great Banks' Depression - Deposit Withdrawals in the German Crisis of 1931

Isabel Schnabel*

December 2002

I would like to thank Reinhold Schnabel for very helpful discussions in the early stages of this project. Moreover, I thank Jochen Bigus, Christoph Buchheim, Mark Carlson, Martin Hellwig, Hans-Joachim Voth, David Wheelock and the participants of the Annual Meeting of the Cliometric Society in Raleigh, the Banking Workshop in Muenster, the Annual Meeting of the European Economic Association in Stockholm, the Annual Meeting of the Economic History Association in Nashville, the Annual Meeting of the Verein fuer Socialpolitik in Zuerich as well as seminar participants at Pompeu Fabra and the University of Mannheim for useful comments and suggestions.

*Department of Economics, University of Mannheim, email: isabel@econ.uni-mannheim.de

Universität Mannheim
L 13,15
68131 Mannheim

The Great Banks' Depression – Deposit Withdrawals in the German Crisis of 1931

Isabel Schnabel*
University of Mannheim
First version: 11 December 2002
This version: 24 March 2003

Abstract

Using monthly balance-sheet data of all major German credit banks, we analyze deposit withdrawals and bank failures in the German banking and currency crisis of 1931. We show that deposit withdrawals were related to indicators of banks' liquidity and solvency and were hence not simply the consequence of a run on the German currency. We find no evidence that branch banks were more stable than unit banks. Finally, we show that larger banks had a lower probability of failure, were more likely to be bailed out by the public authorities, and were granted preferential access to the Reichsbank's discount window. We interpret these results as evidence for a "too-big-to-fail" phenomenon. **(JEL: G21, E5, N24, C34)**

Keywords: Deposit withdrawals, bank failures, "too big to fail", Great Depression.

1 Introduction

In 1931, the German economy was shaken by a crisis that led not only to the breakdown of the banking system, but also to the factual abandonment of the

*Department of Economics, University of Mannheim. E-mail: isabel@econ.uni-mannheim.de. I would like to thank Reinhold Schnabel for very helpful discussions in the early stages of this project. Moreover, I thank Jochen Bigus, Christoph Buchheim, Mark Carlson, Martin Hellwig, Hans-Joachim Voth, David Wheelock and the participants of the Annual Meeting of the Cliometric Society in Raleigh, the Banking Workshop in Münster, the Annual Meeting of the European Economic Association in Stockholm, the Annual Meeting of the Economic History Association in Nashville, the Annual Meeting of the Verein für Socialpolitik in Zürich as well as seminar participants at Pompeu Fabra and the University of Mannheim for useful comments and suggestions.

gold standard in Germany. There is an ongoing debate how the banking and the currency crises were related. The older literature placed a lot of emphasis on (microeconomic) problems in the banking system that were largely independent of the currency problems. However, there is a growing number of authors who consider the banking crisis as being largely the consequence of the currency problems.[1] The argument goes that depositors withdrew their funds not because of the weaknesses in the banking sector, but because of the waning faith in Germany's ability and willingness to service its foreign debt and in the stability of the Reichsmark.

In a recent paper (Schnabel 2002), we have argued that the crisis was not merely a currency crisis, but that there were fundamental weaknesses in the German banking system that contributed to the occurrence and the severity of the crisis. We showed that the banking sector exhibited a large degree of heterogeneity with the great branch banks standing out due to their particularly poor performance both before and during the crisis. This is all the more surprising as these banks may have been expected to be the most stable due to their size and their widespread branch networks. The great branch banks liked to picture themselves as the innocent victims of a run on the German currency, which had hit them particularly hard due to their high holdings of foreign deposits. The Reichsbank used a similar justification for their generous liquidity support to banks that were already insolvent, such as Danatbank and Dresdner Bank: The support was said to be necessary to prevent foreign depositors from withdrawing their funds, thereby endangering the stability of the gold standard. In spite of their poor economic performance, none of the great branch banks failed in the end because all of them were saved through large capital injections, deposit guarantees, and generous loans by the public authorities.

After the crisis, the tone of the discussion shifted. Now the banks were accused of having caused the crisis by their irresponsible business policies. This also

[1] See, e.g., Hardach (1976), Balderston (1994), Ferguson and Temin (2001).

remained the consensus among the scholars of the German crisis over the following decades.[2] Interestingly, the more recent literature on the German crisis appears to be moving back to the first version of the story. This shift was initiated by Hardach (1976) who – rightly – criticized the exclusive focus on the banking issue and gave more emphasis to the currency side of the problem. In our view, the ensuing literature has, however, put too much emphasis on the currency problems and has mostly neglected the banking side of the crisis.

The goal of this paper is to shed new light on this old issue on the basis of disaggregated data. So far, most accounts of the banking crisis rely either on aggregate data, sometimes distinguishing between different bank groups, or on individual data on the six great banks that were all located in Berlin.[3] In our analysis, we employ a panel data set of the monthly balance sheets of all major German credit banks, covering the years 1928 to 1932. This data set reveals a substantial heterogeneity in the evolution of deposits across different banks. This suggests that a purely macroeconomic explanation of the crisis does not go very far. We try to explain this heterogeneity in a regression of deposit changes on bank characteristics and macroeconomic variables, controlling for non-random sample attrition by employing a Heckman correction model. We will explain in some detail why it may be more appropriate to study the evolution of deposits than to analyze bank failures only, as has been done in most of the existing literature.[4] We also analyze public standby activities to find out whether large banks received privileged treatment in times of crisis.

Our analysis is based on three hypotheses. The first hypothesis, named the *"currency-crisis hypothesis"*, states that the German crisis was a pure currency crisis and that deposit withdrawals were merely the consequence of a run on the German currency. In this case we would expect deposit withdrawals to be

[2] See, e.g., Born (1967).

[3] One notable exception is Petri (1998) who tries to explain "bank distress" on the basis of disaggregated data in a microeconometric duration analysis.

[4] In fact, outright failures were a minor problem in the German crisis of 1931 because the protagonists of the crisis, the great branch banks, were not allowed to fail.

particularly strong in times of currency turmoil. Despite the macroeconomic nature of currency problems, the heterogeneity of deposit withdrawals as such would not be sufficient to reject this hypothesis. The reason is that banks may differ with respect to their exposure towards such macroeconomic risks. For example, foreign depositors are likely to react more strongly than domestic ones. Therefore, we would expect those banks to be affected most that have the highest levels of foreign deposits. In contrast, deposit withdrawals should not be linked to indicators of individual banks' solvency or liquidity. The emphasis will be on this latter point. There is no doubt that the currency issue played a role. The question is whether there is an *additional* effect that can be linked to the banks' strength.

The second hypothesis, the *"branching hypothesis"* states that branch banks are more stable than unit banks due to a better diversification on both the assets and the liabilities sides of their balance sheets. This hypothesis goes back to the widely held belief that American banks were particularly fragile during the Great Depression because interstate branching was prohibited. However, this hypothesis stands in a stark contrast to the observation that the banks with nationwide branch networks suffered most in the German crisis. By controlling for the banks' branch structure, we try to find out whether there was a significant relationship between the banks' stability and their maintenance of branch networks in the German crisis.

The third, and maybe most interesting hypothesis states that larger banks had a lower probability of failure than smaller banks because they had a higher probability of being saved by the public authorities in case of a crisis. This hypothesis is named the *"too-big-to-fail hypothesis"*. The resulting moral-hazard problem should translate into higher risk-taking at large banks and into higher deposit growth, i.e., lower withdrawals, holding constant the riskiness of the banks' portfolios. In Schnabel (2002), we have argued that the great branch banks exhibited particularly risky business policies due to an implicit public guarantee. Here we

concentrate on the other predictions of the hypothesis, namely the impact of a bank's size on the probability of survival, on the probability and extent of supporting activities by the public authorities, and on deposit growth. The question is whether we can find statistical evidence for the "too-big-to-fail" phenomenon in addition to the descriptive evidence given in the other paper. The empirical challenge will be to separate the effect of size from other factors, such as the existence of a nationwide branch network.

Our main results can be summarized as follows: First, there is strong evidence that the German crisis cannot be described as a pure currency crisis, but that banking problems constituted an important part of the story. Indicators of banks' liquidity and solvency show a significant, independent impact on both deposit growth and bank failures. Second, there is no evidence that branch banks were more stable than unit banks.[5] Branch banks exhibited neither lower deposit withdrawals, nor a lower probability of failure. Regional shocks as measured by regional employment had no significant impact on deposit changes or on the probability of failure. This indicates that national shocks were more prevalent in the crisis than regional shocks. Third, there is strong evidence for large banks having had a higher probability of survival than smaller banks and somewhat weaker evidence that this also translated into lower deposit withdrawals, controlling for the riskiness of banks' portfolios. These results are consistent with a "too-big-to-fail" argument, but they also could be due to the effects of diversification. We further show that large banks were indeed more likely to be supported in the crisis and that they received preferential access to the Reichsbank's discount window. This clearly supports the "too-big-to-fail" hypothesis.

For the United States, there exist several microeconometric studies on the banking crises during the Great Depression.[6] Most of these studies have focused

[5]Carlson (2000) finds similar evidence for US banks during the Great Depression. In fact, branch banks are found to be less likely to survive and to survive for shorter periods of time, which contradicts the conventional wisdom.

[6]Examples are White (1984), Saunders and Wilson (1996), Calomiris and Mason (1997), Calomiris and Mason (2000), Carlson (2000). Wicker (1996) also makes use of disaggregated

on the explanation of bank failures rather than deposit changes.[7] One of the reasons seems to have been the limitations of the employed data sets in the time series dimension. To our knowledge, the only microeconometric paper on the German crisis is a paper by Petri (1998) who implements a survival analysis on German banks, similar to the ones done for the United States. Our paper differs from the one by Petri in several respects: First, our focus is on modeling deposit changes instead of bank failures. In fact, the estimation procedure used to correct for non-random sample attrition implies that deposit changes and bank failures are modeled simultaneously. Second, we employ a richer data set, which enables us to test the three hypotheses mentioned above. Most importantly, we collected data on banks' foreign debt, while Petri uses medium-term deposits as a proxy. In addition, we collected data on the branch structure of banks and regional data to control for regional shocks. And finally, we also analyze public support activities and the provision of liquidity to banks by the Reichsbank.

The analysis will proceed as follows. We formulate the three hypotheses outlined above in more detail in section 2. In section 3, we describe the data set and its major properties. Section 4 contains the econometric analysis of deposit changes. We first outline the econometric procedure and then present the results of our regression analysis and the corresponding robustness checks. The econometric analysis of standby activities can be found in section 5. Section 6 concludes. The appendix in section 7 contains a number of supplementary tables and the estimation results for some of the regressions described in the robustness sections.

data, while not using econometric techniques.

[7] One notable exception is the paper by Saunders and Wilson (1996).

2 Hypotheses

2.1 Hypothesis 1: Currency-crisis hypothesis

The "currency-crisis hypothesis" states that the German banking crisis was merely the result of the concurrent currency crisis.[8] Deposits were withdrawn from German banks not because these banks were weak, but because depositors wanted to move their funds outside of Germany. This hypothesis requires two pieces of evidence: First, changes in deposits should be related to indicators of the currency problems, such as the Reichsbank's gold cover or the exchange rate. Second, changes in deposits should *not* be related to indicators of individual banks' solvency or liquidity, such as equity or liquidity ratios. A rejection of the latter point would at the same time lend support to the view that depositors distinguished between "good" and "bad" banks. Note that the hypothesis does not imply that there is no heterogeneity across banks. Macroeconomic shocks such as currency problems do not have to affect all banks in the same way, as the exposure to macroeconomic risk may differ across banks. In fact, we may expect the currency problems to affect those banks most strongly that have the most "mobile" depositors. This would first of all be foreign depositors. Therefore, one should control for the share of foreign deposits in total deposits.

2.2 Hypothesis 2: Branching hypothesis

The "branching hypothesis" states that banks maintaining branch networks are more stable than unit banks. This is a widely maintained hypothesis that was based on the observation that a country like the United States with severe branching restrictions suffered much more from bank failures than a country like Canada where interstate branching was possible.[9] Branch banks should be more diversified both on the asset and on the liabilities sides and should therefore be less

[8] Versions of this hypothesis have been stated by Hardach (1976), Balderston (1994), Petri (1998), and Ferguson and Temin (2001).

[9] This hypothesis was first stated by Friedman and Schwarz (1963, pp. 352) and has been reiterated, for example, by White (1984), Bordo (1986), Grossman (1994), and Calomiris (2000).

vulnerable to local or regional asset and liquidity shocks. The branching hypothesis implies that banks maintaining branch networks suffered from lower deposit withdrawals and were less likely to fail than unit banks. This can be checked by including branching variables in the estimation equations. One problem arises from the fact that banks with large branch networks typically are large banks. Therefore, it is important to try to separate the effects of size and branching, for example, by simultaneously including a measure of size, such as total assets.

It should be noted that the rejection of the branching hypothesis does not imply that branch networks never offer any protection to banks. A rejection could, for example, also be due to the prevalence of national instead of regional shocks.

2.3 Hypothesis 3: "Too-big-to-fail" hypothesis

According to the "too-big-to-fail hypothesis", larger banks have a lower probability of failure than smaller banks because they have a higher probability of being saved by the public authorities in case of a crisis. The resulting moral-hazard problem should show up in higher risk-taking at large banks and in higher deposit growth, holding constant the riskiness of the banks' portfolios.

The hypothesis can be checked either by looking at bank survival, at the actual supporting activities by the public authorities, at the riskiness of banks' business strategies, or at banks' deposit growth. We get the following empirical predictions: First, large banks are more likely to survive, i.e., the probability of survival should depend positively on the size of the bank. Second, large banks benefit more from public supporting activities. Hence, the probability of being supported should also be positively related to the size of banks. Apart from looking at the discrete standby activities, one can also analyze the liquidity provision by the central bank. If large banks are "too big to fail", the Reichsbank should privilege them in the provision of liquidity, especially in times of crisis. Third,

large banks should exhibit "excessive risk-taking".[10] Finally, the size of banks should have a positive impact on banks' deposit growth, holding constant the banks' riskiness.

The greater stability of banks alone is not sufficient to confirm the "too-big-to-fail" hypothesis because this could also be due to diversification effects. In this light, the additional analysis of observed public support activities is particularly instructive. In addition, it is important to try to control for diversification effects, e.g., by including variables on branching.

3 Data

3.1 Description of data sources

In this section, we describe the major data sources used in this study. All variables used in our econometric analysis are either in monthly frequency, or are constant over time. The data fall into three categories: bank balance-sheet data, other bank data, and aggregate (national or regional) data. A detailed list of the descriptive statistics and sources of the variables used in the analysis can be found in table A2 in the appendix.

3.1.1 Balance-sheet data

The main data source used in this study are the monthly balance sheets of German banks, which were published in *Deutscher Reichs- und Preußischer Staatsanzeiger*. The publication of interim balance sheets started in 1911 as a consequence of an official examination of the banking sector ("Bankenquête") in 1908. The public authorities were worried about the notoriously low levels of liquidity reserves at the German banks who had learned to rely on the Reichsbank for their liquidity. By agreeing on greater publicity, the banks were able to avoid

[10] We will not follow up on this issue here. Some evidence on excessive risk-taking by the great branch banks can be found in Schnabel (2002).

strict liquidity prescriptions.[11] The obligation to publish interim balance sheets did not apply to all banks. Only banks that wanted their shares to be authorized for trading at a German stock exchange were required to publish at least five interim balance sheets per year, using the balance-sheet scheme prescribed by the Reichsbank.[12] The publication of balance sheets was interrupted during World War I, but was resumed in 1925. Monthly publication started only in March 1928. As the prescribed balance-sheet scheme was modified substantially in March 1928, continuous series exist only from that date on. Hence, our sample stretches from March 1928 till the end of 1932, shortly before the take-over of power by Hitler. No monthly balances were provided for the months of December and January to avoid interference with the annual balances. Due to the common practice of "window dressing" in annual balances, there is no continuity between the monthly and the annual balance sheets, such that the latter cannot be used in our analysis. In addition, not all banks used the Reichsbank scheme for their annual balances. Hence, our sample contains a total of 49 months with balance-sheet data. The high frequency of balances is a particularly attractive property of the data set as it also permits a detailed analysis of deposit flows over time.

In our sample period there was a total of 153 banks who published monthly balance sheets. About one third of these banks were the publicly owned *Staatsbanken*, *Landesbanken*, and *Girozentralen* (SLGs in the following). The remaining banks were larger credit banks. The sample does not include savings banks, mortgage banks, and cooperative banks, as well as smaller credit banks. We decided to exclude the SLGs from the analysis because the bulk of their business was either with other banks or with public authorities and was hence very different from the business of the credit banks.[13] While the SLGs also suffered from a severe

[11] Hardach (1995, p. 918), James (1998, pp. 42).

[12] The publication of interim balance sheets became mandatory only after the crisis through the enactment of the new banking law in 1934.

[13] The Girozentralen were the savings banks' central institutes, which managed the savings banks' mandatory liquidity reserves, served as central clearing organizations, and helped in the provision and investment of funds. The Staatsbanken and Landesbanken belonged directly to the German states and served similar purposes as the Girozentralen.

crisis in 1931, their problems were of a different nature than the ones of the credit banks: they were mostly related to the excessive indebtedness of German municipalities. The currency problems played only a minor role as foreign indebtedness of these banks was negligible. Therefore, it is in our view not appropriate to pool these banks with the credit banks in the analysis.[14] After the exclusion of the Staatsbanken, Landesbanken, and Girozentralen, there remain 110 banks in our sample.[15]

The sample is highly unbalanced in that only 50 of these banks published balance sheets in all of the 49 months. The econometric problems arising from this feature of the data are going to be discussed in detail below (see section 4.1). With respect to total assets, the sample comprises almost one third of the German banking system, and 75 percent of total assets of all German credit banks.

It should be noted that the monthly balances were so-called raw balances, which means that the banks did not book their earnings and losses during the year, but adjusted their capital only once a year. This means, for example, that the monthly balances typically did not contain current allowances for depreciation. In this respect, monthly balance sheets do not yield a very complete picture of the actual situation of a bank. The problem is most severe with respect to the measurement of capital as well as to all items that are subject to depreciation, such as loans and securities portfolios. Its effect is much smaller on items like deposits or liquid means. On the other hand, monthly balance sheets have the advantage that they tend to be subject to less "window dressing" than annual balances.[16]

3.1.2 Other bank data

The balance-sheet data is supplemented by additional information on German banks, which cannot be extracted from the monthly balance sheets. One variable

[14] In contrast, Petri (1998) uses the pooled sample of banks.
[15] One credit bank had to be excluded as there was only a single observation.
[16] Blatz (1971, p. 21).

of major importance is banks' foreign debt. Foreign debt consisted mainly of two kinds of loans[17]: The first kind of loan was an acceptance credit, the amount of which can readily be inferred from banks' balance sheets.[18] The second – and far more important – kind of foreign loan was a short-term cash loan with a maturity of one to three months. Unfortunately, the amount of these loans cannot be inferred from balance sheets directly because they were included in the balance-sheet position "other deposits" that in addition contained all domestic non-bank deposits. However, monthly reporting banks had to report their levels of foreign debt confidentially to the Reichsbank on a quarterly basis. These data were never published, but they partly exist in the Reichsbank's archival material in the Bundesarchiv in Berlin. While the available information is not sufficient to construct continuous time series for all the banks in our sample, we were able to construct a measure of the level of foreign debt as of June 30, 1930.[19] If the relative importance of withdrawals of domestic and foreign deposits at German banks was comparable across banks, this measure should be able to capture cross-sectional differences in the vulnerability of banks to short-term capital reversals in the German economy. In any case, it should be more reliable than the level of medium-term deposits, which has been used by other authors as a proxy for foreign debt.[20]

Another important piece of information concerns the chronology of banks' failures and mergers. We examined all the relevant issues of the periodical *Die*

[17]Enquête-Ausschuß (1930, pp. 80), Blatz (1971, pp. 98).

[18]The corresponding balance-sheet positions were "Rembourskredite" on the assets side and "Seitens der Kundschaft bei Dritten benutzte Kredite" on the liabilities side. The values of these positions - though not numerically identical - are very similar. According to the Deutsche Bundesbank (1976), the position on the liabilities side is a reliable measure of foreign acceptance loans even though it contains a small amount of domestic debt.

[19]The data on foreign debt used in this study can be found in the following files from the Bundesarchiv Berlin, Reichsbank R2501: 6479, 6482, 6484, 6491-2, 6559, 6634, 6709, 6746, 7712. The construction of foreign-debt variables is described in the appendix.

[20]Examples are Balderston (1994, p. 49) and Petri (1998, p. 104). The use of medium-term deposits leads on average to a strong overestimation of the share of foreign deposits: While the average share of foreign deposits was 16 percent according to our measure on June, 30, 1930, the alternative measure gives an average of 39 percent with the measurement error ranging between – 7 and + 91 percentage points.

Bank, which contains a detailed chronology of all major events in the German banking sector. Thereby, we were able to construct a fairly complete chronology for all the banks contained in our sample. As we will explain below (see section 4.1), it is of particular importance to classify the mergers as either competitive mergers or as distress mergers. *Die Bank* also contains information on the standby activities from the side of the government or the Reichsbank. We defined the standby activities to include capital injections, public guarantees, and public loans beyond the discount and lombard loans by the Reichsbank. The ordinary refinancing of banks through the Reichsbank will be treated separately in the analysis.

Finally, we collected information on the banks' branch networks from Saling's Börsenpapiere (1930).

3.1.3 Regional and national data

In addition to the data on individual banks, we collected a large number of national and regional variables. The variables can broadly be classified into the following categories: business cycle (production, prices, employment, insolvencies, interest rates), the currency situation (Reichsbank gold cover, exchange rate, international interest rate differentials), the public sector (public debt, taxes, public expenditures), monetary policy (discount rate, stock of bills at the Reichsbank, monetary aggregates), other financial variables (stock prices), aggregate data on the banking system (insolvencies in the banking sector, stock prices of bank shares, deposit-to-currency ratio, concentration in the banking sector, average interest margins), and other regional characteristics (population density, importance of agriculture). For banks with national branch networks, we inserted the figures for the German Reich when using regional variables. Not all of these variables were actually used in the final analysis.

3.2 Descriptive analysis

Now we describe the major properties of our sample. We first look at the characteristics of the banks contained in our sample. Then we depict the evolution of deposits at the aggregate level over time, as well as at the heterogeneity of deposit changes across different bank groups. Finally, we describe the evolution of endorsement liabilities at different bank groups.

3.2.1 Bank characteristics

Most of the 110 credit banks in our sample were universal banks. Only a small subset of 16 banks (15%) were specialized, mostly sector-specific banks. Six banks (5%) were public credit banks, the most important being *Reichs-Kredit-Gesellschaft* (RKG), the "house bank" of the Reich's big industrial conglomerate VIAG.

The banks in our sample were spread all over the German Reich. The highest numbers of banks were found in Sachsen (23 banks), Berlin (21 banks), and Rheinprovinz (14 banks). With respect to total assets, Berlin clearly stood out as all six of the so-called "great banks" were based in Berlin. While *Deutsche Bank und Disconto-Gesellschaft*, *Darmstädter und Nationalbank* (Danatbank), *Dresdner Bank*, and *Commerz- und Privat-Bank* (Commerzbank) maintained widespread networks of branch offices, *Berliner Handels-Gesellschaft* and *Reichs-Kredit-Gesellschaft* did not have any branch offices. Instead the great non-branch banks maintained correspondence relationships with provincial and other credit banks who often preferred to conduct business with banks not standing in direct competition with them. Out of all banks, more than two thirds had at least one branch outside of the city where they were located, and one fourth maintained at least ten branches outside of their home base. Only eight banks maintained a nationwide network. Besides the great branch banks[21], these were *Mitteldeutsche*

[21]The six great branch banks are Deutsche Bank and Disconto-Gesellschaft (before their merger), Commerzbank, Dresdner Bank, Danatbank, and Deutsche Bank und Disconto-Gesellschaft (after the merger).

Creditbank, which was later to be merged with Commerzbank, and the publicly owned *Deutsche Bau- and Bodenbank*.

The German credit banks relied heavily on foreign funds for their financing, with 29 percent of their total deposits being foreign in June 1930. However, foreign debt was distributed very unevenly across banks, with particularly high shares of foreign deposits at the great banks. At only one third of the credit banks, foreign deposits constituted more than ten percent of total deposits, and at one fifth the share was above twenty percent. The only public bank relying heavily on foreign deposits was *Reichs-Kredit-Gesellschaft*, with the share of foreign deposits being 50 percent.

19 banks in our sample (17%) failed between 1928 and 1932. In addition, 12 banks (11%) received public support. Three of the supported banks still failed, while the remaining nine survived. It is interesting to compare the four different bank groups, the failing banks with or without public support, and the surviving banks with or without public support. Table 1 summarizes the major findings. It includes an extra column on the great branch banks for comparison.

Table 1 suggests the following preliminary observations: First, outright bank failures played a minor role in the German crisis. The failing credit banks, supported or not supported, were very small banks with few branches and low levels of foreign debt.[22] In contrast, the banks that survived with the help of public support were much more important in terms of total assets, foreign debt, and the number of branches. Six of the ten largest German banks, among them all the great branch banks, belonged to this group. In fact, the *sum* of total assets of all failing banks was well below the *median* of total assets of the banks that received public support and survived. Hence, the real problem in the German crisis of 1931 were not the banks who actually failed, but the ones who survived only with the help of the German public authorities. Finally, the surviving banks

[22]Of course, we observe only a subset of all bank failures in our sample. However, the failing banks that are not contained in our sample are likely to be small as well.

that received support had much lower liquidity and equity ratios than the banks that survived without such support. Particularly low equity ratios were found at the great branch banks. It should be noted that these numbers overstate the actual liquidity and solvency of the supported banks, because they already include public liquidity and capital injections.[23]

	All credit banks				Great branch banks
	Failing banks		Surviving banks		Surviving
Public support	no	yes	no	yes	yes
Number of banks	16	3	64	9	4
Total assets, median (million RM)	7	11	8	352	1,815
Total assets, maximum (million RM)	19	38	1,039	3,784	3,784
# branches, median	2	3	2	83	206
# branches, maximum	17	19	154	301	301
Share of foreign deposits, median	9%	9%	9%	38%	41%
Share of foreign deposits, maximum	16%	11%	81%	48%	45%
Cash liquidity, median	1.4%	1.2%	2.5%	2.0%	1.9%
Cash liquidity, mean	2.4%	1.2%	3.0%	2.2%	1.9%
First-order liquidity, median	19%	8%	27%	20%	22%
First-order liquidity, mean	21%	8%	34%	21%	22%
Equity ratio, median	21%	14%	19%	16%	7%
Equity ratio, mean	24%	17%	22%	14%	10%

Table 1: Characteristics of different bank groups. Notes: The numbers refer to the month before failure for failing banks, and to November 1931 for surviving banks. The number of banks in this table is below 110 because it does not include surviving banks that do not have valid data for November 1931. Note that the great branch banks are also contained in the column "All credit banks". The definitions of liquidity and equity ratios can be found in table A2 in the appendix. Sources: Deutscher Reichs- und Preußischer Staatsanzeiger, Bundesarchiv Berlin (Reichsbank R2501, diverse files).

3.2.2 Evolution of deposits

Figure 1 depicts the evolution of the Reichsbank's gold cover and the evolution of deposits at monthly reporting banks. In addition, total deposits are split up into foreign and domestic deposits. In Schnabel (2002), we have described in detail the evolution of aggregate deposits and their relationship to the episodes of currency

[23]For example, Dresdner Bank's equity more than tripled due to a capital injection of 300 million Reichsmark in July 1931.

turmoil and banking problems before and during the crisis of 1931. Here we only want to stress two points: First, there were two periods of high aggregate deposit withdrawals before the actual crisis in 1931, one in spring 1929, the other in fall 1930. These seem to have been related to the concurrent currency problems that had been triggered by political shocks. Just as the final crisis in 1931, the two episodes showed up at basically all bank groups, including the SLGs and the savings banks. Second, the withdrawals affected both domestic and foreign deposits, though foreign deposits were somewhat more volatile than domestic deposits.

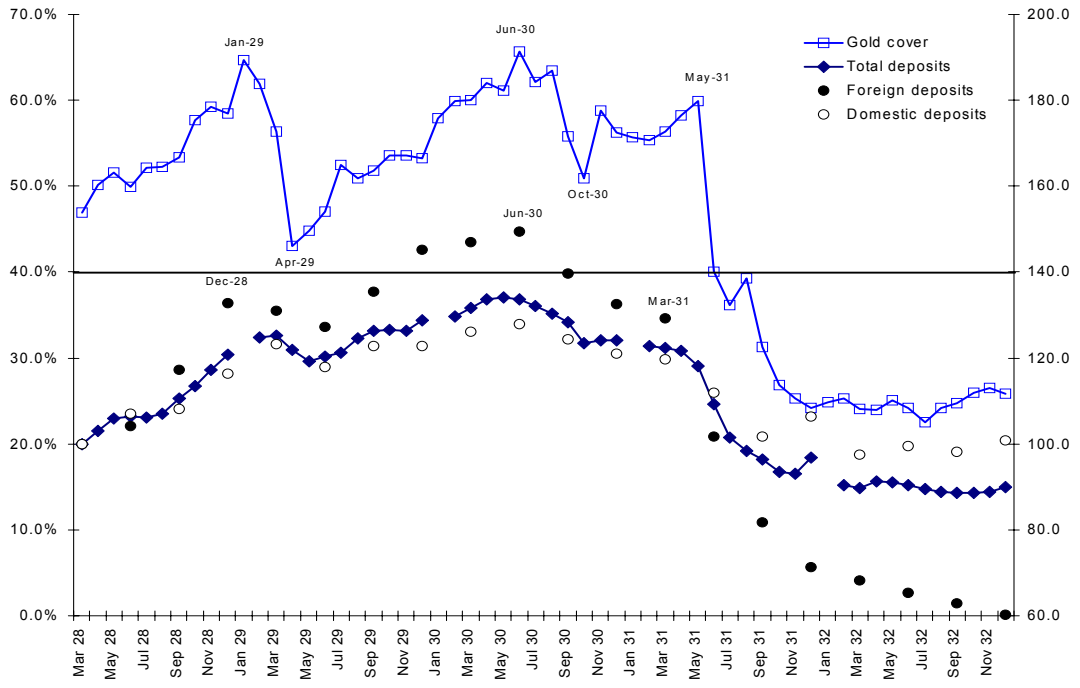

Figure 1: The Reichsbank's gold cover (white square, left scale) and total deposits at monthly reporting banks (black rhombus, March 1928 = 100, right scale), also split into foreign deposits (black circle) and domestic deposits (white circle). Notes: Gaps in the graphs are due to missing data. The definition of the gold cover can be found in table A2 in the appendix. The solid line denotes the mandatory gold cover in the gold exchange standard. Sources: Deutscher Reichs- und Preußischer Staatsanzeiger, Statistisches Jahrbuch für das Deutsche Reich, James (1985, pp. 358), Institut für Konjunkturforschung (1936).

The histogram in figure 2 conveys a first impression of the heterogeneity of deposit changes across banks.[24] The figure is to be read as follows: Each bar shows the fraction of banks experiencing the change in deposits given by the number on the x-axis. Deposit changes refer to the period between June 1930 and November 1931. Figure 2 reveals that there was a considerable heterogeneity of deposit changes across banks. For some banks, deposits even increased.

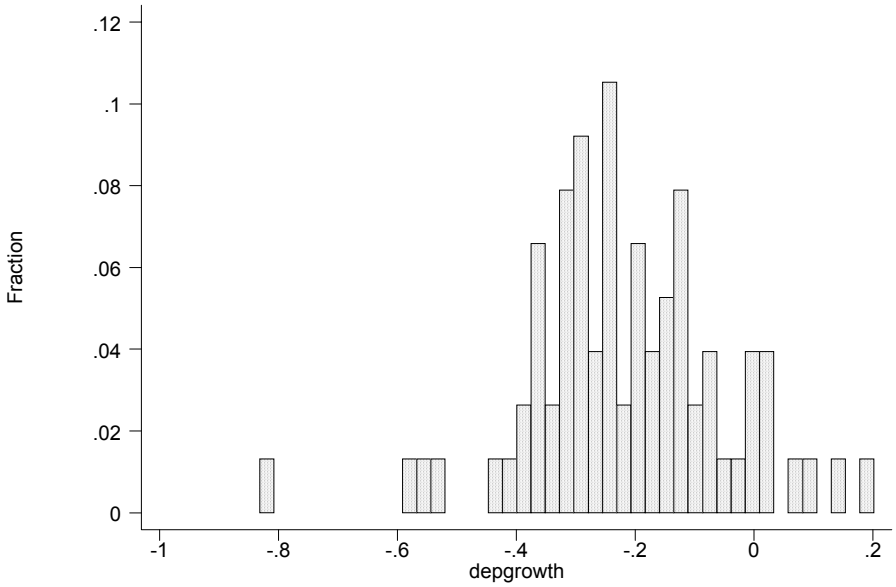

Figure 2: Histogram of changes in deposits between June 1930 and November 1931 for monthly reporting credit banks. Notes: The numbers on the x-axis are given as fractions of the initial level. Example: A value of -0.2 denotes a decrease of deposits by 20 percent. The graph contains only 76 banks due to missing data. Source: Deutscher Reichs- und Preußischer Staatsanzeiger.

Table 2 shows the mean deposit changes for different bank groups, referring again to the period between June 1930 and November 1931. Deposits at monthly reporting credit banks decreased by 21.6 percent on average in the considered time period. At the savings banks and at the SLGs, the respective decline in deposits was much smaller. Also within the group of monthly reporting credit banks,

[24]The variable used in the following analysis is "total deposits". It is the sum of the following balance-sheet items: Foreign acceptance loans ("Seitens der Kundschaft bei Dritten benutzte Kredite"), domestic interbank deposits ("Deutsche Banken, Bankfirmen, Sparkassen und sonstige deutsche Kreditinstitute"), other deposits, including foreign interbank deposits ("Sonstige Kreditoren"), and domestic acceptance loans ("Akzepte").

private banks displayed higher withdrawals than public banks, even though the difference is less pronounced.

	Number of banks	June 1930 to November 1931
Monthly reporting credit banks	76	–21.6%
For comparison: Savings banks	2,570	–1.7%
For comparison: SLGs	37	–10.9%
Private credit banks	71	–22.0%
Public credit banks	5	–15.1%
10 largest credit banks	10	–30.0%
Banks other than 10 largest credit banks	66	–20.3%
1 branch	23	–21.8%
# branches > 1, not nationally	48	–20.8%
Nationwide branch network	5	–27.9%
Foreign debt < 10%	50	–18.9%
Foreign debt ≥ 10%	26	–26.7%
Specialized banks	11	–27.4%
Universal banks	65	–20.6%
Banks with public support	10	–31.8%
Banks without public support	66	–20.0%

Table 2: Percentage change in deposits between June 1930 and November 1931 for different bank groups. Notes: The numbers show the means of the respective bank groups. The table contains all banks for which deposit data was available at both dates. Sources: Deutscher Reichs- und Preußischer Staatsanzeiger, Statistisches Jahrbuch für das Deutsche Reich.

The highest withdrawals of deposits were found at the ten largest credit banks who lost 30.0 percent of their deposits, while the remaining banks lost only 20.3 percent on average. Hence, there is no evidence on the basis of the raw data that large banks were perceived as being particularly safe. Interestingly, the relationship between withdrawals and branching is not monotonic, as the highest withdrawals were found at the banks maintaining nationwide branch networks, while the lowest withdrawals were found at banks maintaining regional branch networks. This cannot easily be reconciled with the view that branch banks were more stable than non-branch banks. As expected, banks with high shares of foreign deposits show particularly high deposit withdrawals. Higher-than-average

withdrawals were also found at specialized banks. Finally, the banks who received public support were banks that had lost particularly high shares of their deposits. As the following regression analysis will show, not all results that come out of this simple descriptive analysis are preserved once we control appropriately for all relevant factors.

3.2.3 Evolution of endorsement liabilities

The discounting of bills was the major instrument of the Reichsbank for providing liquidity to the banking sector. Open market operations were still uncommon at that time, and the amount of lombard loans was small compared to the discounting of bills. The extent of discounting can be assessed by analyzing the evolution of endorsement liabilities of banks. Figure 3 displays the evolution of "other endorsement liabilities", the variable that is going to be used in the regression analysis. This off-balance-sheet item comprises all the bills of exchange that a bank has passed on, apart from bank acceptances and promissory notes ("Solawechsel"). The variable is used as a proxy for the level of outstanding discount loans that the bank has obtained from the Reichsbank. Even though the item may also comprise other bills, its growth is likely to be governed by the changes in rediscounting. We decided to exclude bank acceptances and promissory notes because they were generally not discountable at the Reichsbank, but were mostly sold on a separate market ("Privatdiskontmarkt") to which not all banks were admitted. Therefore, only a small share of banks held these types of bills.[25]

[25]In fact, the Reichsbank also discounted the other two types of bills in the crisis, thereby breaching the banking law. Therefore, we also ran regressions using total endorsement liabilities. All main results are unchanged (see the robustness section 5.3).

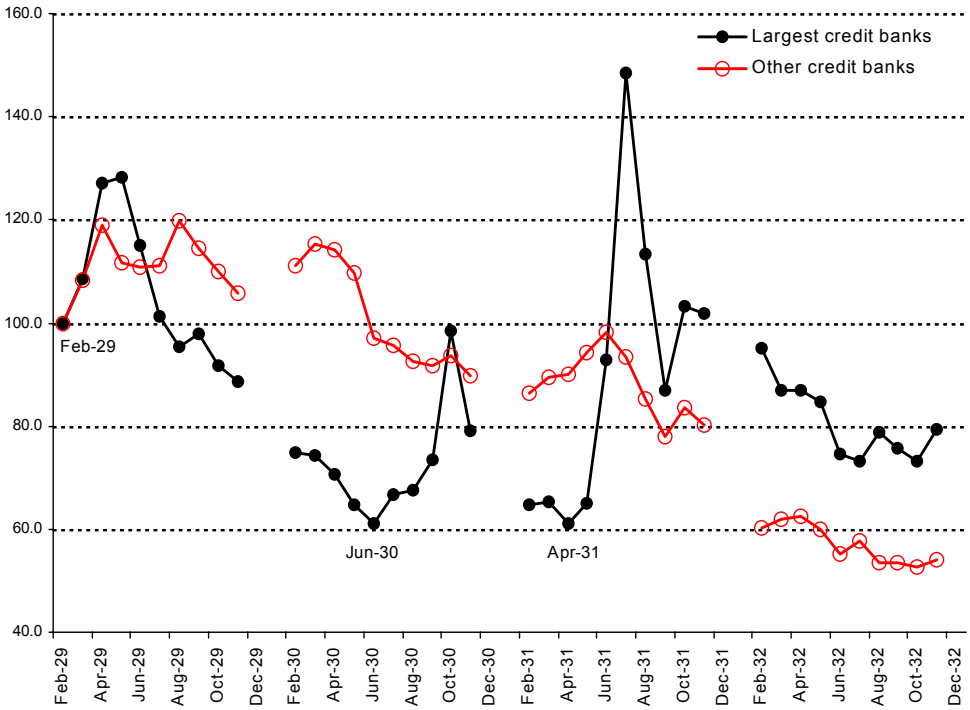

Figure 3: Other endorsement liabilities at largest monthly reporting credit banks (black circle) and at other monthly reporting credit banks (white circle), February 1929 = 100. Notes: The largest credit banks comprise the great Berlin banks and the four largest provincial banks; in addition, they contain all banks that were merged to any of these banks in the considered period. The group "other credit banks" refers to a constant sample of 59 banks. Gaps in the graphs are due to missing data. Source: Deutscher Reichs- und Preußischer Staatsanzeiger.

The figure shows the evolution of other endorsement liabilities for two different bank groups, the largest monthly reporting credit banks and the remaining monthly reporting credit banks. We find that in all three episodes of currency turmoil and banking problems – spring 1929, fall 1930, and summer 1931 – there was a sharp increase in endorsement liabilities at the largest banks. At the other credit banks, endorsement liabilities also increased in these months, but only mildly compared to the largest banks. The question to be answered in the following econometric analysis is why the increase in discount loans in times of crisis was so strong at the large banks compared to other banks. In the preceding section, we have seen that the largest banks also were the ones who lost the highest

shares of their deposits. So one possible explanation for the observed differences in discounting is that the larger banks had the highest liquidity needs due to particularly strong deposit withdrawals. Alternatively, the Reichsbank may have discounted more bills from banks who held high levels of foreign deposits to prevent a panic among foreign depositors. In fact, this was the explanation that was disseminated officially. Finally, it may be that large banks were given preferential access to the Reichsbank's rediscounting facilities due to their economic significance as would be predicted by the "too-big-to-fail" hypothesis.

4 Econometric analysis of deposit changes

4.1 Estimation procedure

Most existing microeconometric studies on banking crises model the incidence of bank failures in the context of a hazard model.[26] In this section, we explain why it is more appropriate to model deposit changes instead of bank failures in our context. For this purpose, we first want to clarify the relationship between deposit withdrawals and bank failures and their connection to the notions of illiquidity and insolvency. Then, we outline the implications for our empirical analysis. Finally, we describe how the interaction of deposit changes and bank failures can be modeled econometrically.

4.1.1 Deposit changes and bank failures

A bank failure occurs when a bank is not able to satisfy its payment obligations or when the bank's capital becomes negative. There are basically two reasons for this to happen: first, "abnormally high" deposit withdrawals, and second, a negative asset shock. This distinction has inspired two different strands of literature, one stressing the liabilities side, the other emphasizing the asset side of a bank's balance sheet in explaining the failure of a bank.[27]

[26] Examples are Petri (1998) and Calomiris and Mason (2000).

[27] This classification has been introduced by Calomiris and Gorton (1991). They named the first strand of literature the "asymmetric information" approach and the second the "random

The first strand of literature starts from the observation that banks are illiquid in the sense that their deposits are more liquid than their assets, or that the liquidation value of assets is below the nominal value of deposits.[28] Given the non-contingent nature of the standard bank deposit contract, this means that no bank is able to honor all claims if a sufficiently large number of creditors demands repayment. Hence, deposit withdrawals can force a bank into failure even in the absence of asset shocks. Deposit withdrawals could be triggered either by self-fulfilling beliefs as in Diamond and Dybvig (1983), or by exogenous liquidity shocks to depositors. Whether a bank succumbs to the run or not, depends on the intensity of deposits withdrawals and on the degree of maturity transformation that the bank has carried out, i.e., its "liquidity". It also depends on the initial level of the bank's capital, which can serve as a buffer for losses from the liquidation of long-term assets.

The second strand of the literature emphasizes the problem of asymmetric information between depositors and banks about the value of the banks' portfolios.[29] Depositors only receive (macro- or microeconomic) noisy signals about the value of their bank's assets and they then have to decide whether to withdraw their deposits or not. Hence, bank runs are triggered by adverse information about banks' asset values, and they have therefore been named "information-based runs". If the depositors decide to withdraw their funds, there are three possible constellations: First, the bank is really insolvent and this insolvency is revealed by the bank run; second, the bank was solvent before the run, but it fails because it cannot honor the demands of its depositors who (wrongly) believe that the bank is insolvent[30]; and third, the bank was solvent before the run and

withdrawal" approach.

[28]This literature was started by Bryant (1980) and Diamond and Dybvig (1983), and has been extremely influential until today.

[29]Early contributions were the papers by Chari and Jagannathan (1988) and Jacklin and Bhattacharya (1988). Calomiris and Kahn (1991) use a similar framework emphasizing the moral-hazard problem on the side of the bank manager. Chen (1999) uses an asymmetric information setup to model informational contagion between banks.

[30]Here the insolvency is caused by the run itself, just as in the first strand of literature.

remains solvent, either because withdrawals were not strong enough or because there are no costs of liquidation for the bank. A further possibility is that an insolvent bank is closed even before deposits are withdrawn.

These observations have several implications for our empirical analysis. First, the relationship between the strength of a bank and bank failure cannot be used to distinguish between the two types of explanations outlined above. In the literature, a significant correlation between indicators for banks' solvency or liquidity and the probability of (or time until) bank failure has often been interpreted as evidence for the "asymmetric information" view of bank runs.[31] However, the probability of failure may depend on the liquidity and equity ratios of banks not only because depositors run on banks that appear to be weak, but also because an illiquid bank with little capital may be less able to withstand a run driven by "random withdrawals". This interpretational problem does not arise when deposit changes are used as the dependent variable: A significant positive correlation between banks' solvency or liquidity and the size of deposit changes justifiably can be interpreted as evidence for the hypothesis that depositors are reacting on the information about their bank and withdraw their funds primarily from "bad" banks. In this sense, an analysis of deposit changes is more informative than an analysis of bank failures.

The evaluation of the "currency-crisis hypothesis" is related to the distinction between the two types of theories outlined above. The currency-type explanation explains the German banking crisis as being driven by depositors who have "exogenous" liquidity needs because they want to transfer their funds abroad. In contrast, the banking-type explanation supposes that depositors withdraw funds from banks that are perceived to be weak. Therefore, the examination of the "currency-crisis hypothesis" is conceptually similar to the distinction between the "asymmetric information" and the "random withdrawal" approaches.

A second implication is that there exists no one-to-one relationship between

[31] See, e.g., Petri (1998) and Calomiris and Mason (2000).

deposit withdrawals and bank failures. Deposit withdrawals may lead to bank failures, but they do not have to, and bank failures may be caused by deposit withdrawals, but they do not have to.[32] Deposit changes and bank failures are distinct phenomena and should also be treated separately in an empirical analysis. However, there are a number of interactions between the two phenomena, which have to be taken into account. It would not be appropriate to consider deposit changes independently of bank failures because the presence in the sample depends on deposit changes and is, hence, not random. In the following section, we describe how the interactions between deposit changes and bank failures can be modeled econometrically.

4.1.2 Non-random sample attrition

In econometric terms, our sample is subject to a problem of non-random sample attrition: Banks join and leave the sample within our sample period, and the selection into the sample of reporting banks is not random, but depends itself on the changes in deposits. We treat the joining decision as random as there are no reasons to believe that the joining of the sample is related to the growth rate of deposits. With respect to leaving the sample, the problem is complicated by the fact that we do not observe the failure of a bank, but we only observe whether a bank published a monthly balance sheet or not. A further complication arises from mergers taking place in our sample period. We want to distinguish the following types of leaving the sample:

1. The bank leaves the sample due to failure.
2. The bank leaves the sample due to merger:
   (a) The bank merges with another bank for reasons of synergy effects.
   (b) The bank is close to failure and is taken over by another bank.

[32] In econometric terms, this means that there is not simply a univariate censoring problem, where deposit withdrawals are only observed if they are below a certain threshold.

(c) The bank takes over another bank that is close to failure.

3. The bank leaves the sample "randomly", e.g., because it decides not to publish monthly balances anymore.

The most problematic cases for our analysis are the cases 1. and 2b. because they are likely to be related to deposit changes. In our analysis, we do not distinguish between these two cases, but they are both treated as failures. The other kinds of sample attrition are treated as random events. Banks resulting from mergers are treated as new banks.[33]

The described selection problem can be modeled in the framework of a simple bivariate model in the spirit of Heckman (1979). This has the nice side effect that we can simultaneously model the evolution of deposits and the occurrence of a bank failure.

The evolution of deposits is described by the following equation:

$$\hat{d}^*_{it} = x_{it}\beta + \varepsilon_{it}, \tag{1}$$

where $\hat{d}_{it}$ is the (latent) monthly growth rate of deposits of bank i at time t and x_{it} is a vector of bank-specific, region-specific, macroeconomic and other explanatory variables. Selection into the sample is determined by the following equation:

$$p^*_{it} = z_{it}\alpha + \nu_{it}, \tag{2}$$

where p^*_{it} is the latent profitability of bank i at time t. We assume that the two disturbance terms are jointly normal with correlation coefficient ρ. The observation rule is as follows: If $p^*_{it} \geq 0$, the bank owners decide to keep the bank open (indicated by a binary variable, which is equal to one in this case) and we observe the true value of $\hat{d}^*_{it}$. If $p^*_{it} < 0$, the bank is closed (again indicated by the

[33]Practically, it is not easy to distinguish the cases 2a. and 2b. or 2c., because what we observe directly is only the merger. The classification was done on the basis of the information reported in the periodical "Die Bank". In those cases where the periodical did not contain any indication that a bank was in distress, a merger was classified as a competitive merger. A list of all failures, distress mergers, and public standby activities can be found in the appendix.

binary variable, which is equal to zero in this case) and we do not observe latent deposit growth. In both cases, we observe the control variables x and z.

In principle, the parameters in this model are identified through functional form assumptions. However, identification is generally believed to be more credible if one includes at least one variable in the selection equation that is not contained in the equation of interest. In our case, there is a natural way of identification. Monthly balance sheets were published with a delay of almost a full month. For instance, the balance sheet referring to March 1928 was published at the end of April 1928. Hence, depositors could react to this balance sheet no earlier than in May 1928. In contrast, the probability of failure clearly would depend on the most recent balance-sheet figures.

So far we have not exploited the panel structure of the data. One could also estimate the model as a dynamic panel, using the procedure proposed by Arrelano and Bond (1991). However, this procedure estimates the model in first differences, implying that all factors that are time-invariant, such as branching and foreign debt, could not be identified. Therefore, we decided to estimate the model with the pooled data set.

4.2 Estimation results

Table 3 presents the results for our main regression equation.[34] The exact definitions of all variables can be found in table A2 in the appendix. The upper part of the panel contains the regression coefficients for the deposit equation, while the lower part shows the results for the selection equation. The dependent variable in the main equation is the logarithm of the growth factor of total deposits at German credit banks. The use of growth factors is preferable to the use of levels since the levels of variables as deposits are typically non-stationary. The logarithms are used to remove the skewness from the dependent variable and to transform the growth factor into a variable that is defined on the whole real line.

[34]Note that we used robust standard errors throughout.

In the selection equation, the dependent variable is a dummy variable, which is equal to one if the bank's balance sheet is observed and zero in the month when the bank leaves the sample.

4.2.1 Deposit equation

First, we are going to interpret the results from the deposit equation. The results show that the currency problems had a significant impact on deposit changes at German banks. The variable "gold cover" enters the equation with a positive sign and is highly significant. We also find that banks holding high levels of foreign debt showed a significantly slower deposit growth than other banks, which is in line with the idea that foreign depositors reacted more strongly to currency problems than domestic depositors.[35] At the same time, the results strongly reject the hypothesis that the German crisis of 1931 was a *pure* currency crisis. There is a positive and significant relationship between a bank's cash liquidity ratio and its changes in deposits. Moreover, lagged deposit changes positively affect current deposit changes. One possible interpretation is that depositors consider banks as fragile that suffered from high deposit withdrawals in the past and that they tend to withdraw their deposits from these banks.

The equity ratio has the expected sign, but is insignificant; however, one should keep in mind that book capital is a rather poor proxy of a bank's profitability. The losses of banks from the depreciation of their stock portfolios are measured by the variable "stocks", which is the growth of a general stock index interacted with the bank's share of stocks in total assets. This variable, too, is insignificant.

[35] Alternatively, one can interact the gold cover variable with a measure of banks' foreign debt holdings. In fact, the interacted variable proves to be highly significant.

Dependent variable	Independent variables	Coefficient	Robust standard errors	p-value
Deposit growth				
	Deposit growth (-2)	0.0415	0.0322	0.197
	Deposit growth (-3)	0.0752	0.0270	**0.005**
	Cash liquidity (-2)	0.0078	0.0020	**0.000**
	Equity ratio (-2)	0.0040	0.0031	0.189
	Branching	0.0016	0.0033	0.619
	Foreign share	-0.0070	0.0024	**0.004**
	Public	0.0015	0.0039	0.697
	Total assets	0.0024	0.0008	**0.002**
	Bank stocks	0.2808	0.0754	**0.000**
	Insolvencies	-0.0344	0.0059	**0.000**
	Regional employment	-0.0089	0.0080	0.268
	Stocks	-0.9821	0.8032	0.221
	Gold cover	0.0137	0.0041	**0.001**
	Constant	0.3065	0.0671	**0.000**
Select				
	Deposit growth	1.9609	0.5251	**0.000**
	Deposit growth (-2)	2.0851	0.6180	**0.001**
	Deposit growth (-3)	-0.7226	0.7610	0.342
	Cash liquidity	0.3168	0.1244	**0.011**
	Cash liquidity (-2)	-0.1294	0.1339	0.334
	Equity ratio	0.6507	0.2555	**0.011**
	Equity ratio (-2)	-0.2944	0.2371	0.214
	Branching	0.0632	0.1660	0.703
	Foreign share	0.1285	0.1010	0.203
	Public	0.0441	0.3804	0.908
	Total assets	0.2212	0.0796	**0.005**
	Bank stocks	1.4533	4.5268	0.748
	Insolvencies	-0.5442	0.3573	0.128
	Regional employment	0.0664	0.6473	0.918
	Stocks	-0.8503	6.6144	0.898
	Gold cover	0.1773	0.3505	0.613
	Constant	7.5672	4.3975	**0.085**
	Rho	0.0415	0.0627	0.509
# Obs (total)	3800			
# Failures	19			
Wald test	144.58			
p-value	**0.0000**			

Table 3: Results from selection model for growth in total deposits. Notes: All explanatory variables are lagged by at least one period. For lags greater than one, the number of lags is given in parentheses.

Another measure of a bank's perceived profitability is the evolution of its stock price. Since individual stock prices are not available for all banks in our sample,

we included the growth of an aggregate price index of bank stocks and it proved to be strongly significant.[36] Hence, indicators of both liquidity and solvency seem to have played a role in the evolution of deposits in our sample period.

The branch structure does not have a significant impact on changes in deposits; branch banks do not display significantly higher deposit growth (or lower withdrawals) than unit banks. Neither does regional employment, which is to measure regional shocks, enter significantly in the equation. In contrast, the lagged number of national bankruptcies is highly significant. This indicates that deposit changes were related rather to national than to regional shocks, implying that a nationwide branch network offered little protection. It may, of course, also reflect that our measure of regional shocks is too poor.

The coefficient of the variable "total assets" is positive and highly significant, implying that large banks experienced higher deposit growth, or lower deposit withdrawals, than small banks, given the riskiness of their portfolios. This is consistent with a "too-big-to-fail" interpretation: Large banks' creditors may have trusted in the safety of their deposits, because they believed that their banks had a high probability of being supported in a crisis. The result is all the more striking if we compare it to the descriptive results in section 3.2: There we have seen that large banks experienced particularly high deposit withdrawals. If we accept the "too-big-to-fail" interpretation, this means that large banks would have suffered even higher withdrawals in the absence of an implicit guarantee. However, we should analyze this issue in more depth before jumping to such a conclusion. As it stands, the result is also consistent with the view that large banks were more stable due to diversification. We will come back to this point later.

[36] In another regression, we also included the change in the deposit-to-currency ratio, a variable that has figured prominently in the famous analysis of US banking crises by Friedman and Schwarz (1963). It is typically interpreted as an indicator of the public's confidence in the stability of the banking system. The variable showed a positive sign and was strongly significant. In the regression shown here, we excluded this variable because its exogeneity may be questioned.

4.2.2 Failure equation

We now turn to the interpretation of the selection equation. ρ, which denotes the correlation coefficient of the disturbances in the two equations and hence the conditional correlation between changes in deposits and bank survival, shows the expected sign, but is insignificant. This may be due to the low number of failures in our sample. It is still worthwhile to have a look at the determinants of bank survival. Lagged changes in deposits have a positive and significant effect on bank survival. Hence, high withdrawals in the past increase the probability of failure. Bank survival also depends positively on indicators of a bank's strength, such as liquidity and equity ratios. Bank survival seems to be unrelated to the presence of a branch network and to the level of foreign debt. In contrast, there is a highly significant positive effect of bank size on bank survival. Large banks had a higher probability of survival than small banks. Again, this is consistent with large banks being "too big to fail", but it could also be explained by diversification effects. None of the macroeconomic variables enters the selection equation significantly; this suggests that the incidence of failures was related much more to bank-specific characteristics than to macroeconomic variables.

We can conclude that the results from table 3 strongly reject the currency-crisis hypothesis in that changes in deposits seem to have been related to indicators of banks' liquidity and solvency. We can also reject the branching hypothesis as the maintenance of a branch network seems to affect neither deposit growth nor bank survival. Finally, the significant impact of size on deposit growth and bank survival is consistent with the existence of a "too-big-to-fail" problem.

4.3 Robustness of results

We performed a large number of robustness checks, some of which are displayed in the appendix. The robustness checks can be divided into the following categories: Choice of dependent variable, sample period, bank groups in sample, the treatment of outliers, and finally the estimation method. In the following, we

explain which effects proved to be robust and which results have to be regarded with more skepticism.

We first checked whether our results depend on the use of total deposits as the dependent variable. The inclusion of domestic acceptances may lead to a bias because acceptances experienced a steep increase from June 1931 on. This was because banks converted illiquid advances into acceptance loans by allowing their customers to draw bills on them, discounting the bills, and exchanging them with another bank to obtain the required third signature. These bills were then discounted at the Reichsbank, which was against the banking law because the bills were pure financial bills. We therefore reran our regression excluding domestic acceptances. The results are virtually unchanged and all effects described above are robust. In addition, it is conceivable that interbank deposits show different dynamics than non-bank deposits. We therefore reran our regression using the item "other deposits" as dependent variable, which excludes domestic and foreign acceptances as well as domestic interbank deposits.[37] Again all results remain qualitatively unchanged. Most coefficients, such as the ones of liquidity, the share of foreign deposits, total assets, and the gold cover, are somewhat higher in absolute terms than in table 3. Hence, our major results do not appear to hinge on the choice of the dependent variable.

Second, we checked the choice of the sample period. One may worry that the dynamics of deposit changes are different in times of "crisis" than at other times. We reran the regression from table 3 using only crisis periods, where a crisis period is defined as a month with a decrease in aggregate deposits (see table A3). Some effects are reinforced in crisis periods, such as the effects of liquidity and bank stock prices. This can be interpreted as depositors reacting more strongly to information about their bank's strength in times of crisis. The coefficient of the share of foreign deposits also increases in size, suggesting that foreign withdrawals

[37]Unfortunately, it is impossible to exclude foreign interbank deposits because these are not shown separately in banks' balance sheets.

were more important in crisis periods. In contrast, the coefficient of "total assets" is no longer significant in the deposit equation in times of crisis.[38] The same is true for the gold cover. However, "total assets" remain highly significant in the selection equation.

Third, we compared the results for different bank groups. First, we excluded banks that were not very active in the retail deposit business.[39] The results proved to be robust to this modification. Then we allowed for a structural break between the great branch banks and the remaining banks. Interestingly, none of the effects seems to hinge on the presence of the great branch banks in the sample. In particular, the size effect remains significant for the other banks in the deposit equation. The only significant deviation between the great branch banks and the other banks concerns the effect of bank stocks, which is stronger for the great branch banks. In a Chow test, the structural break proved to be weakly significant (p-value = 0.084). Finally, we allowed for a structural break between banks that were supported in the crisis and those that were not by allowing coefficients to change after the standby activity. The most important result is that the effect of liquidity is significantly smaller for the supported banks. This suggests that the link between bank-specific characteristics and changes in deposits was weakened for the supported banks, which is in line with a moral-hazard argument. In fact, the structural break is significant at a 5 percent confidence level.

Fourth, we analyzed the sensitivity of our results to outliers. In the regression above, six observations have been excluded because they were suspected to have an unduly high influence on the results.[40] We first checked whether the basic results were still present when we included all observations. As can be seen in table A4 in the appendix, most coefficients are unaffected. Especially, the results

[38]This may, however, also be the result of how we defined crisis periods. Periods with aggregate deposit withdrawals tend to be periods in which the deposit withdrawals at the great banks were particularly large.

[39]We excluded banks where deposits constituted less than 30 percent of total assets.

[40]The monthly growth rates of deposits for the left-out observations were between between minus 78 and 68 percent and between plus 176 and 263 percent, respectively.

on liquidity, bank stocks, the share of foreign deposits and the gold cover are very similar. However, the result on size appear not to be robust in the deposit equation. We then tried to exclude even more observations from the regression.[41] Now all results are virtually the same as in table 3. We can conclude that the presence of outliers does not change our basic conclusions, apart from the effect of size in the deposit equation.

Finally, we checked our estimation method by re-estimating all regressions using simple OLS regression with robust standard errors (see table A5). As would be expected in the light of the insignificance of the correlation coefficient ρ, the results change only slightly. However, the OLS regressions reveal one noteworthy finding. The R^2 of the regressions are very low, mostly well below ten percent.[42] This is partly the result of the differencing of the data. It is generally much easier to explain levels than growth rates. But it is also a reflection of the high heterogeneity of banks contained in our sample. When running a simple time-series regression on the aggregate series including only aggregate variables, we are able to explain around 50 percent of the total variation in the aggregates. Therefore, the low explanatory power of the regression seems to stem from the diversity of our sample in the cross-sectional dimension. However, this diversity should be regarded as a major advantage of the data set as it facilitates the identification of effects. The magnitude of the R^2 always depends on the data set in hand and its importance should not be overstated. In addition, the high degree of heterogeneity could also be taken as evidence against a pure macroeconomic explanation of the crisis.

We can conclude that most of the effects shown in the basic regression in table 3 are robust to the modifications. In particular, there is a positive and significant relationship between a bank's liquidity and its deposit growth. There also is

[41] The number of excluded observations was 21. The monthly growth rates of deposits of the left-out observations were now in the range of minus 78 and 37 percent, and between plus 55 and 263 percent, respectively.

[42] The deposit regressions by Saunders and Wilson (1996) also display low R^2.

a positive and significant relationship between deposit growth and the growth rate of an index of banks' stock prices. Hence, the robustness checks confirm the rejection of the currency-crisis hypothesis. We can also reject the branching hypothesis as the maintenance of a branch network seems to affect neither deposit growth nor bank survival. Finally, the relationship between asset size and deposit growth is not entirely robust. Hence, we cannot assert with confidence that larger banks exhibited higher deposit growth. In contrast, size has a very robust effect on the survival probability. Thus, we can safely claim that larger banks were less likely to fail.

5 Econometric analysis of standby activities

5.1 Estimation procedure

The preceding analysis of deposit changes has confirmed a necessary condition for large banks being "too big to fail", namely that larger banks had a lower probability of failure than smaller banks. The results suggest that this may also have translated into higher deposit growth, even though this effect is not entirely robust. While both results are consistent with the "too-big-to-fail" explanation, they could also imply that large banks were better able to withstand the crisis for other reasons such as better diversification. Therefore, we also analyze public standby activities directly to find out whether large banks received a privileged treatment in times of crisis. The descriptive analysis in section 3.2 has shown already that many large banks benefited from public support activities and that the increase in endorsement liabilities in times of crisis was particularly strong at the larger banks. We will now examine these preliminary findings more thoroughly in an econometric analysis.

First, one can check whether the probability of receiving public support was higher for larger than for smaller banks. This can be done in a simple, cross-sectional probit regression, where the dependent variable is a dummy variable in-

dicating whether a bank received public support, such as capital injections, public guarantees, or public loans beyond ordinary refinancing loans by the Reichsbank. On the right-hand side of this regression, one should include a number of control variables, such as indicators of the banks' liquidity and solvency or foreign deposits. The question then is whether there remains a significant effect of a bank's size on the probability of receiving support after controlling for these variables.

Second, one can also look at the provision of liquidity by the Reichsbank. Public support activities, such as capital injections, would only be employed when a bank is already close to failure. In contrast, a differential treatment of banks according to their size with respect to the provision of liquidity may take place much earlier and may make an outright bail-out unnecessary. In addition, it can be disguised more easily. The modeling of liquidity provision is more involved than the modeling of the discrete standby activities. Therefore, we will discuss the estimation procedure and the assumptions needed for identification in some detail.

In order to model endorsement growth, one has to consider the process of liquidity provision by the Reichsbank. Under the gold standard, monetary policy had to proceed subject to the constraint that the gold cover did not fall below the prescribed forty-percent level. This implicitly defined a maximum level of discount loans that could be extended if the central bank did not want to endanger the maintenance of the gold standard. In normal times, this constraint would not binding. By setting the discount rate, the Reichsbank could influence the aggregate level of discount loans and it discounted all eligible bills that were offered by the banks at the prevailing rate. In times of crisis, defined as periods of aggregate deposit withdrawals, the aggregate demand curve for discount loans would shift outward due to the higher liquidity needs of banks and at the same time become less elastic. Therefore, an increase in the discount rate would have only a small impact on the demand for discount loans by the banks. In this kind of situation, the Reichsbank tended to impose discount restrictions, limiting the

aggregate quantity of discount loans to the level compatible with the maintenance of the gold standard, while keeping the discount rate at a relatively low level.

Hence, there were two different policy regimes of liquidity provision, a crisis regime with credit rationing and a non-crisis regime with free liquidity provision. This will be taken into account in the econometric analysis by allowing for a structural break between crisis and non-crisis periods.

The question then is how the Reichsbank distributed the given aggregate level of discount loans among different banks in the rationing regime. The "too-big-to-fail" hypothesis asserts that large banks were given privileged access to the Reichsbank's rediscounting facilities in times of crisis, meaning that larger banks were rationed less than smaller banks due to their economic significance. This is a statement about the *supply* of discount loans by the Reichsbank to different banks. In general, one does not observe the supply directly, but instead one observes equilibrium points that result from the interplay of demand and supply. Hence, a higher endorsement growth at larger banks could be due either to a greater demand by the large banks or to a greater supply by the Reichsbank. In a rationing regime, however, the level of discount loans equals the *minimum* of supply and demand, and changes in the levels of discount loans are determined by the supply side alone as long as the rationing constraint is binding. This may be exploited to identify the above supply-side effect.

But even in a rationing regime, it is important to control for variables that shift the banks' demand curves such as the liquidity ratio, the equity ratio, the stock of bills, and past deposit changes. Demand factors may enter the determination of endorsement growth in two ways: First, the Reichsbank may react to banks' demand in setting quotas, allocating more discount loans to banks that need them most. Second, it is possible that not all rationing constraints are binding because some banks' demand is smaller than their quotas.

Therefore, the crucial assumption needed to identify the supply effect in question is that large banks do not have a higher growth in their demand for discount

loans than smaller banks in times of crisis, holding constant the observed shift factors of the demand curves. A significantly positive effect of size on endorsement growth can then be interpreted as a higher supply by the Reichsbank, reflecting the large banks' privileged access to the Reichsbank's rediscounting facilities in times of crisis.

In Schnabel (2002), we have already presented some qualitative evidence that discount restrictions were applied very selectively and that large banks received preferential treatment at the Reichsbank's discount window in times of crisis.[43] However, it is difficult to separate the effect of size from other factors, such as foreign deposits and the maintenance of a branch network, because the great branch banks were not only large, but they also held particularly high shares of foreign deposits and maintained nationwide branch network. Here we try to separate these factors statistically by checking whether the size of banks has a statistically significant impact on the allocation of discount loans to different banks, controlling for other factors such as foreign deposits or the existence of a branch network.

Note that the regression of endorsement liabilities suffers from the same selection problem as the regression of deposit changes. The presence of a bank in the sample depends on how much liquidity it receives from the Reichsbank and is, therefore, not random. Hence, we apply the same estimation procedure as in table 3 in order to control for non-random sample attrition.[44]

5.2 Estimation results

5.2.1 Probability of support

We will first present the results from the regression of the probability of being supported before discussing the estimation for endorsement liabilities. Table 4

[43]Note that, apart from setting different quotas, the Reichsbank could also impose different quality requirements with respect to the submitted bills.

[44]Here, we use a number of lagged macroeconomic variables (such as insolvencies, employment, stock prices) as instruments.

presents the results of the simple probit regression described above. The dependent variable is a dummy variable that is equal to one if a bank received public support. The regression is cross-sectional, and the independent variables refer to April 1931, the month before the beginning of the final banking crisis.[45] The most important result is that the size of a bank has a significantly positive effect on the probability that a bank receives public support, which confirms the preliminary finding from the descriptive analysis in section 3.2. As predicted by the "too-big-to-fail" hypothesis, large banks were more likely to be supported than small banks. The branching variable is weakly significant. In fact, wide-spread branch networks can be interpreted here as measuring another aspect of size, namely geographical dispersion. Moreover, we find that the supported banks appear to have had particularly low first-order liquidity ratios.[46] In contrast, there is neither a relationship with the equity ratio, nor with the level of foreign debt.[47]

Dependent variable	Independent variables	Coefficient	Robust standard errors	p-value
Support				
	First-order liquidity	-0.0743	0.0396	**0.008**
	Equity ratio	0.0278	0.0402	0.474
	Branching	0.1242	0.0472	**0.094**
	Foreign share	0.0377	0.0277	0.188
	Total assets	0.0446	0.0201	**0.003**
# Obs	91			
Pseudo R^2	0.3264			

Table 4: Results from probit regression for standby activities. Notes: All explanatory variables refer to April 1931.

[45]Note that the results are displayed such that the coefficients correspond to the change in the probability of being supported for an infinitesimal change in each independent continuous variable, and to the discrete change in the probability for dummy variables.

[46]If one uses the cash liquidity ratio instead, the coefficient becomes insignificant.

[47]The variable "public" is not identified here because it perfectly predicts the outcome "no support". An exclusion of the public banks changes the results only slighty. In fact, the effect of total assets increases somewhat in size. However, the branching variable becomes insignificant.

5.2.2 Endorsement liabilities

Table 5 presents the results from the selection model for the growth in endorsement liabilities. The correlation coefficient ρ is again insignificant (see table 5). The results for the selection equation are suppressed here because they are very similar to the ones in the other table. In the main equation, the dependent variable is the logarithm of the growth factor of "other endorsement liabilities". We allowed for a structural break between crisis and non-crisis periods, where a crisis period is defined as a month with a decrease in aggregate deposits. On the right-hand side of the regression, we included a number of bank-specific variables that are to capture the shifts in individual demand curves as well as one aggregate variable, the gold cover, which accounts for the constraints imposed upon the Reichsbank by the gold standard.[48]

The panel on the left of table 5 displays the coefficients for non-crisis periods, while the panel on the right shows the estimates for crisis periods. We are mostly interested in the right-hand-side results because only in crisis periods we would expect there to be an effect of a bank's size on endorsement growth under the "too-big-to-fail" hypothesis.[49]

The regression results strongly support the conjecture that large banks received preferential access to the Reichsbank's rediscounting facilities in times of crisis. Endorsement growth in crisis periods is significantly related to the size of banks, given the other bank-specific variables. In contrast, size does not matter in non-crisis periods. This is exactly what would have been expected under the "too-big-to-fail" hypothesis.

[48]Note that the regression in table 5 is not a demand or supply curve. The effect of the price variable is not modeled here. Instead, the regression gives the allocation of discount loans across different banks.

[49]In fact, there is no evidence for the discrimination of smaller banks in normal times in the Reichsbank's archival materials; instead it seems that liquidity was provided freely and non-discriminatory at the prevailing discount rate.

Dependent variable	Independent variables	Coefficient	Robust standard errors	p-value	Independent variables	Coefficient	Robust standard errors	p-value
Endorsement growth		**No crisis**				**Crisis**		
	Total assets	0.0008	0.0040	0.848	Total assets	0.0142	0.0060	**0.018**
	Endorsement growth	-0.0782	0.0423	**0.065**	Endorsement growth	-0.1153	0.0394	**0.003**
	Endorsement growth (-2)	-0.0405	0.0338	0.232	Endorsement growth (-2)	-0.0442	0.0309	0.152
	Endorsement growth (-3)	-0.0294	0.0294	0.317	Endorsement growth (-3)	-0.0626	0.0378	**0.097**
	Deposit growth	0.3242	0.0978	**0.001**	Deposit growth	0.3079	0.0981	**0.002**
	Deposit growth (-2)	-0.0247	0.0629	0.694	Deposit growth (-2)	0.1426	0.1284	0.267
	Deposit growth (-3)	-0.0694	0.0836	0.406	Deposit growth (-3)	0.1413	0.0975	0.147
	Share of bills	0.0154	0.0067	**0.023**	Share of bills	0.0217	0.0079	**0.006**
	Cash liquidity	-0.0105	0.0087	0.226	Cash liquidity	-0.0258	0.0129	**0.045**
	Equity ratio	-0.0079	0.0128	0.536	Equity ratio	0.0143	0.0190	0.452
	Foreign share	-0.0150	0.0126	0.233	Foreign share	-0.0130	0.0158	0.411
	Branching	0.0117	0.0159	0.462	Branching	0.0120	0.0215	0.577
	Public	0.0133	0.0332	0.689	Public	-0.0496	0.0307	0.106
	Gold cover	-0.0116	0.0321	0.719	Gold cover	0.0546	0.0206	**0.008**
	Constant	-0.1007	0.0539	**0.062**	Constant	-0.0626	0.0692	0.366
Select	...							
	Rho	-0.010	0.376	0.980				
# Obs (total)	3,689							
# Failures	19							
Wald test $Chi^2(30)$:	121.42							
p-value	**0.0000**							

Table 5: Results from selection model for growth in endorsement liabilities, allowing for a structural break between crisis and non-crisis periods. Notes: All explanatory variables are lagged by at least one period. For lags greater than one, the number of lags is given in parentheses.

It is also instructive to examine the other coefficients in the regression even though one has to be careful with a structural interpretation of these coefficients. In both crisis and non-crisis periods, the growth in endorsement liabilities displays a negative autocorrelation, meaning that high growth rates were likely to be followed by small ones and vice versa. In times of crisis, a lower cash liquidity implied a higher growth in endorsement liabilities, reflecting the greater need for liquidity. However, the discounting of bills was only possible if the bank actually possessed bill material eligible for discount. This explains the highly significant coefficient of the share of bills in total assets. The same effect is also present in

non-crisis periods. If liquidity pressure was a driving force of endorsement growth in times of crisis, one would also expect past deposit growth to have a negative effect on endorsement growth. Somewhat surprisingly, the effect is positive and highly significant in both crisis and non-crisis periods.[50]

Another interesting result is the insignificant coefficient of the share of foreign deposits in times of crisis, which suggests that banks holding high levels of foreign debt were not favored in the provision of discount loans. Neither does the growth of endorsement liabilities depend on the equity ratio, the branching variable, or on whether a bank is public or private. Finally, the gold cover enters positively in times of crisis and is highly significant, which reflects the constraints imposed upon the Reichsbank by the gold standard. The higher the gold cover, the wider the Reichsbank's scope for rediscounting activities.

We can conclude that there is strong evidence for a privileged treatment of large banks, both with respect to public supporting activities, such as capital injections and public guarantees, and with respect to rediscounting. In combination with our findings on deposit changes and bank failures, this is strong evidence for the "too-big-to-fail" hypothesis.

5.3 Robustness of results

In this subsection, we check the robustness of our results from the regression of endorsement liabilities. The simple probit regression does not lend itself to a robustness analysis. As before, we examined the robustness of our results to the choice of the dependent variable, the sample period, the bank groups included in the sample, the treatment of outliers, and finally the estimation method. We will mostly concentrate on the coefficient of "total assets" in the discussion.

By choosing the item "other endorsement liabilities" as our dependent variable we excluded bank acceptances and promissory notes. In order to check whether this introduces a bias into our results, we reran the regression from table 5 using

[50]It is important to control for lagged deposit changes to account for the effect detected in the earlier regression, namely that large banks may experience lower deposit withdrawals.

the variable "total endorsement liabilities" as dependent variable. We find that our results are robust to the choice of the dependent variable, with the p-value of the coefficient of "total assets" being somewhat higher than before (p-value = 0.062).

Then we checked the robustness of results to the choice of the sample period. The process of liquidity provision may have changed after the factual abandonment of the gold standard because this removed an important constraint on monetary policy. Therefore, we reran the regression allowing for another structural break after July 1931 (see table A6). In fact, the results show some notable changes compared to the pooled regression. First, the size of a bank is significant only in crisis periods before the bank holiday, while it turns insignificant after July 1931. This suggests that large banks were privileged primarily in times when the gold standard constraint was still binding. Second, the share of bills and the gold cover are significant for crisis and non-crisis periods before July 1931, but turn in both cases insignificant after July 1931. This indicates that the provision of liquidity in the latter period was no longer limited by gold standard considerations, nor by the availability of bills. A Chow test shows that the structural break is, in fact, significant at the 5 percent level.

Again we checked whether the results hinged on the presence of particular bank groups in the sample. The results are virtually unchanged when we exclude banks that were not very active in the retail deposit business. In contrast, the coefficient of "total assets" becomes insignificant when we exclude the great branch banks. Hence, the results appear to be driven mostly by the privileged treatment of the great branch banks.

In the regression presented in table 5 we have excluded outliers.[51] For endorsement liabilities the problem of outliers is particularly severe as endorsement liabilities tend to be very volatile. Small absolute changes can translate into enor-

[51] We excluded 25 outliers. Their growth rates of endorsement liabilities ranged from minus 95 to 87 percent, and from plus 698 to 2,900 percent.

mous growth rates if the initial level was close to zero. Again all major effects appear to be insensitive to the exclusion of outliers, which can be seen from table A7 in the appendix. The same is true when we exclude an even larger number of outliers.[52] Hence, we can conclude that our results do not hinge on the exclusion of outliers.

Finally, we reran the basic regression using OLS instead of the Heckman procedure. Again the results are very similar to the former results, and again the fit of the regression appears to be relatively poor as judged by the R^2.

Therefore, we can conclude that the results from table 5, especially the one concerning "total assets", are extremely robust. This strongly supports the view that large banks enjoyed preferential access to the Reichsbank's rediscounting facilities.

6 Conclusion

The main results from this paper can be summarized by going back to the three hypotheses stated in the beginning of the paper. It is clearly inappropriate to describe the German crisis of 1931 as a pure currency crisis, and the banking crisis as an inevitable corollary. It is true that the currency problems had an impact on banks' deposit growth and that banks holding foreign debt lost more deposits than other banks. But it was also shown that illiquid banks lost more deposits than liquid banks, indicating that depositors withdrew their funds primarily from banks that were thought to be particularly fragile. The positive autocorrelation of deposit growth could be interpreted in the same way. Similarly, depositors reacted to indicators of banks' solvency, namely the change in the index of banks' stock prices, while the individual equity ratio did not exert a significant influence. The incidence of failures seems to have been related much more to bank-specific characteristics, such as lagged deposit growth, liquidity and equity ratios, than

[52]Here we excluded 94 outliers. The respective growth rates of endorsement liabilities were between minus 95 and 64 percent and between plus 173 and 2,900 percent, respectively.

to macroeconomic variables. Thus, both deposit growth and the incidence of failures suggest that the (macroeconomic) currency crisis was accompanied by a (microeconomic) banking crisis that had independent origins and was not purely caused by the concurrent currency problems. Hence, we can reject the currency-crisis hypothesis.

The results also contradict the branching hypothesis. Branch banks exhibited neither higher deposit growth (or lower withdrawals) in times of crisis, nor a lower probability of failure. Hence, the evidence suggests that branch networks offered little protection in the German crisis. This does not necessarily mean that branch networks in general do not offer any protection. It is also consistent with the view that national shocks were more prevalent in the German crisis than regional shocks. In fact, regional employment did affect neither deposit growth nor the incidence of bank failures significantly.

The third hypothesis stated that larger banks have a lower probability of failure and – given the riskiness of their portfolios – lower deposit withdrawals than smaller banks because they have a higher probability of being saved by the public authorities in case of a crisis. This hypothesis was named the "too-big-to-fail" hypothesis. In our main specification, we found a positive and significant effect of "total assets" on deposit changes. However, this result appeared not to be entirely robust. Moreover, the size of a bank also had a positive and significant impact on the probability of survival, and this result proved to be robust in all of our robustness checks. Both effects could, however, also be due to a diversification effect. Therefore, we investigated this issue more directly by looking at the probability of receiving public support and at the growth rate of endorsement liabilities, which are a good proxy for the extent of rediscounting at the Reichsbank. In a simple cross-sectional regression, we found that the probability of receiving public support depended strongly on the bank's total assets. In addition, there was a strong and significant effect of "total assets" on the growth of endorsement liabilities in times of crisis, which suggests that large

banks received preferential access to the Reichsbank's discount window. This result proved to be very robust in our robustness checks. This is strong evidence for the "too-big-to-fail" hypothesis.

These findings are not only of interest for the economic historian, but their message reaches well beyond the historical case. First, our evidence adds to the literature on twin crises. We have shown that currency problems can translate into deposit withdrawals at banks, possibly endangering these banks' liquidity and solvency positions. The results suggest, however, that the currency problems were not the only driving factors for the banking crisis. Instead, there were a number of other factors, such as the macroeconomic downturn and idiosyncratic problems in the banking system, which affected deposit withdrawals and bank failures equally strongly or even more strongly. Hence, it is questionable whether currency problems alone would be sufficient to cause a full-blown banking crisis as the one in 1931. Instead, it seems that what makes twin crises particularly serious is the accumulation of different problems that tend to reinforce each other, as has been described in Schnabel (2002).

Second, the results suggest that one should not overestimate the benefits of branching. In macroeconomic crises, the diversification effect offered by branch networks may be negligible, as the prevalent risks are not diversifiable. In fact, since branch banks also tend to be large banks, branch banks may bring about other problems: they may suffer from a moral-hazard problem because the public and the central bank consider these banks to be "too big to fail". As our paper shows this problem does not depend on the existence of official deposit insurance, as there was no such insurance in Germany at that time. In fact, depositors did run on the great banks to withdraw their deposits. However, the disciplining effect of bank runs was impaired by the public authorities, both by providing preferential access to liquidity and by outright bail-outs. One important challenge of bank regulation will be how to deal with these types of problems in a globalizing world of ever growing banks.

Nowadays, the German banking system is again in a delicate situation. German banks once again suffer from loan portfolios fraught with bad loans, from losses in their securities portfolios, and from the inertia in investment banking. Rents have decreased due to fierce competition, not least from the side of the public (and publicly subsidized) banks. The newspapers already start talking about a German banking crisis. An interesting question arises: Would the great banks still be too big to fail?

7 Appendix

7.1 Data construction

Foreign debt variables The variable "foreign share" used in our regression analysis is defined as the share of foreign deposits in total deposits. The variable was calculated for June 30, 1930 only as there are no continuous time series for a sufficiently large number of banks. The levels of foreign acceptance loans can be obtained from banks' monthly balance sheets, but the levels of foreign cash loans can only be inferred from archival material. For June 1930, the Reichsbank's archival material contains detailed information on the levels of foreign debt for those banks holding large amounts of foreign debt. In addition, it contains the aggregate level of foreign deposits for all monthly reporting banks. In order to estimate the levels of foreign cash loans at individual banks, the non-attributable part of the aggregate level of cash loans was distributed evenly among the remaining credit banks, assuming that the SLGs did not hold any foreign cash loans, unless it was specified explicitly in the Reichsbank's material.[53] For banks that did not publish balance sheets in June 1930, the levels of acceptance loans were updated on the basis of the aggregate evolution of acceptance loans.

[53]This assumption is consistent with the statement in Enquête-Ausschuß (1930, p. 80) that the bulk of banks' foreign debt was held by the German credit banks and private bankers, not the SLGs.

Bank failures and official standby activities Table A1 lists those banks that we have classified as failures, distress mergers, and as banks receiving official support as well as the respective dates. The classification differs somewhat from the one proposed by Petri (1998, p. 99).

Date	**Bank name**	**Classified as ...**
Sep 28	Berliner Bankverein	Failure
Sep 29	Kieler Bank	Failure
Nov 29	Bankverein Bischofswerda	Failure
Dec 29	Ostbank für Handel und Gewerbe	Distress merger
Feb 30	Frankfurter Bankverein	Failure
Dec 30	Rheinisch-Westfälische Getreide-Kredit AG	Failure
May 31	Hansabank Oberschlesien	Failure
May 31	Bankhaus Bühl und Co.	Failure
May 31	Rheinische Bauernbank	Standby
Jun 31	Gewerbebank	Distress merger
Jul 31	Dresdner Bank	Standby
Jul 31	Darmstädter und Nationalbank (Danatbank)	Standby
Jul 31	Allgemeine Deutsche Credit-Anstalt	Standby
Aug 31	Hallescher Bankenverein von Kulisch, Kaempf & Co.	Standby
Aug 31	Leipziger Credit-Bank	Standby
Sep 31	Bank für Handel und Gewerbe	Failure
Sep 31	Leipziger Credit-Bank	Failure
Sep 31	Leipziger Immobilien-Gesellschaft Bank für Grundbesitz AG	Failure
Oct 31	Rheinische Bauernbank	Failure
Oct 31	Hollandsche Credietbank	Failure
Nov 31	Vorschuß- und Spar-Vereins-Bank in Lübeck	Failure
Dec 31	Anhalt-Dessauische Landesbank	Standby
Dec 31	Commerz-Bank in Lübeck	Standby
Feb 32	Wernigeröder Bank für Handel und Gewerbe	Failure
Feb 32	Dresdner Bank (merged with Danatbank)	Standby
Feb 32	Commerz- und Privat-Bank (merged with Barmer Bank-Verein)	Standby
Feb 32	Allgemeine Deutsche Credit-Anstalt	Standby
Feb 32	Deutsche Bank und Disconto-Gesellschaft	Standby
Jun 32	Städte- und Staatsbank der Oberlausitz	Failure
Jun 32	Anhalt-Dessauische Landesbank	Distress merger
Jul 32	Bernburger Bank	Failure
Aug 32	Westfalenbank	Standby

Table A1: Bank failures, distress mergers, and official standby activities. Source: Die Bank.

Descriptive statistics The following table contains the descriptive statistics of the variables used in the regressions. If the variables enter the regressions in logarithmic forms, the given statistics refer to the variables before the logarithmic transformation. The sources are denoted as follows: 1 = Deutscher Reichs- und Preußischer Staatsanzeiger, 2 = Saling's Börsenpapiere (1930), 3 = Bundesarchiv Berlin (Reichsbank R2501, diverse files), 4 = Die Bank (diverse issues), 5 = Institut für Konjunkturforschung (1936), 6 = James (1985, pp. 358).

Variable name	Description	Functional form	# Obs	Mean	Std. Dev.	Min	Max	Sources
Deposit growth	Total deposits (including acceptances)	log of growth factor	3781	0.997	0.071	0.428	2.190	1
Cash liquidity	(Cash + deposits at central bank) / total deposits (including acceptances)	log	3800	0.026	0.020	0.000	0.283	1
First-order liquidity	(Cash + deposits at central bank + deposits at other banks + bills of		3800	0.340	0.478	0.006	10.905	1
Equity ratio	(Capital + reserves) / total assets	log	3800	0.214	0.143	0.048	0.878	1
Branching	Dummy = 1 if number of branches > 1, 0 otherwise		3800	0.680	0.466	0	1	2
Foreign share	Foreign deposits / total deposits on June 30, 1930	log	3800	0.155	0.137	0.007	0.814	3
Public	Dummy = 1 if bank is public, 0 otherwise		3800	0.061	0.240	0	1	2, 4
Total assets	Total assets in million Reichsmark	log	3800	165.4	568.4	0.9	5726.8	1
Bank stocks	Stock index for bank shares	log of growth factor	3800	0.987	0.020	0.942	1.033	5
Insolvencies	Number of corporate insolvencies	log	3800	1247	291	727	1972	5
Regional employment	Regional number of employees, January 1928 = 100	log	3800	93.7	14.8	62.0	140.8	5
Stocks	General stock index [Descriptive statistics refer to the stock index without interaction]	log of growth factor, interacted with share of stocks	3800	0.988	0.040	0.898	1.130	5
Share of stocks	Share of security portfolio in total assets		3800	0.063	0.098	0.000	0.874	1
Gold cover	Reichsbank reserves / Reichsbank note circulation	log	3800	0.478	0.138	0.225	0.657	5, 6
Endorsement growth	Endorsement liabilities	log of growth factor	3670	1.028	0.408	0.140	7.000	1
Share of bills	Bills of exchange / Total assets	log	3689	0.138	0.100	0.000	0.863	1

Table A2: Definition of variables, descriptive statistics, and sources.

7.2 Tables for the robustness checks

The following tables contain selected regression results from the robustness sections. As before, all explanatory variables are lagged by one period unless noted otherwise.

7.2.1 Deposit changes

Dependent variable	Independent variables	Coefficient	Robust standard errors	p-value
Deposit growth				
	Deposit growth (-2)	0.0077	0.0435	0.860
	Deposit growth (-3)	0.0970	0.0452	**0.032**
	Cash liquidity (-2)	0.0106	0.0034	**0.002**
	Equity ratio (-2)	0.0029	0.0045	0.518
	Branching	0.0058	0.0048	0.234
	Foreign share	-0.0088	0.0040	**0.026**
	Public	0.0077	0.0059	0.192
	Total assets	0.0007	0.0013	0.598
	Bank stocks	0.4367	0.1632	**0.007**
	Insolvencies	-0.0448	0.0121	**0.000**
	Regional employment	0.0032	0.0119	0.791
	Stocks	-1.6741	1.5957	0.294
	Gold cover	0.0007	0.0062	0.913
	Constant	0.3208	0.1030	**0.002**
Select				
	Deposit growth	2.0356	0.6874	**0.003**
	Deposit growth (-2)	1.9196	0.8355	**0.022**
	Deposit growth (-3)	-1.1305	0.7115	0.112
	Cash liquidity	0.3070	0.1134	**0.007**
	Cash liquidity (-2)	-0.0941	0.1220	0.441
	Equity ratio	0.8323	0.3938	**0.035**
	Equity ratio (-2)	-0.4220	0.3771	0.263
	Branching	0.1455	0.1903	0.445
	Foreign share	0.1415	0.1255	0.259
	Public	-0.1020	0.4208	0.808
	Total assets	0.2384	0.0965	**0.014**
	Bank stocks	-1.1860	8.4640	0.889
	Insolvencies	-0.8229	0.5614	0.143
	Regional employment	0.5304	0.9766	0.587
	Stocks	-6.0124	17.9052	0.737
	Gold cover	0.0173	0.5324	0.974
	Constant	7.4184	5.0811	0.144
	Rho	0.0470	0.0865	0.587
# Obs (total)	1,685			
# Failures	13			
Wald test $Chi^2(14)$:	65.30			
p-value	**0.0000**			

Table A3: Robustness check for deposit changes – Restriction of sample to crisis periods.

Dependent variable	Independent variables	Coefficient	Robust standard errors	p-value
Deposit growth				
	Deposit growth (-2)	0.0523	0.0409	0.202
	Deposit growth (-3)	0.0736	0.0430	**0.087**
	Cash liquidity (-2)	0.0070	0.0023	**0.003**
	Equity ratio (-2)	0.0019	0.0042	0.657
	Branching	0.0002	0.0040	0.951
	Foreign deposits	-0.0060	0.0028	**0.033**
	Public	0.0016	0.0041	0.689
	Total assets	0.0016	0.0011	0.164
	Bank stocks	0.2374	0.0801	**0.003**
	Insolvencies	-0.0356	0.0070	**0.000**
	Regional employment	-0.0098	0.0087	0.262
	Stocks	-1.0474	0.8334	0.209
	Gold cover	0.0163	0.0047	**0.000**
	Constant	0.3195	0.0796	**0.000**
Select				
	Deposit growth	1.9659	0.5201	**0.000**
	Deposit growth (-2)	2.0692	0.6154	**0.001**
	Deposit growth (-3)	-0.7706	0.7447	0.301
	Cash liquidity	0.3182	0.1226	**0.009**
	Cash liquidity (-2)	-0.1253	0.1317	0.341
	Equity ratio	0.6603	0.2591	**0.011**
	Equity ratio (-2)	-0.2998	0.2417	0.215
	Branching	0.0629	0.1657	0.704
	Foreign deposits	0.1222	0.0995	0.220
	Public	0.0404	0.3792	0.915
	Total assets	0.2239	0.0799	**0.005**
	Bank stocks	1.3954	4.5424	0.759
	Insolvencies	-0.5435	0.3567	0.128
	Regional employment	0.0611	0.6488	0.925
	Stocks	-1.1269	6.3644	0.859
	Gold cover	0.1742	0.3509	0.620
	Constant	7.5919	4.3994	**0.084**
	Rho	0.0034	0.0387	0.929
# Obs (total)	3,806			
# Failures	19			
Wald test $Chi^2(14)$:	107.44			
p-value	**0.0000**			

Table A4: Robustness check for deposit changes – Sensitivity to outliers.

Dependent variable	Independent variables	Coefficient	Robust standard errors	p-value
Deposit growth				
	Deposit growth (-2)	0.0411	0.0321	0.200
	Deposit growth (-3)	0.0753	0.0270	**0.005**
	Cash liquidity (-2)	0.0078	0.0020	**0.000**
	Equity ratio (-2)	0.0040	0.0031	0.192
	Branching	0.0016	0.0033	0.622
	Foreign deposits	-0.0070	0.0024	**0.004**
	Public	0.0015	0.0039	0.699
	Total assets	0.0024	0.0008	**0.002**
	Bank stocks	0.2807	0.0756	**0.000**
	Insolvencies	-0.0343	0.0059	**0.000**
	Regional employment	-0.0089	0.0080	0.269
	Stocks	-0.9821	0.8043	0.222
	Gold cover	0.0137	0.0042	**0.001**
	Constant	0.3062	0.0673	**0.000**
# Obs	3,781			
R^2	0.048			

Table A5: Robustness check for deposit changes – OLS regression.

7.2.2 Endorsement liabilities

Dependent variable	Independent variables	Coefficient	Robust standard errors	p-value	Independent variables	Coefficient	Robust standard errors	p-value
Endorsement growth	**No crisis, until July 1931**				**Crisis, until July 1931**			
	Total assets	0.0004	0.0042	0.930	Total assets	0.0201	0.0081	**0.013**
	Endorsement growth	-0.0666	0.0447	0.136	Endorsement growth	-0.1339	0.0521	**0.010**
	Endorsement growth (-2)	-0.0379	0.0375	0.312	Endorsement growth (-2)	-0.1183	0.0563	**0.035**
	Endorsement growth (-3)	-0.0483	0.0338	0.153	Endorsement growth (-3)	-0.0775	0.0587	0.187
	Deposit growth	0.3961	0.1253	**0.002**	Deposit growth	0.3001	0.1489	**0.044**
	Deposit growth (-2)	0.0102	0.0866	0.906	Deposit growth (-2)	-0.1692	0.1806	0.349
	Deposit growth (-3)	-0.0570	0.1037	0.582	Deposit growth (-3)	0.0316	0.0895	0.724
	Share of bills	0.0156	0.0067	**0.021**	Share of bills	0.0267	0.0105	**0.011**
	Cash liquidity	-0.0126	0.0085	0.141	Cash liquidity	-0.0079	0.0142	0.579
	Equity ratio	-0.0129	0.0132	0.326	Equity ratio	0.0027	0.0237	0.910
	Branching	0.0154	0.0160	0.336	Branching	0.0060	0.0257	0.817
	Foreign share	-0.0206	0.0127	0.104	Foreign share	0.0216	0.0186	0.245
	Public	0.0056	0.0364	0.877	Public	-0.0271	0.0359	0.451
	Gold cover	0.1348	0.0618	**0.029**	Gold cover	0.1213	0.0675	**0.072**
	Constant	-0.0442	0.0684	0.518	Constant	0.0994	0.0850	0.242
	No crisis, after July 1931				**Crisis, after July 1931**			
	Total assets	0.0079	0.0146	0.589	Total assets	0.0106	0.0094	0.261
	Endorsement growth	-0.1094	0.1181	0.354	Endorsement growth	-0.1196	0.0515	**0.020**
	Endorsement growth (-2)	-0.0613	0.0809	0.448	Endorsement growth (-2)	-0.0181	0.0387	0.640
	Endorsement growth (-3)	0.0731	0.0707	0.301	Endorsement growth (-3)	-0.0537	0.0486	0.268
	Deposit growth	0.1098	0.1324	0.407	Deposit growth	0.2873	0.1483	**0.053**
	Deposit growth (-2)	-0.0421	0.1074	0.695	Deposit growth (-2)	0.1996	0.2191	0.362
	Deposit growth (-3)	-0.1286	0.1559	0.410	Deposit growth (-3)	0.1351	0.1616	0.403
	Share of bills	0.0197	0.0282	0.484	Share of bills	0.0141	0.0117	0.229
	Cash liquidity	0.0213	0.0452	0.637	Cash liquidity	-0.0329	0.0222	0.139
	Equity ratio	0.0368	0.0545	0.500	Equity ratio	0.0347	0.0308	0.261
	Branching	-0.0290	0.0743	0.696	Branching	0.0137	0.0344	0.690
	Foreign share	0.0140	0.0470	0.766	Foreign share	-0.0526	0.0251	**0.036**
	Public	0.0801	0.0683	0.240	Public	-0.0638	0.0511	0.212
	Gold cover	0.5247	0.9607	0.585	Gold cover	-0.0785	0.0832	0.345
	Constant	0.9431	1.3452	0.483	Constant	-0.3200	0.1691	**0.058**
Select	...							
	Rho	0.039	0.174	0.823				
# Obs (total)	3,689							
# Failures	19							
Wald test $Chi^2(60)$:	163.35							
p-value	**0.0000**							

Table A6: Robustness check for growth in endorsement liabilities – Allowing for structural break after July 1931.

Dependent variable	Independent variables	Coefficient	Robust standard errors	p-value	Independent variables	Coefficient	Robust standard errors	p-value
Endorsement growth		**No crisis**				**Crisis**		
	Total assets	0.0011	0.0048	0.828	Total assets	0.0132	0.0065	**0.043**
	Endorsement growth	-0.1463	0.0653	**0.025**	Endorsement growth	-0.2012	0.0594	**0.001**
	Endorsement growth (-2)	-0.1090	0.0499	**0.029**	Endorsement growth (-2)	-0.0609	0.0503	0.226
	Endorsement growth (-3)	0.0061	0.0436	0.889	Endorsement growth (-3)	-0.0990	0.0433	**0.022**
	Deposit growth	0.2904	0.1017	**0.004**	Deposit growth	0.4021	0.1266	**0.001**
	Deposit growth (-2)	-0.0130	0.0759	0.865	Deposit growth (-2)	0.1573	0.1406	0.263
	Deposit growth (-3)	-0.1226	0.1033	0.235	Deposit growth (-3)	0.1868	0.1239	0.132
	Share of bills	0.0088	0.0078	0.259	Share of bills	0.0294	0.0089	**0.001**
	Cash liquidity	-0.0132	0.0111	0.238	Cash liquidity	-0.0346	0.0149	**0.021**
	Equity ratio	-0.0170	0.0148	0.248	Equity ratio	0.0176	0.0223	0.430
	Branching	0.0101	0.0181	0.576	Branching	0.0103	0.0247	0.676
	Foreign share	-0.0116	0.0147	0.430	Foreign share	-0.0034	0.0203	0.867
	Public	-0.0086	0.0404	0.832	Public	-0.0853	0.0437	**0.051**
	Gold cover	-0.0299	0.0357	0.402	Gold cover	0.0638	0.0253	**0.012**
	Constant	-0.1502	0.0594	**0.011**	Constant	-0.0335	0.0850	0.694
Select	...							
	Rho	-0.1482	0.1207	0.226				
# Obs (total)	3,714							
# Failures	19							
Wald test $Chi^2(30)$:	138.97							
p-value	**0.0000**							

Table A7: Robustness check for growth in endorsement liabilities – Sensitivity to outliers.

References

[1] Arellano, Manuel and Stephen Bond (1991): "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations," *Review of Economic Studies*, 58(2), 277-297.

[2] Balderston, Theo (1994): "The banks and the gold standard in the German financial crisis of 1931," *Financial History Review*, 43-68.

[3] Bank, Die: Diverse issues.

[4] Blatz, Joachim (1971): *Die Bankliquidität im Run 1931.* Bankwirtschaftliche Sonderveröffentlichungen des Instituts für Bankwirtschaft und Bankrecht an der Universität zu Köln, Band 16. Köln.

[5] Bordo, Michael D. (1986): "Financial Crises, Banking Crises, Stock Market Crashes and the Money Supply: Some International Evidence, 1870-1933," in *Financial Crises and the World Banking System* by Capie, Forrest and Geoffrey E. Wood (eds.). New York: St. Martin's Press.

[6] Born, Karl Erich (1967): *Die deutsche Bankenkrise 1931.* München: Piper.

[7] Bryant, John (1980): "A Model of Reserves, Bank Runs, and Deposit Insurance," *Journal of Banking and Finance*, 43, 749-761.

[8] Bundesarchiv Berlin (Reichsbank R2501): Files 6462, 6484, 6479, 6482, 6484, 6491-92, 6494-96, 6501, 6557-59, 6572, 6574, 6631, 6634, 6709, 6746, 6925, 6984, 7712, Berlin-Lichterfelde.

[9] Calomiris, Charles W. (2000): *U.S. Bank Deregulation in Historical Perspective.* New York: Cambridge University Press.

[10] Calomiris, Charles W. and Gary Gorton (1991): "The Origin of Banking Panics: Models, Facts, and Bank Regulation," in *Financial Markets and*

Financial Crises by R. Glenn Hubbard (ed.). Chicago: University of Chicago Press.

[11] Calomiris, Charles W. and Charles M. Kahn (1991): "The Role of Demandable Debt in Structuring Optimal Banking Arrangements," *American Economic Review*, 81, 497-513.

[12] Calomiris, Charles W. and Joseph R. Mason (1997): "Contagion and Bank Failures During the Great Depression: The June 1932 Chicago Bank Panic," *American Economic Review*, 87(5), 863-883.

[13] Calomiris, Charles W. and Joseph R. Mason (2000): "Causes of U.S. Bank Distress During the Depression," NBER Working Paper # 7919.

[14] Carlson, Mark (2000): "Are Branch Banks Better Survivors? Evidence From the Depression Era," unpublished working paper, University of California, Berkeley.

[15] Chari, V.V. and Ravi Jagannathan (1988): "Banking Panics, Information, and Rational Expectations Equilibrium," *Journal of Finance,* 43, 749-760.

[16] Chen, Yehning (1999): "Banking Panics: The Role of the First-Come, First-Served Rule and Information Externalities," Journal of Political Economy, 107, 946-968.

[17] Deutsche Bundesbank (1976): *Deutsches Geld- und Bankwesen in Zahlen* 1876-1975. Frankfurt am Main: Fritz Knapp Verlag.

[18] Deutscher Reichs- und Preußischer Staatsanzeiger: Diverse issues.

[19] Diamond, Douglas W. and Philip H. Dybvig (1983): "Bank Runs, Deposit Insurance, and Liquidity," *Journal of Political Economy*, 91, 401-419.

[20] Enquête-Ausschuß (1930): *Der Bankkredit.* Verhandlungen und Berichte des Unterausschusses für Geld-, Kredit- und Finanzwesen. Berlin: Mittler & Sohn.

[21] Ferguson, Thomas and Peter Temin (2001): "Made in Germany: The German Currency Crisis of July, 1931," working paper, University of Massachusetts at Boston and Massachusetts Institute of Technology.

[22] Friedman, Milton and Anna Schwartz (1963): *A Monetary History of the United States, 1867-1970.* Princeton: Princeton University Press.

[23] Grossman, Richard S. (1994): "The Shoe That Didn't Drop: Explaining Banking Stability During the Great Depression," *Journal of Economic History*, 54, 654-682.

[24] Hardach, Gerd (1976): *Weltmarktorientierung und relative Stagnation: Währungspolitik in Deutschland 1924-1931.* Berlin: Duncker Humblot.

[25] Hardach, Gerd (1995): "Zwischen Markt und Macht: Die deutschen Banken 1908-1934," in *Wirtschaft, Gesellschaft, Unternehmen* by W. Feldenkirchen, F. Schönert-Röhlk, and G. Schulz (eds.), Vierteljahresschrift für Sozial- und Wirtschaftsgeschichte, Beiheft 120, 914-938.

[26] Heckman, James. J. (1979): "Sample Selection Bias as a Specification Error," *Econometrica*, 47, 153-161.

[27] Institut für Konjunkturforschung (1933): *Konjunkturstatistisches Handbuch 1933.* Hamburg: Hanseatische Verlags-Anstalt.

[28] Institut für Konjunkturforschung (1936): *Konjunkturstatistisches Handbuch 1936.* Hamburg: Hanseatische Verlags-Anstalt.

[29] Jacklin, Charles and Sudipto Bhattacharya (1988): "Distinguishing Panics and Information-Based Bank Runs: Welfare and Policy Implications," *Journal of Political Economy*, 96(3), 568-592.

[30] James, Harold (1985): *The Reichsbank and Public Finance in Germany 1924-1933: A Study of the Politics of Economics during the Great Depression.* Frankfurt am Main: Fritz Knapp Verlag.

[31] James, Harold (1998): "Die Reichsbank 1876 bis 1945," in *Fünfzig Jahre Deutsche Mark: Notenbank und Währung in Deutschland seit 1948* by Deutsche Bundesbank (ed.). München: C.H. Beck'sche Verlagsbuchhandlung (Oscar Beck).

[32] Petri, Martin H. (1998): *The Causes of the German Banking Crisis of July 1931 Viewed from Bank Balance Sheets and the Contemporary Financial Press*, Ph.D. dissertation, University of California, Berkeley.

[33] Saling's Börsenpapiere (1930): *Deutsche Banken und Bankiers 1929/30*, 4. Teil. Berlin, Leipzig, Hamburg: Verlag für Börsen- und Finanzliteratur.

[34] Saunders, Anthony J. and Berry Wilson (1996): "Contagious Bank Runs: Evidence from the 1929-1933 Period," *Journal of Financial Intermediation*, 5,409-423.

[35] Schnabel, Isabel (2002): "The German Twin Crisis of 1931," SFB 504 Discussion Paper # 02-48.

[36] Temin, Peter (1989): *Lessons from the Great Depression.* Cambridge, Massachusetts: MIT Press.

[37] White, Eugene N. (1984): "A Reinterpretation of the Banking Crisis of 1930," *Journal of Economic History*, 44(1), 119-138.

[38] Wicker, Elmus (1996): *The banking panics of the Great Depression.* Cambridge: Cambridge University Press.

Nr.	Author	Title
03-11	Isabel Schnabel	The Great Banks‘ Depression - Deposit Withdrawals in the German Crisis of 1931
03-10	Alain Chateauneuf Jürgen Eichberger Simon Grant	Choice under Uncertainty with the Best and Worst in Mind: Neo-additive Capacities.
03-09	Peter Albrecht Carsten Weber	Combined Accumulation- and Decumulation-Plans with Risk-Controlled Capital Protection
03-08	Hans-Martin von Gaudecker Carsten Weber	Surprises in a Growing Market Niche - An Evaluation of the German Private Annuities Market
03-07	Markus Glaser Martin Weber	Overconfidence and Trading Volume
03-06	Markus Glaser Thomas Langer Martin Weber	On the trend recognition and forecasting ability of professional traders
03-05	Geschäftsstelle	Jahresbericht 2002
03-04	Oliver Kirchkamp Rosemarie Nagel	No imitation - on local and group interaction, learning and reciprocity in prisoners break
03-03	Michele Bernasconi Oliver Kirchkamp Paolo Paruolo	Expectations and perceived causality in fiscal policy: an experimental analysis using real world data
03-02	Peter Albrecht	Risk Based Capital Allocation
03-01	Peter Albrecht	Risk Measures
02-51	Peter Albrecht Ivica Dus Raimond Maurer Ulla Ruckpaul	Cost Average-Effekt: Fakt oder Mythos?
02-50	Thomas Langer Niels Nauhauser	Zur Bedeutung von Cost-Average-Effekten bei Einzahlungsplänen und Portefeuilleumschichtungen