Micro-Evidence From a System-Wide Financial Meltdown: The German Crisis of 1931

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Rationales of Short-term Debt in Banking

• **Rationale 1: Provide liquid/safe asset**
  Diamond and Dybvig (1983), Gorton and Pennachi (1990)

• **Rationale 2: Disciplining device**
  Calomiris and Kahn (1991), Diamond and Rajan (2001)

* Both types of rationales differ considerably in their basic premise:
  * Depositors as liquidity demanders
  * Depositors as informed providers of discipline

* Important policy implication (e.g., effects of deposit insurance)
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  - Depositors as *informed* providers of discipline

- Important policy implication (e.g., effects of deposit insurance)
This Paper

- Can both types of theories prevail empirically?
- Do different depositors take different roles?
  - Some being informed and able to discipline bank behavior?
  - Others being less well informed but valuing bank liquidity provision?

→ This paper: Study the German Crisis of 1931
The German Crisis of 1931

- Failure of Austrian Creditanstalt on May 11, 1931
- German government suspends reparations payment on June 6, 1931
- Both coincide with large-scale deposit withdrawals at German banks
- The run culminated in large number of distressed banks
  
  E.g., failure of Danatbank and Dresdner Bank on July 13, 1931

Figure: Retail depositors withdrawing from Berliner Sparkasse on July 13, 1931.
Why the German Crisis of 1931?

Ideal laboratory for three reasons:

1. **Light regulation** and **limited central bank intervention**

2. Detailed, monthly **micro-level** data

3. **Cross-sectional variation in both deposit flows and bank distress**

   - Identify heterogeneity in depositor behavior:
     - Step 1: Explain cross-sectional variation in deposit flows and bank distress
     - Step 2: Study predictive power of deposit flows for bank distress
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Findings

Deposit Withdrawals:

1. Competing banks are the most informed depositors
   - Observable characteristics (equity, liquidity) don’t explain withdrawals
   - Withdrawals themselves predict bank distress

2. Wholesale depositors are less well informed

3. Retail depositors are least informed
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   - Withdraw only after prominent bank failures at height of crisis
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   - Withdrawals themselves predict bank distress

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   - Observable characteristics (equity, liquidity) *do* explain withdrawals
   - Withdrawals *themselves* predict bank distress *after* interbank collapse

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Maturity:

4. Maturity shortening of informed depositors in early phase of run
   - Conversion of time deposits into demand deposits
   - Maturity shortening in fragile banks
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1 The German Crisis of 1931

2 Informational Content of Deposit Flows
Aggregate Monthly Changes in 1931
Aggregate Monthly Changes in 1931

Monthly difference in mil. RM

31mar1931
30apr1931
30may1931
30jun1931
31jul1931
31aug1931
30sep1931
31oct1931
30nov1931

Monthly difference in mil. RM

0
-500
-1000
-1500
-2000
-2500
-3000

31mar1931
30apr1931
30may1931
30jun1931
31jul1931
31aug1931
30sep1931
31oct1931
30nov1931

Legend:
- Blue: Loans
- Orange: Interbank Deposits
- Red: Liquid securities
- Black: Customer Deposits + Interbank Deposits
- Green: Interbank Lending
Aggregate Monthly Changes in 1931

The graph shows the monthly differences in millions of RM from March 31, 1931, to November 30, 1931. The monthly differences are represented along the vertical axis, ranging from -1500 to 0. The months are indicated on the horizontal axis. The graph includes lines for Loans, Interbank Deposits, Liquid Securities, Customer Deposits + Interbank Deposits, and Interbank Lending.
Aggregate Monthly Changes in 1931
Aggregate Monthly Changes in 1931

![Graph showing monthly changes in aggregate monthly differences in mil. RM for various dates in 1931.](image)
• (Uninsured) demand deposits are stable; Wholesale funding dry-up
• Highlights the potential role of depositor information/sophistication
But in part also reflecting maturity shortening

- Brunnermeier and Oehmke (2013)
Figure: Density of Deposits Flows.
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Density

monthly % change in deposits

31 March 1931  30 April 1931
30 May 1931  30 June 1931
31 July 1931
Figure: Density of Deposits Flows.
1 The German Crisis of 1931

2 Informational Content of Deposit Flows
Dissecting Informational Content of Deposit Flows

Regress bank distress on deposit flows month-by-month

- 19 out of around 125 banks become distressed during the crisis
- Exploit that as econometricians, we are able to observe ex-post outcomes
- Correlation test
  
  See Chiappori and Salanie (2000)
- Does variation in deposit flows itself predict bank distress?
  
  - Is there variation across different types of deposits?
  - Is there variation across time?
  
  Predictive power in deposit flows would be an indication of (some) depositors being informed
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    → Predictive power in deposit flows would be an indication of (some) depositors being informed
Solvency vs. Liquidity

- Cannot identify whether
  - withdrawals are primarily caused by the prospect of default [solvency run/fundamental]
  - or to which extent withdrawals are the primary cause of default [liquidity run/panic-based]

- Identify depositor information:
  Do depositors understand which banks will become distressed?
  - Either because they have information about a specific bank’s solvency
  - Or, information about banks other depositors are likely to perceive as fragile

- **Key assumption:** No single depositors action induces distress
Variation in Distress and Deposit Flows

- Does variation in deposit flows predict distress?
- Regress unexplained variations month-by-month

$$\Pr[\text{Distress}_b] = \alpha + \beta \times \Delta \% D_b + \rho \times X_b + \epsilon_b,$$

- $D_b$:
  - Interbank vs. customer deposits
  - Demand vs. time deposits
- $X_b$: equity, liquidity, etc.
Figure: Deposit Flows and Distress.

(a) Interbank Deposits

(b) Customer Deposits

- Interbank deposit flows are predicting default in June
- Customer deposit flows are only informative *later*, in July
  → Banks are relatively more informed
Figure: Customer Deposit Flows and Lagged Interbank Deposit Flows.

- Customer deposit withdrawals become correlated with lagged interbank flow during height of the crisis
- Suggestive of contagion via
  → Learning
  → or increased refinancing cost (see Liu 2016)
Figure: Deposit Flows and Distress.

- Demand deposit *inflows* predicts distress in May 1931
- Mirrored by predictive power of time deposit *outflows*
  - Arguably reflecting maturity shortening at banks that are at risk
What Do We Learn?

- Roles of short-term debt in banking:
  - Provide liquid/safe asset
    Diamond and Dybvig (1983), Gorton and Pennachi (1990)
  - Disciplining device
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- Seemingly in conflict?

- Various phases of run:
  - Informed investors (interbank market) provide discipline
  - Wholesale depositors are less well informed
    → Discipline not from retail depositors
    → True in absence of deposit insurance, capital and liquidity requirements

- Policy implications
  - Heterogeneity across depositors important
  - Deposit insurance does not undermine discipline
  - Lack of interbank markets potentially do
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  - Evidence from German Crisis of 1931 offers (some) reconciliation
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Dynamics of Aggregate Banking Data

![Graph showing dynamics of aggregate banking data over time.](image-url)
List of Distressed Banks

<table>
<thead>
<tr>
<th>Bank</th>
<th>Event Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landesbank d. Rheinprovinz</td>
<td>June 1931</td>
<td>Bail out</td>
</tr>
<tr>
<td>Gewerbebank AG</td>
<td>June 1931</td>
<td>Distressed merger</td>
</tr>
<tr>
<td>Dresdner Bank</td>
<td>July 1931</td>
<td>Bail out</td>
</tr>
<tr>
<td>Allgem. Deutsche Kredit-Anstalt</td>
<td>July 1931</td>
<td>Bail out</td>
</tr>
<tr>
<td>Darmstaedter und Nationalbank</td>
<td>July 1931</td>
<td>Distressed merger</td>
</tr>
<tr>
<td>Hallescher Bankverein v. Lullisch, Kaempf u. Co., K. a. A.</td>
<td>August 1931</td>
<td>Bail out</td>
</tr>
<tr>
<td>Leipziger Immobilienges. Bk. Grundbesitz A.-G.</td>
<td>September 1931</td>
<td>Default</td>
</tr>
<tr>
<td>Leipziger Kredit-Bank</td>
<td>September 1931</td>
<td>Bail out</td>
</tr>
<tr>
<td>Bank fuer Handel und Gewerbe</td>
<td>September 1931</td>
<td>Default</td>
</tr>
<tr>
<td>Rheinische Bauernbank A.-G.</td>
<td>October 1931</td>
<td>Bail out</td>
</tr>
<tr>
<td>Hollandische Kreditbank AG</td>
<td>October 1931</td>
<td>Default</td>
</tr>
<tr>
<td>Vorschuss- u. Spar-Vereins-Bk. In Luebeck</td>
<td>November 1931</td>
<td>Default</td>
</tr>
<tr>
<td>Commerz-Bank in Luebeck</td>
<td>December 1931</td>
<td>Bail out</td>
</tr>
<tr>
<td>Anhalt-Dessauische Landesbank</td>
<td>December 1931</td>
<td>Distressed merger</td>
</tr>
<tr>
<td>Deutsche Bank</td>
<td>February 1932</td>
<td>Bail out</td>
</tr>
<tr>
<td>Wernigeroeder Bank</td>
<td>February 1932</td>
<td>Default</td>
</tr>
<tr>
<td>Staedte u. Staatsbank d. Oberlausitz K. a. A.</td>
<td>June 1932</td>
<td>Default</td>
</tr>
<tr>
<td>Bernburger Bank</td>
<td>July 1932</td>
<td>Default</td>
</tr>
<tr>
<td>Westfalenbank A.-G.</td>
<td>August 1932</td>
<td>Bail out</td>
</tr>
</tbody>
</table>
Literature I: Theory

- First generation of bank run models:
  - Diamond and Dybvig (1983), Bryant (1980)

- Second generation of bank run models:
  - Rochet and Vives (2004), Goldstein and Pauzner (2005)

- Dynamic and structural models of bank runs
  - He and Xiong (2012), He and Manela (2012)
  - Egan, Hortacsu, Matvos (2017)
Literature II: Empirical evidence

- Single institution bank runs:
  - Iyer and Puri (2012); Iyer et al. (2016); Martin, Puri, Ufier (2018)
  - Artavanis et al. (2019)

- U.S. evidence from U.S. history

- Evidence from 2007-2008:
  - Ivashina and Scharfstein (2010); Ippolito, Peydro, Polo, Sette (2016); Acharya and Mora (2014)

- The Great Depression in Germany:
### The Reichsbank’s Balance Sheet: Liabilities

<table>
<thead>
<tr>
<th>Date</th>
<th>Other (incl. Security &amp; Treasury)</th>
<th>Stock &amp; Reserves</th>
<th>Bills of Exchange</th>
<th>Notes</th>
<th>Gold Reserves</th>
<th>Other Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 Feb 1931</td>
<td>-7000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 Mar 1931</td>
<td>-3500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 Apr 1931</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 May 1931</td>
<td>3500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 Jun 1931</td>
<td>7000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 Jul 1931</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 Aug 1931</td>
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<td></td>
</tr>
<tr>
<td>30 Sep 1931</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>30 Oct 1931</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 Nov 1931</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

The chart above visualizes the balance sheet of the Reichsbank from February to November 1931, showing the changes in liabilities over time.
Step 2: Deposit Flows:

Can balance sheet characteristics explain deposit flows?

\[ \Delta \% D_{b,t} = \tau_t + \beta_1 \times \text{Equity}_b \times \text{May } 1931_t + \beta_2 \times \text{Liquidity}_b \times \text{May } 1931_t \]

\[ + \rho \times X_{b,t} \times \text{May } 1931_t + \gamma_b + \epsilon_{b,t} \]

- \( \Delta \% D_{b,t} \) is the monthly growth in deposits for bank \( b \)
  - Interbank vs. regular deposits
  - Demand vs. time deposits
- May \( 1931_t \); dummy from May 1931 onwards
- \( \tau_t \) time fixed effects
- \( X_{b,t} \) is a set of bank-level controls
### What Explains Deposit Flows?

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>( \Delta %\text{Deposits} )</th>
<th>( \Delta %\text{Inter} )</th>
<th>( \Delta %\text{Cust} )</th>
<th>( \Delta %\text{Time} )</th>
<th>( \Delta %\text{Demand} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity × May 1931</td>
<td>0.033***</td>
<td>-0.018</td>
<td>0.020***</td>
<td>0.034***</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.026)</td>
<td>(0.007)</td>
<td>(0.007)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>Liquidity × May 1931</td>
<td>0.110***</td>
<td>0.134</td>
<td>0.042</td>
<td>0.108**</td>
<td>0.069</td>
</tr>
<tr>
<td></td>
<td>(0.035)</td>
<td>(0.110)</td>
<td>(0.035)</td>
<td>(0.051)</td>
<td>(0.061)</td>
</tr>
<tr>
<td>Mean</td>
<td>-.026</td>
<td>-.037</td>
<td>-.018</td>
<td>-.032</td>
<td>-.019</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>.26</td>
<td>.1</td>
<td>.16</td>
<td>.24</td>
<td>.13</td>
</tr>
<tr>
<td>N</td>
<td>1389</td>
<td>1389</td>
<td>1389</td>
<td>1389</td>
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<tr>
<td>No of Banks</td>
<td>126</td>
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<tr>
<td>Controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Time FE</td>
<td>Yes</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>BankType-Time FE</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

- Interbank flows insensitive to observable characteristics
- Regular deposits more stable at well capitalized and liquid banks