Wholesale funding dry-ups

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Swissquote conference
EPFL

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Motivation

Wholesale funding:

- A growing source of bank funding
  - Repurchase agreements, interbank loans, certificates of deposit
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  - Repurchase agreements, interbank loans, certificates of deposit

- Prevailing view: Wholesale funding is fragile
  - Uninsured, short-term, unsecured
Wholesale funding:

- A growing source of bank funding
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- Prevailing view: Wholesale funding is fragile
  - Uninsured, short-term, unsecured

- Penalized by new liquidity regulation (LCR, NSFR)
Related literature

- **Aggregate resilience of unsecured markets**
  - U.S.: Schoar et al. (2011)
  - Europe: Gabrieli & Georg (2015)

- **Aggregate resilience of secured markets**
  - U.S.: Krishnamurthy et al. (2014), Copeland et al. (2014)
  - Europe: Boissel et al. (2015), Mancini et al. (2015)

- **Our focus:** Beyond aggregate, explore cross-section
Key friction: **asymmetric information**.
Theory

- **Key friction:** asymmetric information.

- **Lenders equally uninformed** (Akerlof 1970; Stiglitz & Weiss 1981)
  - High- and low-quality banks indistinguishable by lenders
  - Adverse selection: high-quality banks withdraw as rates increase
    \[\Rightarrow\] Relative quality of pool of borrowers decreases in periods of stress

- Some lenders are informed (Gorton & Pennacchi 1990)
  - Debt derives value from being information-insensitive
    - When information-sensitive: uninformed lenders cut funding
      - Informed lenders still lend to high-quality banks
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- Test competing theories
  - Ideal laboratory: European market for certificates of deposits (CDs)
  - Different policy implications: transparency vs. opacity
Theory

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Main results

- R1: No market-wide freeze
  - But many bank-specific funding dry-ups
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- **R1: No market-wide freeze**
  - But many bank-specific funding dry-ups

- **R2: Low-quality banks are more likely to lose access to wholesale funding in times of stress**
  - Inconsistent with adverse selection
  - Consistent with heterogeneity across lenders
Main results

- **R1**: No market-wide freeze
  - But many bank-specific funding dry-ups

- **R2**: Low-quality banks are more likely to lose access to wholesale funding in times of stress
  - Inconsistent with adverse selection
  - Consistent with heterogeneity across lenders

- **R3**: In times of stress, funds are reallocated towards high-quality banks
  - Inconsistent with adverse selection
  - Consistent with heterogeneity across lenders
Data on certificates of deposit

- **Certificate of deposit (CD)**
  - Issued by credit institutions
  - Initial maturity between 1 day and 1 year (median = 33 days)
  - Unsecured
  - Issued over-the-counter, placed mostly to money market funds

CD dataset
- From Banque de France, over 2008-2014
- 1,383,202 ISIN-level observations, with 838,703 individual ISINs
- All events: issuance, re-issuances, buybacks

More than 80% of all euro-denominated CDs
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- More than 80% of all euro-denominated CDs
CD market versus other wholesale markets

- CD is a large segment of wholesale funding
  - Similar size as the repo market
  - Larger than ECB funding and unsecured interbank market
  - No previous study on the CD market

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Wholesale funding dry-ups
Pricing in the CD market

CD yields vs. Euribor

CD yields vs. ECB MRO rate

- CDs are cheaper than close substitutes
No market freeze

- **R1:** No market-wide freeze in CD market
  - ... even when CDS spreads increase
CD issuers

- 276 individual issuers
- 196 French, 80 from IT, DE, UK, NL, IE, etc.
- Most large European banks
CD issuers

- 276 individual issuers
  - 196 French, 80 from IT, DE, UK, NL, IE, etc.
  - Most large European banks

Matching with balance sheet and market data

- 263 issuers matched with balance sheet data (Bankscope)
- Short-term credit ratings (Fitch)
- Stock price and CDS spread data (Bloomberg)
The importance of bank-specific dry-ups

- **Definitions of funding dry-ups**
  - Full dry-up: Amount outstanding falls to zero
  - Partial dry-up: Loses 50% or more in 50 days or less
The importance of bank-specific dry-ups

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- 75 events, including 29 full dry-ups
The importance of bank-specific dry-ups

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  - Full dry-up: Amount outstanding falls to zero
  - Partial dry-up: Loses 50% or more in 50 days or less

- 75 events, including 29 full dry-ups

- One full and one partial dry-up
Timeline of events

- Year with highest number of funding dry-ups is 2011
Banks facing a funding dry-up are weaker on observables

<table>
<thead>
<tr>
<th></th>
<th>One year before event</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Diff. from mean</td>
</tr>
<tr>
<td>ROA</td>
<td>-1.249***</td>
</tr>
<tr>
<td>Net income / Assets</td>
<td>-0.014***</td>
</tr>
<tr>
<td>Impaired loans / Equity</td>
<td>55.879***</td>
</tr>
<tr>
<td>Equity / Assets</td>
<td>-0.036***</td>
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<tr>
<td>CDS spread</td>
<td>82.180</td>
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<td>Short-term credit rating</td>
<td>-0.424***</td>
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Dry-ups predict future bank characteristics

- **R2**: Low-quality banks are more likely to lose access to wholesale funding in times of stress
  - Quality: *Unobservable* quality $\rightarrow$ *Changes* in performance
Dry-ups predict future bank characteristics

- **R2:** Low-quality banks are more likely to lose access to wholesale funding in times of stress
  - Quality: *Unobservable* quality $\rightarrow$ Changes in performance

- **Base regression**

  \[
  \Delta ROA_{i,t} = \beta_0 \mathbb{1} \{ t - 1 \leq \tau_{DryUp_i} < t \} + \beta_1 \text{Size}_{i,t-1} + \beta_2 \text{Controls}_{i,t-1} + \beta_3 \text{Controls}_{c,t-1} + F E_{c} + F E_{t} + \varepsilon_{i,t},
  \]

- $\Delta ROA_{it} = ROA_{it} - ROA_{it-1}$
- Coefficient of interest: $\beta_0$
Dry-ups predict future bank characteristics

\[ \Delta ROA_t = ROA_t - ROA_{t-1} \]
**Dry-ups predict future bank characteristics**

- **Facing a dry-up predicts a decrease in ROA**
  - Inconsistent with adverse selection being large

**Dependent variable:** $\Delta ROA = ROA_t - ROA_{t-1}$

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Share CD</th>
<th>Crisis</th>
</tr>
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<tbody>
<tr>
<td>DryUp</td>
<td>-0.341** (0.135)</td>
<td>-0.508*** (0.139)</td>
<td>-0.874*** (0.176)</td>
</tr>
<tr>
<td>Size$_{t-1}$</td>
<td>-0.018 (0.025)</td>
<td>-0.004 (0.025)</td>
<td>-0.017 (0.025)</td>
</tr>
<tr>
<td>ROA$_{t-1}$</td>
<td>-0.713*** (0.038)</td>
<td>-0.717*** (0.037)</td>
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<td>Impaired / Loans$_{t-1}$</td>
<td>-0.025*** (0.009)</td>
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<tr>
<td>GDP growth</td>
<td>38.957*** (4.969)</td>
<td>37.561*** (4.955)</td>
<td>38.732*** (4.954)</td>
</tr>
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<td>DryUp $\times$ Share CD $\in [4%, 9%]$</td>
<td>0.372 (0.407)</td>
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<td>N. Obs.</td>
<td>948</td>
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Wholesale funding dry-ups
Dry-ups predict future market outcomes

- Concern for tests of asymmetric information
  - Information of market agents $\neq$ information of the econometrician

\[
\begin{align*}
\Delta \text{CDS spread} & \quad 6 \text{ months} & 1 \text{ year} \\
36.443 & \quad & 49.033 \\
& \quad & 43.824 \\
& \quad & 61.896 \\
(15.748) & \quad & (17.577) \\
& \quad & (25.510) \\
\end{align*}
\]

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\begin{align*}
\text{Size}_{t-1} & \quad -0.707 & -1.680 \\
(0.901) & \quad & (1.770) \\
\text{ROA}_{t-1} & \quad -2.354 & 3.948 \\
(1.552) & \quad & (2.756) \\
\text{Impaired / Loans}_{t-1} & \quad -2.041 & -2.410 \\
(0.787) & \quad & (1.180) \\
\text{GDP growth} & \quad -1214.823 & -2187.640 \\
(650.329) & \quad & (1437.262) \\
\text{Adj. } R^2 & \quad 0.570 & 0.585 & 0.563 & 0.573 \\
\text{N. Obs.} & \quad 2,099 & 956 & 1,937 & 956
\end{align*}
\]
Dry-ups predict future market outcomes

- **Concern for tests of asymmetric information**
  - Information of market agents ≠ information of the econometrician

- Use market data → Incorporate information in real time
  - Dry-ups predict increases in CDS spreads
  - Also predict negative excess stock return, but insignificant

\[
\Delta \text{CDS spread}
\]

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Wholesale funding dry-ups
Endogeneity concerns

- Evidence consistent with presence of informed lenders
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- However, reverse causality concern
  - Can funding dry-ups cause decreases in ROA?
  - As in models of bank runs (Diamond & Dybvig 1983).
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- However, reverse causality concern
  - Can funding dry-ups cause decreases in ROA?
  - As in models of bank runs (Diamond & Dybvig 1983).

- Three solutions
  - Use changes in impaired loans as dependent variable → [See results]
  - Interact DryUp dummy with share of CD funding → [See results]
  - Banks do not downsize significantly → No fire sales [See results]
Maturity shortening

- Uninformed lenders value information-insensitive securities
- In stress, long-term debt becomes information-sensitive first
- Predicts maturity shortening before dry-ups

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>Weighted average maturity of new issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Partial and full dry-ups</td>
<td>Panel B: Full dry-ups only</td>
</tr>
<tr>
<td>( \tau - 1 )</td>
<td>(-24.660^{***} )</td>
</tr>
<tr>
<td>( \tau - 2 )</td>
<td>(-17.278^{***} )</td>
</tr>
<tr>
<td>( \tau - 3 )</td>
<td>(-12.134^{***} )</td>
</tr>
<tr>
<td>( \tau - 4 )</td>
<td>(-7.628 )</td>
</tr>
<tr>
<td>( \tau - 5 )</td>
<td>(-7.506^{*} )</td>
</tr>
<tr>
<td>( \tau - 6 )</td>
<td>(-0.689 )</td>
</tr>
<tr>
<td>Adj. ( R^2 )</td>
<td>0.166</td>
</tr>
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<td>N. Obs.</td>
<td>11,420</td>
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**R3:** In times of stress, funds are reallocated to high-quality banks
Reallocation

- **R3**: In times of stress, funds are reallocated to high-quality banks

- **Issuance in excess of the market**

\[ E_{i,t} = \left[ \log(CD_{i,t}) - \log(CD_{i,t-1}) \right] - \left[ \log(CD_{m,t}) - \log(CD_{m,t-1}) \right] \]

- **\( CD_{it} \)**: Outstanding amount by \( i \) in month \( t \)
- **\( CD_{mt} \)**: Aggregate size of CD market in month \( t \)
R3: In times of stress, funds are reallocated to high-quality banks

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Probit specification

\[ \Pr(I_{i,t} = 1|X_t) = \Phi(\beta_0 \Delta ROA_{i,t} + \beta_1 Controls_{i,t-1} + \beta_2 Controls_{c,t-1} + FE_c + FE_m) \]

- \( I_{it} = 1 \) if \( E_{it} \) above median or 75th percentile
- **Banks increasing ROA increase relative CD funding**

  - Regardless of whether market is stressed

  **Dependent variable:**
  Prob. of CD issuance in excess of the market above median above 75th percentile

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<td>( \Delta \text{ROA} )</td>
<td>0.024*** (0.005)</td>
<td>0.031** (0.014)</td>
</tr>
<tr>
<td>Controls</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Month FE</td>
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Reallocation in times of stress

**Stress Index**

\[
Stress\ Index_t = \frac{\sum_i R_{i,t}}{CD_{m,t}},
\]

- \(R_{i,t}\): Euro amount of dry-up by \(i\) at \(t\)
- \(CD_{m,t}\): Aggregate CD market size at \(t\)
- Computed at monthly frequency \(\rightarrow\) [See index]

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Reallocation in times of stress

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- \(R_{it}\): Euro amount of dry-up by \(i\) at \(t\)
- \(CD_{mt}\): Aggregate CD market size at \(t\)
- Computed at monthly frequency → [See index]

- **Interact \(\Delta ROA\) with quantiles of Stress Index**
  - If effect magnified → Accelerated reallocation
  - If effect disappears → Adverse selection worsens
Reallocation in times of stress

- **Reallocation magnified when market stress is high**
  - ... Increasing in quantiles of the Stress Index

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<td>-0.003</td>
<td>0.008</td>
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<td>(0.016)</td>
<td>(0.006)</td>
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<tr>
<td>$\Delta \text{ROA} \times \text{Stress Index in Quartile 3}$</td>
<td>0.033***</td>
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Dependent variable: Prob. of CD issuance in excess of the market

High-quality banks do not reduce but increase funding. Inconsistent with adverse selection being first-order.
Reallocation in times of stress

- **Reallocation magnified when market stress is high**
  - ... Increasing in quantiles of the Stress Index

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- High-quality banks do not reduce but *increase* funding
  - Inconsistent with adverse selection being first-order

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Wholesale funding dry-ups
Conclusion and implications

- **Frictions on wholesale funding markets**
  - No evidence that asymmetric information is first-order
    - No market freeze
    - Dry-ups predict low future performance
  - Investors value information-insensitive (“safe”) securities
    - Dry-ups occur when debt turns information-sensitive
    - Reallocation not random → From low- to high-quality banks

Implications of our results

- Disciplinary role of wholesale funding (“tough creditors”)
- Challenge to liquidity ratios? No account for externalities
- Lender of last resort most likely to benefit weakest banks
- Private production of safe assets
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The absence of market freeze

- No system-wide drop in volume
- ... Even when CDS spreads increase
Average maturity of new issues

- No system-wide drop in average maturity

Weighted-average maturity (days)

Average maturity

Bank CDS


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CD Yields

- Negative spread with the Euribor of same maturity

Back
CD Yields

- Yields on CDs with initial maturity up to 7 days

Back
Dry-ups predict future bank characteristics

Facing a dry-up predicts an increase in impaired loans

<table>
<thead>
<tr>
<th>Dependent variable: $\Delta$ Impaired loans / Loans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>DryUp</td>
</tr>
<tr>
<td>Size$_{t-1}$</td>
</tr>
<tr>
<td>ROA$_{t-1}$</td>
</tr>
<tr>
<td>Impaired / Loans$_{t-1}$</td>
</tr>
<tr>
<td>GDP growth</td>
</tr>
<tr>
<td>DryUp $\times$ Share CD $\in [4%, 9%]$</td>
</tr>
<tr>
<td>DryUp $\times$ Share CD $\geq 9%$</td>
</tr>
<tr>
<td>DryUp $\times$ Crisis</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
</tr>
<tr>
<td>N. Obs.</td>
</tr>
</tbody>
</table>
## Endogeneity checks

- **Effect not magnified for banks with large CD exposure**

Dependent variable: $\Delta ROA = ROA_t - ROA_{t-1}$

<table>
<thead>
<tr>
<th>Baseline</th>
<th>Share CD</th>
<th>Crisis</th>
</tr>
</thead>
<tbody>
<tr>
<td>DryUp</td>
<td>-0.341** (0.135)</td>
<td>-0.508*** (0.139)</td>
</tr>
<tr>
<td>Size$_{t-1}$</td>
<td>-0.018 (0.025)</td>
<td>-0.004 (0.025)</td>
</tr>
<tr>
<td>ROA$_{t-1}$</td>
<td>-0.713*** (0.038)</td>
<td>-0.717*** (0.037)</td>
</tr>
<tr>
<td>Impaired / Loans$_{t-1}$</td>
<td>-0.025*** (0.009)</td>
<td>-0.026*** (0.009)</td>
</tr>
<tr>
<td>GDP growth</td>
<td>38.957*** (4.969)</td>
<td>37.561*** (4.955)</td>
</tr>
<tr>
<td>DryUp $\times$ Share CD $\in [4%, 9%]$</td>
<td></td>
<td>0.372 (0.407)</td>
</tr>
<tr>
<td>DryUp $\times$ Share CD $\geq 9%$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DryUp $\times$ Crisis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>-0.001</td>
<td>0.407</td>
</tr>
<tr>
<td>N. Obs.</td>
<td>948</td>
<td>684</td>
</tr>
</tbody>
</table>

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**Christophe Péron, David Thesmar, Guillaume Vuillemey**

**Wholesale funding dry-ups**
Endogeneity checks

- Facing a dry-up does not predict a decrease in size

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Share CD</th>
<th>Crisis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DryUp</strong></td>
<td>-0.039</td>
<td>-0.008</td>
<td>-0.019</td>
</tr>
<tr>
<td></td>
<td>(0.035)</td>
<td>(0.017)</td>
<td>(0.018)</td>
</tr>
<tr>
<td><strong>Size_{t-1}</strong></td>
<td>-0.005**</td>
<td>-0.005**</td>
<td>-0.005**</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.002)</td>
<td>(0.002)</td>
</tr>
<tr>
<td><strong>ROA_{t-1}</strong></td>
<td>0.008**</td>
<td>0.008**</td>
<td>0.008**</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
</tr>
<tr>
<td><strong>Impaired / Loans_{t-1}</strong></td>
<td>-0.000</td>
<td>-0.000</td>
<td>-0.000</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td><strong>GDP growth</strong></td>
<td>0.028</td>
<td>0.054</td>
<td>0.014</td>
</tr>
<tr>
<td></td>
<td>(0.497)</td>
<td>(0.500)</td>
<td>(0.497)</td>
</tr>
<tr>
<td><strong>DryUp \ast Share CD \in [4%, 9%]</strong></td>
<td></td>
<td>-0.009</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.041)</td>
<td></td>
</tr>
<tr>
<td><strong>DryUp \ast Share CD \geq 9%</strong></td>
<td></td>
<td>-0.017</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.030)</td>
<td></td>
</tr>
<tr>
<td><strong>DryUp \ast Crisis</strong></td>
<td></td>
<td>0.008</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.007)</td>
<td></td>
</tr>
<tr>
<td><strong>Adj. ( R^2 )</strong></td>
<td>0.031</td>
<td>0.197</td>
<td>0.195</td>
</tr>
<tr>
<td><strong>N. Obs.</strong></td>
<td>950</td>
<td>685</td>
<td>685</td>
</tr>
</tbody>
</table>

Dependent variable: ∆ Size

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Consistency checks

- **Predictability remains when market stress is high**

Dependent variable: $\Delta ROA = ROA_t - ROA_{t-1}$

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Share CD</th>
<th>Crisis</th>
</tr>
</thead>
<tbody>
<tr>
<td>DryUp</td>
<td>-0.341**</td>
<td>-0.508***</td>
<td>-0.874***</td>
</tr>
<tr>
<td></td>
<td>(0.135)</td>
<td>(0.139)</td>
<td>(0.176)</td>
</tr>
<tr>
<td>Size$_{t-1}$</td>
<td>-0.018</td>
<td>-0.004</td>
<td>-0.017</td>
</tr>
<tr>
<td></td>
<td>(0.025)</td>
<td>(0.025)</td>
<td>(0.025)</td>
</tr>
<tr>
<td>ROA$_{t-1}$</td>
<td>-0.713***</td>
<td>-0.717***</td>
<td>-0.717***</td>
</tr>
<tr>
<td></td>
<td>(0.038)</td>
<td>(0.037)</td>
<td>(0.038)</td>
</tr>
<tr>
<td>Impaired / Loans$_{t-1}$</td>
<td>-0.025***</td>
<td>-0.026***</td>
<td>-0.026***</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.009)</td>
<td>(0.009)</td>
</tr>
<tr>
<td>GDP growth</td>
<td>38.957***</td>
<td>37.561***</td>
<td>38.732***</td>
</tr>
<tr>
<td></td>
<td>(4.969)</td>
<td>(4.955)</td>
<td>(4.954)</td>
</tr>
<tr>
<td>DryUp $\times$ Share CD $\in [4%, 9%]$</td>
<td></td>
<td>0.372</td>
<td>0.372</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.407)</td>
<td>(0.407)</td>
</tr>
<tr>
<td>DryUp $\times$ Share CD $\geq 9%$</td>
<td></td>
<td>0.351</td>
<td>0.351</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.302)</td>
<td>(0.302)</td>
</tr>
<tr>
<td>DryUp $\times$ Crisis</td>
<td></td>
<td>0.133</td>
<td>0.133</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.192)</td>
<td>(0.192)</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>-0.001</td>
<td>0.407</td>
<td>0.415</td>
</tr>
<tr>
<td>N. Obs.</td>
<td>948</td>
<td>684</td>
<td>684</td>
</tr>
</tbody>
</table>

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Christophe Péignon, David Thesmar, Guillaume Vuillemey  Wholesale funding dry-ups
Stress Index

- Captures number and magnitude of dry-ups
  - Both partial and full

run_index.pdf

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