Slow capital, fast prices: Shocks to funding liquidity and stock price reversals

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Stock market volatility during 2008/2009



This paper

German stock market during Great Depression

- 5 big banks acted like market makers
- Each bank provided liquidity to a different subset of stocks
- I identify a shock to the funding liquidity of one bank, the Danatbank
 - 11 May 1931: Largest borrower is near bankruptcy
 - During May 1931: Constrained liquidity provision of Danatbank to each of its other firms
 - \Rightarrow Difference-in-differences approach

Main results:

- Increase in illiquidity measured by order imbalances
- V-shaped price patterns

Main results



Related Literature

- Limits to arbitrage and frictional finance
 - De Long et al. 1990, Duffie et al. 2005, Biais 2011
- Price pressure and V-shaped price patterns
 - Kraus and Stoll 1972, Coval and Stafford 2007, Duffie 2010, Hendershott and Menkveld 2013
- Intermediary's balance sheet and asset prices
 - Coughenour and Saad 2004, Comerton-Forde et al 2010, Adrian and Shin 2010
 - Gromb and Vayanos 2002, Brunnermeier and Pedersen 2009
- Pre-WW II Germany
 - De Long and Becht 1994: no excess volatility in pre-WW II German stock market

Historical background The big Berlin banks as liquidity providers

- Interwar Germany: only 5 universal banks
- Banks held close connections to firms
 - Creditor, underwriter, supervisory board etc.
- On the stock exchange, banks acted like market makers for stocks of connected firms

Historical background The big Berlin banks as liquidity providers

"...sometimes the demand or supply of a few shares can lead to unreasonable price increases or decreases. Here it is the task of the bank to provide liquidity in order to establish a more balanced price setting. The underwriting bank can fulfill this task best, since it is mostly better informed about the true value of the shares... " (A. Weber 1915)

The funding liquidity shock

- Danatbank 's largest borrower: Nordwolle
 - Credit: 80% of Danatbank's equity
- May 1931: Nordwolle on the verge of bankruptcy
- Danatbank's CEO Goldschmidt: "Nordwolle goes down, Danat goes down, I go down!"
- Danatbank's reaction:
 - No disclosure of information
 - Planned equity offering (with Danatbank as main buyer)
 - Danatbank "sought desperately to find means of supporting Nordwolle" (Feldman 1995)
 - Secretly buying own shares
- In June information became public

Timeline



Identification

<u>Firm</u>

Connected bank

AG fuer Bergbau	Deutsche Bank
Buderus	Deutsche Bank
Kaliwerke Strassfurt	Deutsche Bank
Grube Leopold	BHG
Zellstoff Waldhof	BHG
Adler Werke	Danatbank
Atlas Werke	Danatbank
Atlas Werke Charlottenhuette	Danatbank Danatbank
Atlas Werke Charlottenhuette Hamburger Elek. Werke	Danatbank Danatbank Commerz

Measuring market illiquidity: Order imbalances

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Information on order imbalances in daily quotes

- bz: no order imbalance
- bz B, B: supply order imbalance
- bz G, G: demand order imbalance

Supply order imbalance as measure of market illiquidity

• Dummy variable: 1 if stock is quoted with *bz B* or *B*

Order book imbalances



Order book imbalances



Data



- IPO and SEO prospectuses and bank annual reports (German Federal Archives)
- Daily stock market data for 87 firms (Berliner Boersen Zeitung)
- Period: 01.11.1930-04.06.1931 (15.138 firm-day observations)
- Other archival sources (letters, reports etc.)

Data description

19 57.58 34.1	Manufacturing 37 68.52 52.4 Mining	-18 -10.94 -18.3
19 57.58 34.1	37 68.52 52.4 Mining	-18 -10.94 -18.3
57.58 34.1	68.52 52.4 Mining	-10.94 -18.3
34.1	52.4 Mining	-18.3
	Mining	
6	10	-4
18.18	18.52	-0.34
83.8	56.1	27.7
	Utilities	
4	5	-1
12.12	9.26	2.86
44.2	79.3	-35.1
	Finance	
4	0	4
12.12	0	12.12
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9	13	-4
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Market illiquidity

Frequency of supply order imbalances

	Before May 11	After May 11	Total
BHG	0.09	0.11	0.09
Commerz	0.13	0.13	0.13
Deu-Dis	0.10	0.15	0.10
Danat	0.06	0.23	0.08
Dresdner	0.10	0.16	0.11

Market illiquidity: Baseline results

$\textit{Imbalance}_{it} = \beta_1 \times \textit{Danat}_i + \beta_2 \times \textit{May}_p + \beta_3 \times (\textit{May}_p \times \textit{Danat}_i) + \alpha_i + \delta_t + \epsilon_{it}$

	(1)	(2)	(3)
May×Danat	0.158***	0.167***	0.181***
	(0.0438)	(0.0470)	(0.0507)
$May \times BHG$		-0.0147	-0.0162
		(0.0319)	(0.0394)
$May \times Commerz$		-0.00133	-0.0131
		(0.0423)	(0.0553)
$May \times DeuDis$		0.0227	0.0300
		(0.0380)	(0.0386)
$May \times Dresdner$		0.0342	0.0410
		(0.0449)	(0.0441)
Time FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Size			Yes
SizeMay			Yes
N	15138	15138	15138
R^2	0.128	0.128	0.130

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Market illiquidity: Placebo test



 $\mathbb{E}[\mathbf{x}] = \mathbb{E}[\mathbf{x}] \otimes \mathbb{E}[\mathbf{x}]$

Market illiquidity: One vs. more underwriter banks

	(1)	(2)	(3)
$May \times Only Danat$	0.166***		0.167***
	(0.0227)		(0.0289)
OnlyDanat	0.0173		0.0172
	(0.0260)		(0.0261)
May	-0.00886	0.109*	-0.00969
	(0.0626)	(0.0637)	(0.0665)
$May \times Danat + Other$		-0.117***	0.00140
		(0.0220)	(0.0275)
Danat+other		-0.0224	-0.000144
		(0.0259)	(0.0228)
Ν	9396	9396	9396
R^2	0.101	0.095	0.101

V-shaped price patterns



Investing in illiquidity: A contrarian trading strategy



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Investing in illiquidity: A contrarian trading strategy



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Robustness: Firm news



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Stock prices



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Robustness: Banks' stock prices



Robustness: Fire sales

- Danatbank-portfolio December 1931: Most stocks still in their portfolio
- Danatbank's balance sheets: No change in overall value of stock inventory between May 1931 and July 1931

Robustness: Fire sales

	(1)	(2)
Price above nom. value	0.0138*	
	(0.00752)	
May×(Price above nom. value)	-0.133*	
* ` ` ` ` ` ` ` ` ` ` ` ` ` ` ` ` ` ` `	(0.0727)	
May	0.151	0.227*
v	(0.118)	(0.130)
Price at t_0		-0.00145***
		(0.0000520)
$May \times (Price at t_0)$		-0.00131**
		(0.000503)
N	5742	5742
R^2	0.150	0.155

A model of asymmetric information and imperfect competition

- Kyle (1989): Asymmetric information and imperfect competition
- Informed bank, o uninformed traders, and noise traders
- CARA utility
- Risky asset pays $d \sim N(\overline{d}, \tau_d^{-1})$
- Noise traders: aggregate supply of $u \sim N(0, \tau_u^{-1})$

Informed trader

- Informed trader with market power
- Informative signal $s = d + \epsilon$, $\epsilon \sim N(0, \tau_{\epsilon}^{-1})$
- Counteracts noise trading *u* with αz , where $z \sim N(0, \tau_z^{-1})$ and $\rho \equiv corr(u, z) < 0$
- Demand:

$$x_i = x_i^{\text{spec}} + x_i^{\text{mm}} \tag{1}$$

$$= b_i + as - c_i p + \alpha z \tag{2}$$

Uninformed traders

- Learn from prices about the bank's signal
- Demand:

$$x_o = b_o - c_o p \tag{3}$$

• Expectations are formed using Bayes' rule

Equilibrium

• Linear price function

$$\boldsymbol{\rho} = \lambda (\boldsymbol{a}\boldsymbol{s} + \boldsymbol{b}_i + \boldsymbol{o}\boldsymbol{b}_o + \boldsymbol{u} + \alpha \boldsymbol{z}), \quad \lambda = (\boldsymbol{c}_i + \boldsymbol{o}\boldsymbol{c}_o)^{-1}$$
(4)

• Linear demand function of the bank

$$x_i = \alpha \mathbf{s} + b_i - c_i p + \alpha z \tag{5}$$

Linear demand function of uninformed traders

$$x_o = b_o - c_o p \tag{6}$$

Price volatility



Price impact



Conclusion

- Case study where balance sheet shock had asset pricing implications
- Unique setting:
 - Clear identification of liquidity provider
 - Large balance sheet shock
- V-shaped price patterns
- Discussion on universal banking: More prone to shocks

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Market illiquidity: Logit results

Go back

$\textit{Exc.supply}_{it} = \beta_1 * \textit{Danat}_i + \beta_2 * \textit{May}_t + \beta_3 * (\textit{May}_t * \textit{Danat}_i) + \alpha_i + \delta_t + \epsilon_{it}$

	(1) Logit	(2) Logit	(3) Logit
May*Danat	1.662***	1.887***	2.029***
•	(0.327)	(0.472)	(0.494)
May*BHG		-0.269	-0.314
		(0.223)	(0.313)
May*Commerz		0.0581	0.0172
		(0.470)	(0.485)
May*DeuDis		0.472	0.501
		(0.443)	(0.466)
May*Dresdner		0.180	0.219
		(0.367)	(0.391)
Time FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Size			Yes
SizeMay			Yes
N	14616	14616	14616
Pseudo R^2	0.158	0.159	0.159

Volatility during May/June



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