Tracing the International Transmission of a Crisis Through Multinational Firms

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Research Questions

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- We focus on how shocks to individual firms propagate globally.

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- We focus on how shocks to individual firms propagate globally.

1. Can a single firm affect growth in foreign countries where it has no connections and operations?
2. Through which mechanism can a shock to a single firm affect foreign countries?

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- We show that a shock to a single firm (a bank) in a single country can impact growth all over the world – even if the bank has no direct foreign connections or operations.

- The transmission mechanism operates via internal capital flows through multinational firms.
  - Internal capital flows are large enough to shape aggregates: 50% of total capital inflows and 3.6% of GDP in the median country.

- We emphasize that exposure to internal capital markets determines real outcomes of firms and how firms recover from internal capital shocks.

What Do We Learn About Individual Firms?

- We know: "Granular" firms comove with growth in their home country and with connected countries.

  Theory: Gabaix 2011; Acemoglu et al. 2012; di Giovanni & Levchenko 2012; Grassi 2017; Magerman et al. 2017; Carvalho & Grassi 2019.
  Evidence: di Giovanni et al. 2014, 2018, 2019; Amiti & Weinstein 2018.

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- Contributions of this paper:
  - A shock to a firm with only domestic connections can impact growth all over the world.
  - We focus on the importance of a single firm, rather than the aggregate impact of all firm-level shocks jointly.
  - We identify a quasi-experiment to estimate causal effects of an idiosyncratic shock.

What Do We Learn About Internal Capital Markets?

- We know: Foreign-owned affiliates perform better than domestically-owned firms during capital crises. But they also differ in other respects: productivity, import & export shares, human capital.

  Desai et al. 2004, 2008; Foley & Manova 2015; Manova et al. 2015; Kalemli-Özcan et al. 2016; Bloom et al. 2012; Guadalupe et al. 2012; Setzler and Tintelnot 2021.

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- Contributions of this paper:
  - Internal capital flows matter. Only firms that increase internal lending experience real effects after a shock.
  - Internal capital markets can be destabilizing, rather than beneficial.
  - Internal capital shocks are very harmful in the short run, but affiliates overcome them after ~3 years.

An Idiosyncratic Shock

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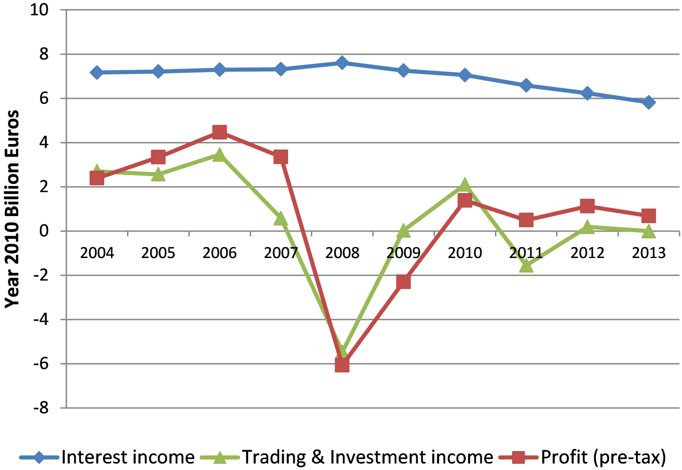
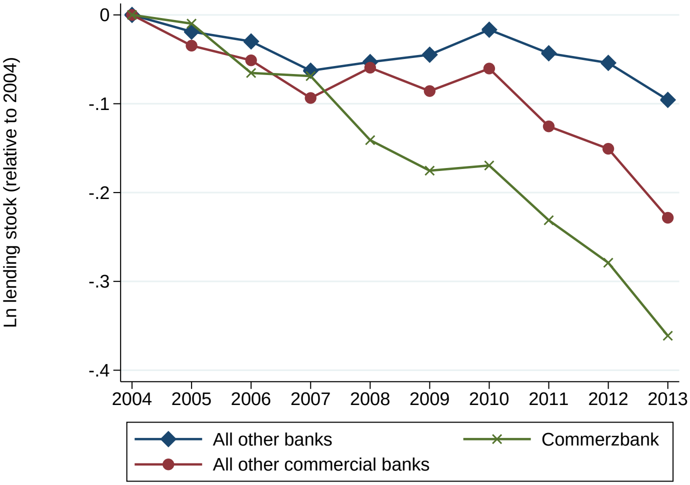
- Identifying the importance of an individual firm is difficult. We need an exogenous shock to a single firm.
- We analyze an idiosyncratic shock to a large German bank, Commerzbank.
- Commerzbank suffered losses due to investments on international financial markets from 2007 to 2009.
- The losses led to an exogenous lending cut to German firms. The losses were unrelated to the German loan portfolio, as shown by analyst reports and a firm survey.

Evidence from Commerzbank's Income Statement



Commerzbank Cuts Lending



Commerzbank includes lending by branches of Commerzbank and Dresdner Bank.

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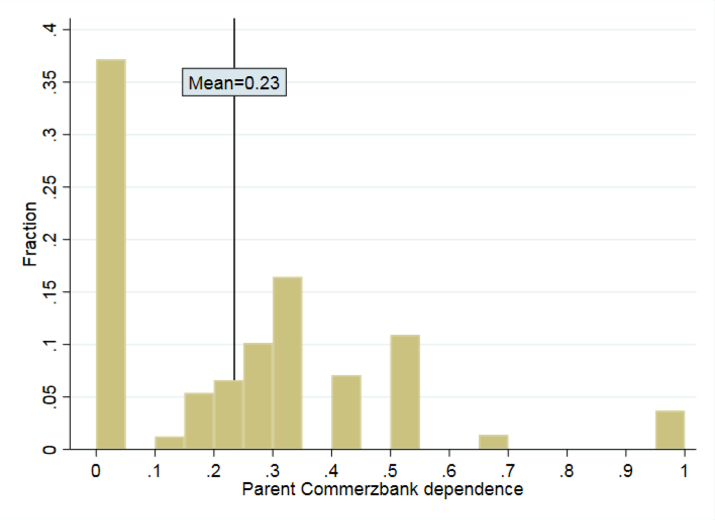
- German firms of all sizes depend on the loan supply of their relationship banks.
- Two steps:
  - We compare multinational parents with higher Commerzbank dependence to other parents (with lower Commerzbank dependence).
  - We compare international affiliates whose German parents were dependent on Commerzbank to other affiliates.

Data

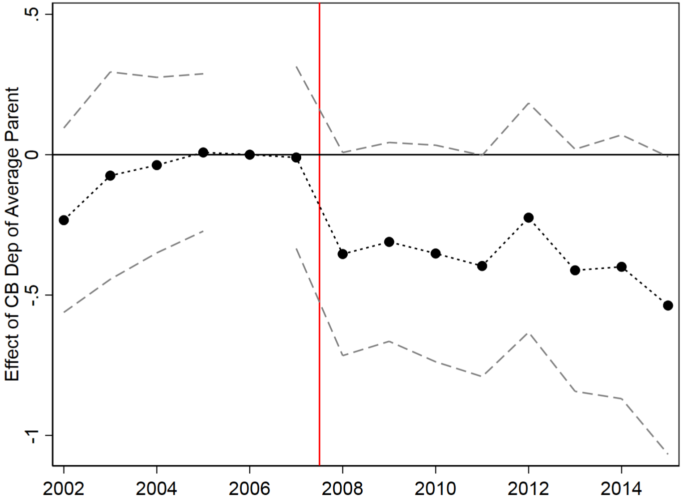
- Proprietary data on the names of the relationship banks (Hausbanken) of 655 German parents in 2006.
- Main treatment variable: share of bank relationships that were with Commerzbank.
- Bundesbank data on internal capital markets of German multinationals (e.g., loans from affiliate to parent).
- Firms with and without parent Commerzbank dependence are balanced on observables.

Distribution of Parent CB Dep



Effect on Parents

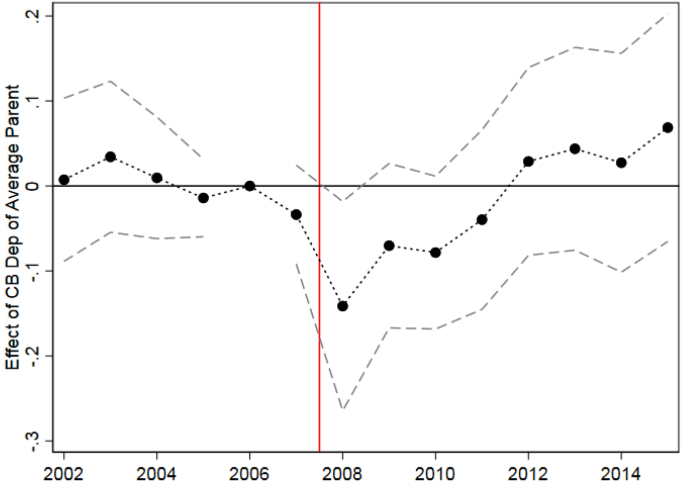
Differences-in-differences: Bank debt and sales of parents with higher CB dep fell by more after 2008.



Controls: deciles of sales*year; industry*year; affiliate in Asia/EU/US*year; deciles of leverage*year. 90% CI plotted.

Effect on Affiliates

Affiliate sales were lower 2008-2010 and recovered after 2011.



Controls for: deciles of firm sales*year; industry*year; country*year; deciles of firm leverage*year. 90 CI plotted.

Investigating the Sales Effect in Detail

Effects are robust to country x industry x year effects.

	(1)	(2)	(3)
Parent CB dep: (0.25, 1] × 2008-10	−0.0538***	−0.0450***	−0.0435***
	(0.0178)	(0.0161)	(0.0169)
Parent CB dep × 2011-15	0.0290	0.0580	0.0302
	(0.0387)	(0.0385)	(0.0347)
R^2	0.092	0.192	0.294
Number of firms	2,695	2,695	2,695
Observations	24,941	24,941	24,941
Affiliate FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Controls × Time FE	Yes	No	No
Controls × Year FE	No	Yes	Yes
Country FE × Industry FE × Year FE	No	No	Yes

The Role of Internal Capital Flows

Effect is driven by affiliates with long-term loans to their parent before 2008. These were more likely to financially support the parent after 2008.

	(1)	(2)	(3)
Parent CB dep × 2008-10	−0.0647	−0.0305	−0.0265
	(0.0408)	(0.0434)	(0.0415)
Parent CB dep × 2008-10 × Previous long-term loans to parent	−0.5414***		−0.5094**
	(0.1774)		(0.1824)
Parent CB dep × 2008-10 × Previous short-term claims on parent		−0.1244*	−0.0751
		(0.0668)	(0.0604)
Parent CB dep × 2011-15	0.0327	0.0310	0.0333
	(0.0431)	(0.0423)	(0.0430)
R^2	0.093	0.092	0.093
Number of firms	2,695	2,695	2,695
Observations	24,941	24,941	24,941
Affiliate FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Controls × Time FE	Yes	Yes	Yes
Previous long-term loans to parent × 2008-10	Yes	No	Yes
Previous short-term claims on parent × 2008-10	No	Yes	Yes

Why Internal Capital Flows May Matter

- Constrained parents withdraw capital from affiliates. This can lower affiliate sales (Chari et al. 1995).
  - Working capital pays for short-run inputs (labor, raw materials, marketing).
  - It funds the distribution of output to points of sales (shipping).
  - Firms rebuild liquidity buffers instead of generating sales.

- We analyze whether affiliates exposed to the internal capital shock suffered more.

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- We analyze whether affiliates exposed to the internal capital shock suffered more.
- Heterogeneity 1: Affiliates that had lent long-term to their parent before 2008 raised internal lending after 2008.
- Heterogeneity 2: Affiliates that had issued short-term claims before 2008 were affected by the reduction in internal trade after 2008.

External Financing Did Not Rise

No change in external financing,
consistent with affiliates becoming financially constrained.

	(1) LT loans excl. to parent	(2) Equity excl. from parent	(3) Liabilities excl. toward parent	(4) ST assets excl. claims on parent
Parent CB dep × 2008-10	0.0898	0.0153	0.0008	–0.0487**
	(0.0774)	(0.0441)	(0.0349)	(0.0197)
Parent CB dep × 2011-15	0.0504	0.0024	0.0289	0.0024
	(0.0829)	(0.0526)	(0.0499)	(0.0337)
R^2	0.047	0.074	0.067	0.089
Number of firms	2,695	2,695	2,695	2,695
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Controls × Time FE	Yes	Yes	Yes	Yes

Inputs Into Short-Run Production Assets Fell

Lower short-term assets,
consistent with reduced materials and inventory.

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Domestic Credit and Pre-Growth Matter

Larger sales effect if affiliate country has a small financial sector or weak pre-growth.

	(1)	(2)
Outcome	Affiliate sales	
Parent CB dep × 2008-10	−0.1080*	−0.0953*
	(0.0613)	(0.0490)
Parent CB dep × 2008-10 × Credit/GDP low	−0.1984***	
	(0.0282)	
Parent CB dep × 2008-10 × Credit/GDP high	0.0276	
	(0.0568)	
Parent CB dep × 2008-10 × Affiliate pre-growth in sales		0.0597**
		(0.0280)
Parent CB dep × 2011-15	0.0298	0.0333
	(0.0474)	(0.0427)
R^2	0.073	0.117
Number of firms	2,661	2,244
Observations	24,681	23,143
Affiliate FE	Yes	Yes
Year FE	Yes	Yes
Controls × Time FE	Yes	Yes
Affiliate Sales growth × 2008-10	No	Yes

The Total Impact Across Countries

- Impact in each country = How much greater would total sales of German affiliates have been if affiliates with positive parent CB dep had grown at the same rate as other affiliates?

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- Impact in each country = How much greater would total sales of German affiliates have been if affiliates with positive parent CB dep had grown at the same rate as other affiliates?
- The shock to Commerzbank had first-order effects on the distribution of firm growth in many foreign countries.
- The estimates are driven solely by indirect transmission through internal networks of multinationals, not direct links to foreign countries.

% Decrease in Aggregate Sales By Country

Affiliate country	
Czech Republic	0.49
Austria	0.36
Poland	0.31
Netherlands	0.10
Spain	0.10
France	0.07
United Kingdom	0.07
Italy	0.05
United States	0.03
Mean	0.18
Median	0.10

The numbers are: average effect (~10%) * average parent Commerzbank dependence of German affiliates (21% for Czech Republic - 32% for Poland) * sales share of German affiliates (0.2% for US - 4% for Czech Republic).

Conclusion

1. An idiosyncratic shock to Commerzbank initially only hit its operations in Germany.

2. Nonetheless, the shock lowered relative growth of firms by over 0.3% of aggregate sales in Austria, the Czech Republic, and Poland.

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2. Nonetheless, the shock lowered relative growth of firms by over 0.3% of aggregate sales in Austria, the Czech Republic, and Poland.

3. Internal capital markets of multinationals transmit shocks across countries, but shocked firms recover after ~3 years.

4. A large firm can impact growth in countries far beyond its direct scope of operation.

Appendix

Parent Summary Statistics

	Range of parent Commerzbank dependence				
	0	0.01-0.30	0.31-0.50	0.51-1	Total
Commerzbank dep	0	0.211	0.400	0.896	0.235
	(0)	(0.038)	(0.073)	(0.157)	(0.238)
Sales	349,843	388,961	486,493	152,829	395,394
	(1,527,767)	(1,608,385)	(1,881,804)	(515,649)	(1,641,595)
Total assets	535,864	636,072	1,322,907	578,200	831,892
	(2,929,303)	(3,274,836)	(5,253,431)	(2,184,213)	(3,934,859)
Number of affiliates	2.95	3.87	4.56	4.89	3.82
	(4.56)	(6.56)	(6.88)	(9.18)	(6.23)
Bank debt	73,915	46,438	60,743	54,447	59,895
	(197,131)	(151,148)	(145,504)	(96,847)	(161,721)
Trade credit	44,047	38,768	46,579	23,139	42,693
	(159,189)	(174,204)	(142,832)	(64,090)	(155,222)
Leverage (%)	46.38	50.41	48.66	43.67	47.97
	(29.01)	(21.28)	(22.86)	(25.67)	(25.12)
Number of parents	242	153	225	35	655

Notes: The table shows means (standard deviations) by bins of parent Commerzbank dependence. Leverage is defined as liabilities divided by total assets. Bank debt, sales, total assets, and trade credit are in thousand Euro. The number of parents in the bottom row refers to the number of parents in MiDi in 2006. The data are from 2006. Data source: Research Data and Service Centre of the Deutsche Bundesbank, MiDi 2002-2015, Ustan 2002-2015, Orbis Historical Financials, own calculations.

Further Related Literatures

- Banks transmit financial crises across countries. We focus on real firms.

  Peek & Rosengren 1997, 2000; Acharya & Schnabl 2010; Cetorelli & Goldberg 2012; Popov & Udell 2012; Schnabl 2012; de Haas & van Lelyveld 2014; Ongena et al. 2015; di Giovanni et al. 2019.

- Domestic firms use internal capital markets. We focus on multinationals.

  Lamont 1997; Shin & Stulz 1998; Rajan et al. 2000; Boutin et al. 2013; Matvos & Seru 2014; Almeida et al. 2015; Giroud & Mueller 2015, 2019; Santioni et al. 2019.

- There are other transmission channels from parents to affiliates. We estimate overall effects and focus on internal capital markets.

  Input-output links: Boehm et al. 2019; Alfaro-Urena et al. 2019. (Domestic firms: Barrot & Sauvagnat 2016; Carvalho et al. 2016; Costello 2018.)
  Technology transfers: Javorcik 2004; Arnold & Javorcik 2009; Keller & Yeaple 2013; Alfaro-Urena et al. 2019; Bilir & Morales 2019; Fons-Rosen et al. 2019.

Evidence from Analyst Reports

- 110 financial analyst research reports about Commerzbank:
  - Its German loan portfolio was "a source of strength."
  - Pre-2008, trading and loan income were not more volatile.
  - In 2008, it wrongly forecast the duration of the US subprime crisis and predicted bail-outs for US banks.

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  - In 2008, it wrongly forecast the duration of the US subprime crisis and predicted bail-outs for US banks.
- A firm survey shows that Commerzbank's German borrowers were hit by lower credit supply, not lower demand.

Affiliate Summary Statistics

	Range of parent Commerzbank dependence				
	0	0.01-0.30	0.31-0.50	0.51-1	Total
Sales	42,184	50,003	65,453	52,495	54,400
	(107,225)	(131,105)	(178,741)	(128,354)	(147,351)
Employment	162	222	200	211	196
	(434)	(530)	(518)	(452)	(496)
Total assets	69,818	75,754	118,448	97,095	93,160
	(280,584)	(303,448)	(426,236)	(353,319)	(357,546)
Leverage (%)	52.10	50.69	52.82	49.18	51.83
	(33.75)	(32.18)	(34.62)	(32.74)	(33.65)
Long-term loans to parent (%)	0.38	0.15	0.44	1.92	0.46
	(3.28)	(2.19)	(3.54)	(7.04)	(3.60)
Equity from parent (%)	14.11	14.07	15.37	15.13	14.69
	(22.82)	(19.26)	(22.45)	(21.33)	(21.71)
Liabilities toward parent (%)	11.24	13.74	13.39	8.37	12.54
	(21.01)	(22.26)	(22.26)	(16.56)	(21.60)
Short-term claims on parent (%)	4.40	4.80	3.81	3.45	4.19
	(12.51)	(12.80)	(11.17)	(10.40)	(11.91)
Ownership share of parent in affiliate	0.878	0.869	0.885	0.842	0.876
	(0.240)	(0.235)	(0.236)	(0.276)	(0.240)
Number of affiliates	721	676	1,100	198	2,695

Notes: The table shows means (standard deviations) by bins of parent Commerzbank dependence. Leverage is defined as liabilities divided by total assets. The reported percentages are in percent of total assets of the affiliate. Sales and total assets are in thousand Euro. The number of affiliates in the bottom row refers to the number of affiliates in MiDi in 2006. The data are from 2006. Data source: Research Data and Service Centre of the Deutsche Bundesbank, MiDi 2002-2015, own calculations.

Affiliate Industries and Locations (in %)

	CB $Dep_p^{par} = 0$	CB $Dep_p^{par} > 0$	Total
Industry			
Wholesale, retail, and repair	36.62	36.52	36.55
Manufacturing	26.35	33.28	31.43
Real estate, renting, and business activities	28.57	16.97	20.07
Transport, storage, and communication	3.19	5.72	5.05
Other industries	5.27	7.50	6.90
Country			
United States	8.18	7.85	7.94
France	9.57	7.24	7.87
Italy	6.38	4.46	4.97
Netherlands	5.27	4.86	4.97
United Kingdom	6.24	4.51	4.97
Switzerland	6.80	3.85	4.64
Spain	5.83	4.05	4.53
Austria	6.24	3.80	4.45
Poland	3.47	4.41	4.16
China	2.08	4.41	3.78
Czech Republic	4.58	3.14	3.53
Other countries	35.37	47.42	44.19
Number of affiliates	721	1,974	2,695

Notes: The table displays the most common industries (measured using the NACE 1.1. classification) and the most common host countries of foreign affiliates, separately for affiliates whose parents had zero Commerzbank dependence and for affiliates whose parents had positive Commerzbank dependence. The data are from 2006. Data source: Research Data and Service Centre of the Deutsche Bundesbank, MiDi 2002-2015, own calculations.

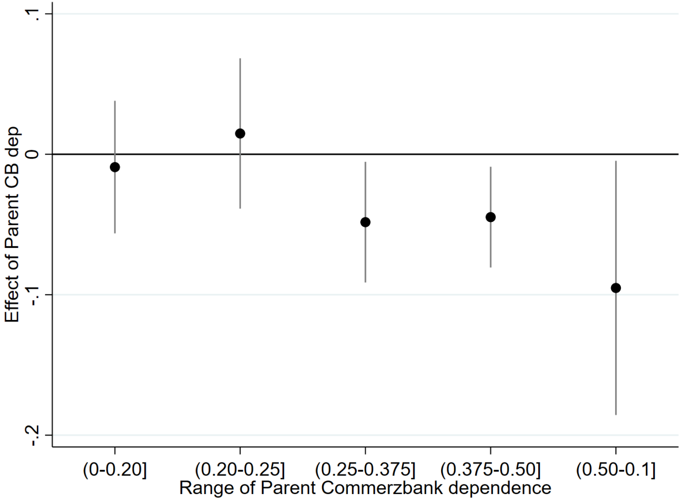
Affiliate Sales and Parent CB Dep

Affiliate sales lower 2008-2010 and recovered after 2011.

	(1)	(2)	(3)
Parent CB dep × 2008-10	–0.1286	–0.1403*	–0.0967**
	(0.0979)	(0.0806)	(0.0489)
Parent CB dep × 2011-15	0.0574	0.0486	0.0298
	(0.0527)	(0.0523)	(0.0422)
R^2	0.011	0.038	0.092
Number of firms	2,695	2,695	2,695
Observations	24,941	24,941	24,941
Affiliate FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Size bin FE × Time FE	No	Yes	Yes
Industry FE × Time FE	No	Yes	Yes
Country FE × Time FE	No	No	Yes
Leverage bin FE × Time FE	No	No	Yes

Substitution to Other Banks

No effect on affiliates whose parents had several other banks



Affiliate Employment and Parent CB Dep

Affiliate employment lower 2008-2010 and recovered after 2011.

	(1)	(2)	(3)	(4)
Parent CB dep × 2008-10	−0.0447	−0.0461		
	(0.0307)	(0.0302)		
Parent CB dep × 2008-10 × Affiliate sales growth 2006-07		0.0249*		
		(0.0141)		
Parent CB dep: (0, 0.25] × 2008-10			0.0040	
			(0.0076)	
Parent CB dep: (0.25, 0.5] × 2008-10			−0.0180*	
			(0.0093)	
Parent CB dep: (0.5, 1] × 2008-10			−0.0555	
			(0.0345)	
Parent CB dep: (0.25, 1] × 2008-10				−0.0242***
				(0.0093)
Parent CB dep × 2011-15	0.0109	0.0134	0.0057	0.0110
	(0.0271)	(0.0271)	(0.0268)	(0.0224)
R^2	0.078	0.085	0.079	0.079
Number of firms	2,695	2,244	2,695	2,695
Observations	24,941	23,143	24,941	24,941
Affiliate FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Controls × Time FE	Yes	Yes	Yes	Yes
Affiliate sales growth × Time FE	No	Yes	No	No

Results Are Stable in Additional Tests

- Exclude countries with CB branches. Correlation between affiliate and parent CB dep is 0.025. No heterogeneity by aggregate cross-border lending by 3 largest German banks.
- Drop tax havens. No heterogeneity by corporate tax rate.
- Internal trade not the whole story: No heterogeneity in vertical (different industry) versus horizontal (same industry) affiliates and for services (less trade) versus others.
- Exclude affiliates in wholesale and retail that might only resell parents' output.
- Control for parent dependence on other German banks.
- No heterogeneity by Asia, EU, US and by severity of housing/GDP drop in affiliate country.