Disentangling the Effects of a Banking Crisis: Evidence from German Firms and Counties

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Research Questions

- How do cuts to bank lending affect the real economy?

1. Are there **indirect effects** on firms with stable loan supply, but located in regions where many other firms face a lending cut?

2. Can the effects of a temporary lending cut **persist** beyond the duration of the lending cut?

Approach of this Paper

- This paper presents causal evidence from a natural experiment: a lending cut by Commerzbank, a large German bank.
- The key empirical challenge is reverse causality, from economic growth to bank lending.
- The lending cut was exogenous, caused by losses on international trading markets in 2008/09.
- I test how the growth of German firms and counties dependent on Commerzbank was affected by the lending cut.

Contribution to the Literature 1: Indirect Effects

- Firm-level, partial equilibrium studies find that lending cuts to individual firms reduce firm growth.
  - Gan 2007, Khwaja & Mian 2008, Amiti & Weinstein 2011, Almeida et al. 2012, Schnabl 2012, Chodorow-Reich 2014, Paravisini et al. 2015, Garicano & Steinwender 2016, Bentolila et al. 2018

- Mixed evidence on the regional effects.
  - Peek & Rosengren 2000, Calomiris & Mason 2003, Driscoll 2004, Ashcraft 2005, 2006, Benmelech et al. 2011, Greenstone et al. 2014, Mondragon 2017, Bord et al. 2017, Chen et al. 2017

- Contribution: **What is the relation between firm-level and regional effects? Do indirect effects matter?**

- Empirical setting: Variation in exposure to the same lending cut **across regions** and **within regions, across firms**.

- General question: What can we learn from partial equilibrium studies about higher levels of aggregation (Acemoglu 2010)?

Key Findings 1: Indirect Effects

- The employment and output of firms directly connected to Commerzbank fell $\rightarrow$ the **direct, partial equilibrium** effect.
- Firms with no direct relationship to Commerzbank, but in counties highly dependent on Commerzbank, grew more slowly $\rightarrow$ the county-level **indirect** effect.
- Indirect mechanisms: shortfalls in county demand and high-innovation spillovers.
- Idiosyncratic bank shocks translate into lower growth (Gabaix 2011, Acemoglu et al. 2012, Amiti & Weinstein 2016), through direct and indirect channels.

Contribution to the Literature 2: Persistence

- Cross-country evidence: Severe banking crises are correlated with persistent recessions.
  - Cerra & Saxena 2008, Reinhart & Rogoff 2009, Gourinchas & Obstfeld 2012, Schularick & Taylor 2012, Giesecke et al. 2014, Krishnamurthy & Muir 2017, Romer & Romer 2017

- The Great Recession was unusually persistent (Friedman 1993, Barro 2011). US output failed to recover even though banks stabilized by 2011 (Hall 2010, Fernald & Jones 2014).

US GDP

- Contribution: **Causal evidence** on the growth of firms and counties **after a lending cut**.

- Empirical setting: **Identify when loan supply stabilizes**.

Key Findings 2: Persistence

- The causal effects of the lending cut resemble the Great Recession. GDP in Developed Economies
- After the lending cut, firms and counties dependent on Commerzbank did **not converge** to the unaffected levels.
- In contrast, exporting firms and counties recovered from the trade collapse by 2011.
- The results suggest the banking crisis 2008/09 may have contributed to the slow recovery from the Great Recession.
- The persistence is inconsistent with standard neoclassical growth theory. Productivity losses could explain the persistence.

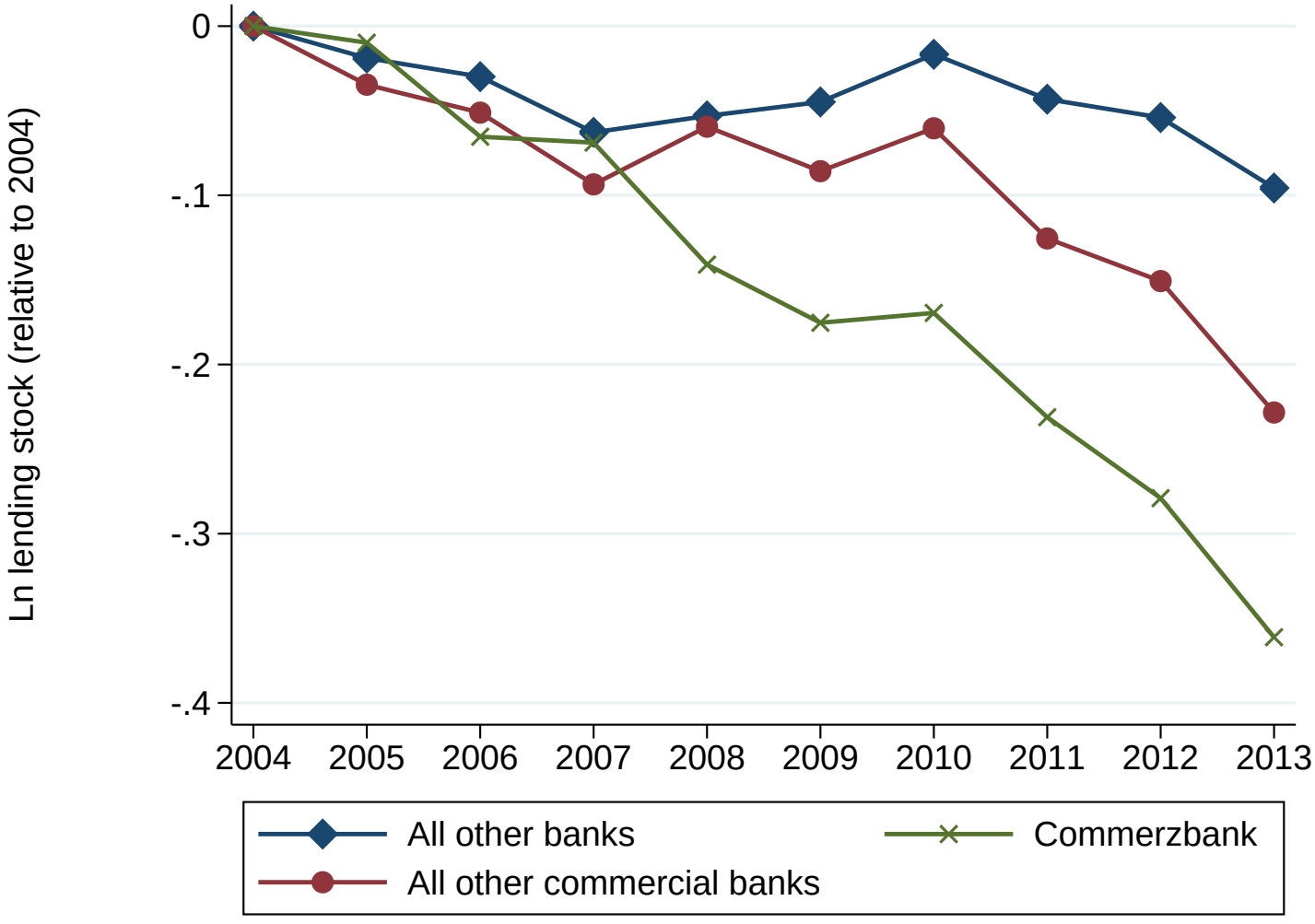
Outline

Identification and Institutional Background

Commerzbank During the Financial Crisis

- Commerzbank's trading portfolio in 2008 was exposed to US subprime markets, Lehman Brothers, and the Icelandic banks.
- Trading and investment losses led to a 68% drop in equity capital from 2007 to 2009. Equity Changes
- Lending fell, because Commerzbank's cost of funding rose and its capital ratio was too low.

Commerzbank Cuts Lending



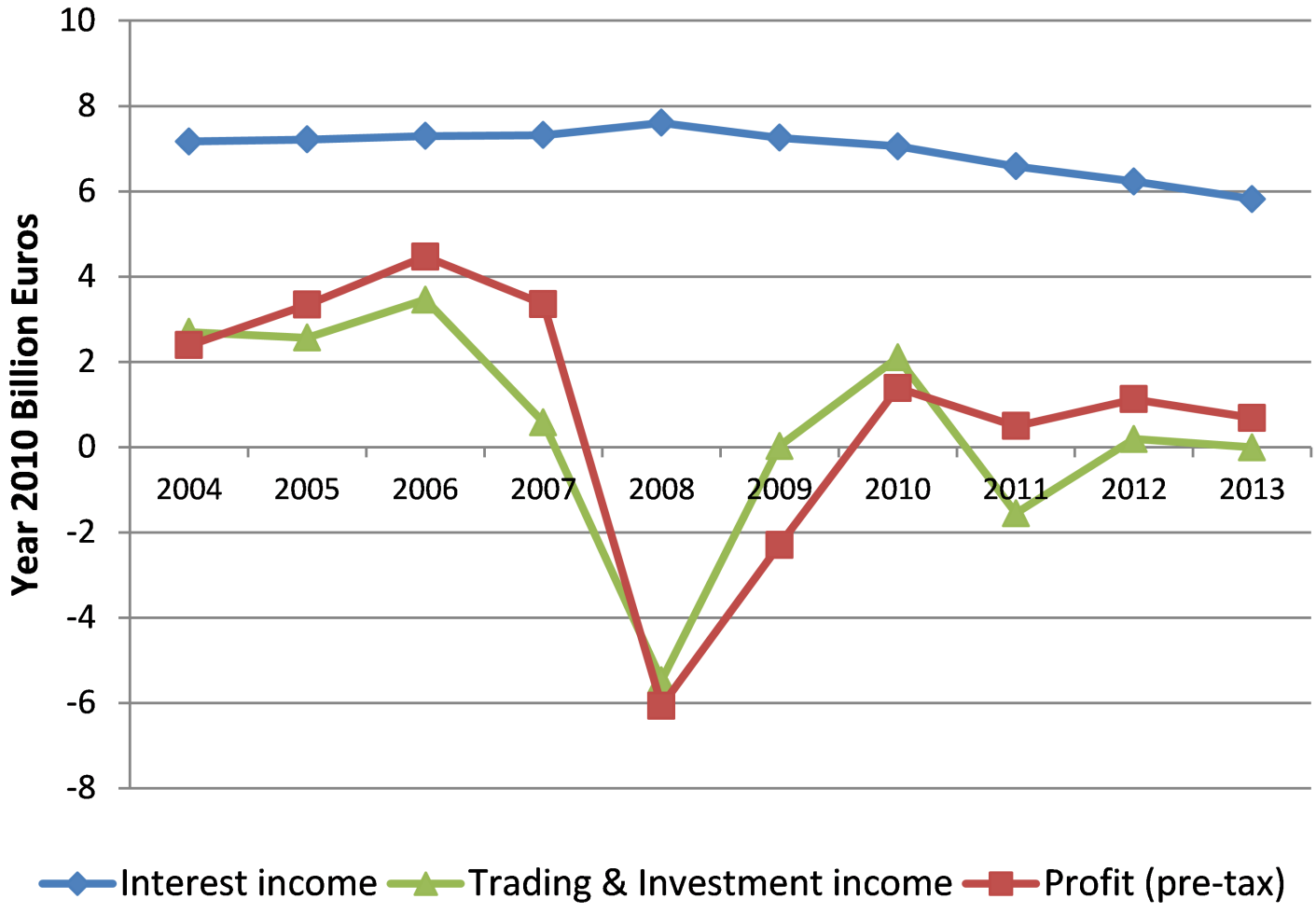
Commerzbank includes lending by branches of Commerzbank and Dresdner Bank.

Evidence from Analyst Reports

- The paper contains a systematic analysis of 110 financial analyst research reports.

- Insights about Commerzbank:
  - Its German loan portfolio was "a source of strength."
    Stability of the German Economy
  - Its trading and lending divisions operated separately.
  - 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.
  - By 2011, it had stabilized and repaid the majority of its government support.

Evidence from Commerzbank's Income Statement



Firm Survey on Bank Loan Supply

How do you evaluate the current willingness of banks to grant loans to businesses: cooperative, normal, or restrictive?

	(1)	(2)	(3)	(4)	(5)	(6)
YEAR	2007	2008	2009	2010	2011	2012
$Firm\ CB\ dep$	-0.111	-0.095	-0.473	-0.316	0.059	0.379
	(0.157)	(0.140)	(0.190)	(0.182)	(0.197)	(0.184)
Observations	856	988	1,032	946	898	503

The coefficients are interpreted as the standard deviation increase in banks' willingness to grant loans from increasing Commerzbank dependence by one. Controls: the outcome variable from 2006, industry, state, size bin (1-49, 50-249, 250-999, and over 1000 employees in the year 2006), and ln firm age.

Product Demand Survey

Empirical Strategy

- Firms with pre-existing relationships to Commerzbank were more exposed to the lending cut, because finding new lenders is difficult (Sharpe 1990).
- I compare firms and counties dependent on Commerzbank to other firms and counties.
- Dependence on Commerzbank (in 2006) serves as proxy variable for exposure to a lending cut.
- This method captures all the channels through which a lending cut affects firms and counties.

Statistics from the Firm Panel (Bins) Statistics from the County Panel (Bins)

Data

Data on Relationship Banks

- Confidential data on the relationship banks of 112,000 German firms in 2006, collected by a credit rating agency.
- Firm CB dep = fraction of relationship banks that are Commerzbank branches.
  - E.g. a firm has a Commerzbank and a Deutsche Bank branch as relationship banks $\rightarrow$ CB dep = 1/2.
  - No data on exact amount of lending by individual banks.
- County CB dep = average of firm CB dep in county.
- Mean CB dep = 0.15, similar to CB's national lending share.

Distribution CB dep

Data on Outcomes

- Firm employment and balance sheets from database Dafne.
- Employment sample representativeness:
  - 72% of firms have <50 employees (98% in population).
  - 53% of firms in service sector (60% in population).
- County data from the Statistical Federal Office (~200,000 inhabitants per county)
- Survey on firms' perceived loan supply and product demand from ifo Institute.

Statistics from the Firm Panel (Bins) Statistics from the County Panel (Bins)
Statistics from the County Panel (Means)

Next: Did the Lending Cut Have Real Effects?

1. Commerzbank's lending cut was exogenous to German firms and counties. ✓

2. Data on firm-bank relationships, and firm and county outcomes. ✓

3. **Real Effects of the Lending Cut**

   3.1 **Effects on Firms**

   3.2 **Effects on Counties**

4. Discussion of the Results

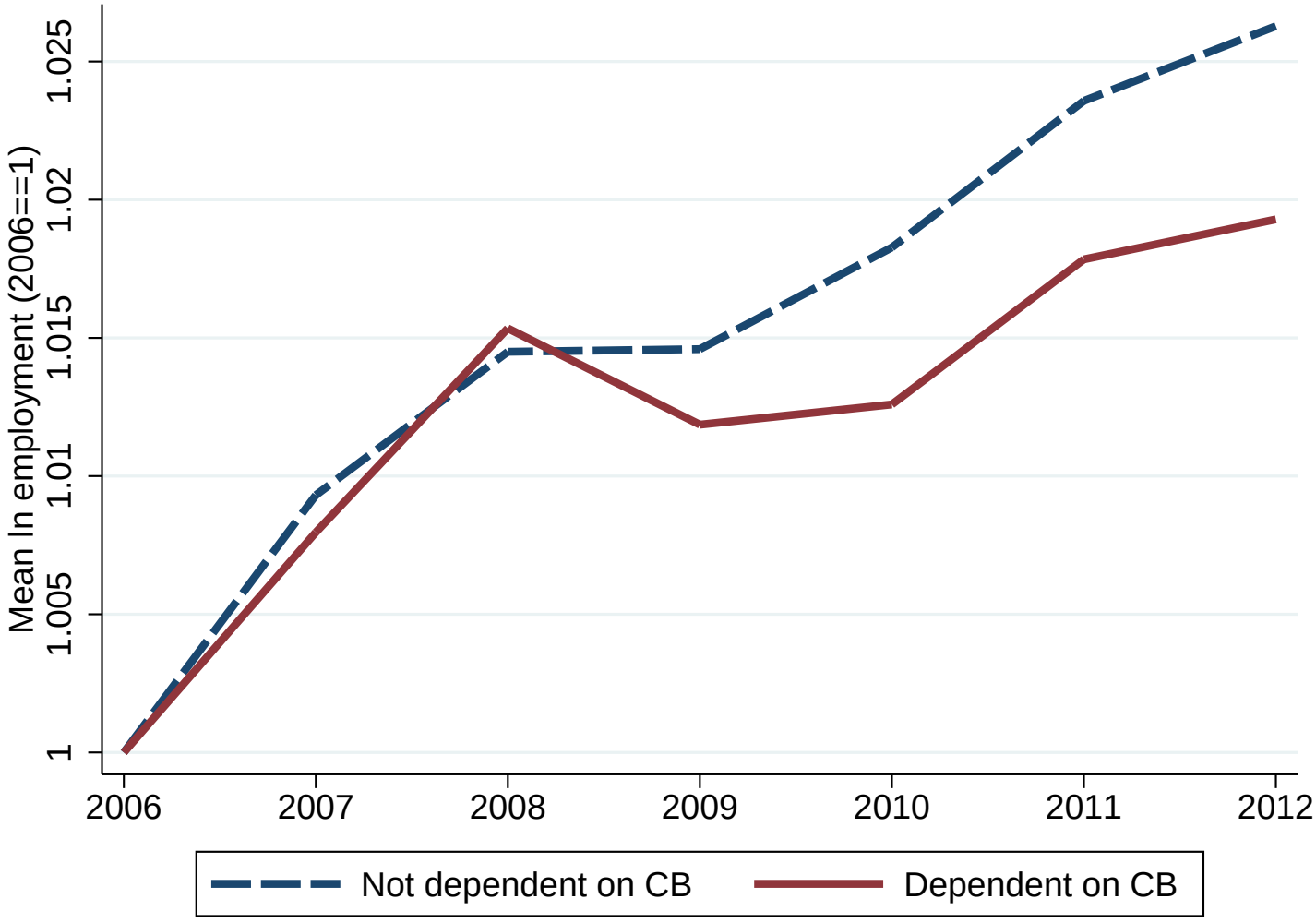
   4.1 Indirect Effects

   4.2 Persistence of the Effects

The Effects on Firms

Commerzbank Dependence and Employment

Raw Data: Parallel Pre-trends and a Treatment Effect



Firm-Level Specification

- I formally test for an effect.
- Panel specification:

$$ln\ y_{fct} = \beta \cdot CB\ dep_{fc} \cdot d_t^{post} + \kappa_c \cdot d_t^{post} + \Gamma'\ X_{fc} \cdot d_t^{post} + \gamma_{fc} + \lambda_t + \epsilon_{fct}$$

  - firm f, county c, year t
  - post-lending cut dummy d_t^{post}
  - controls X_{fc}: county FE κ_c, industry FE, size bin FE (1-49, 50-249, 250-999, 1000+ employees), ln firm age, export and import share
  - firm FE γ_{fc}
  - year FE λ_t

Firm Regression Results

OUTCOME	(1) Empl	(2) Empl	(3) Empl	(4) Empl
$Firm\ CB\ dep \cdot d^{post}$	-0.044	-0.053	-0.071	-0.035
	(0.021)	(0.015)	(0.020)	(0.032)
Controls	No	Yes	Yes	Yes
Firm Type	All	All	High bank debt / liabilities	Low bank debt / liabilities

OUTCOME	(5) Bk debt	(6) Cap/Empl	(7) Val add/cap	(8) Salary
$Firm\ CB\ dep \cdot d^{post}$	-0.205	-0.077	0.069	0.001
	(0.078)	(0.032)	(0.038)	(0.011)
Controls	Yes	Yes	Yes	Yes
Firm Type	All	All	All	All

Number of firms: 2,011. Controls (interacted with d^{post}): ln age, size bin FE, industry FE, county FE, export and import share.

Result on Large Firms | Non-linear Treatment

Support for the Identifying Assumption

- Identifying assumption: Without the lending cut, firms dependent on Commerzbank would have grown in parallel to other firms.
- No effect on the value of firm financial assets.
- Results insensitive to the controls.
- Parallel pre-trends. No Pre-Trends
- Firms are balanced on key observables.

Summary Statistics from the Firm Panel

Lending Cut Heterogeneity

The Effects on Counties

County-Level Specification

- Use county data. The regressor of interest is the average CB dep of firms in county.
- Analogous to firm-level specification.
- Panel specification:

$$ln\ y_{ct} = \rho \cdot \overline{CB\ dep_c} \cdot d_t^{post} + \Gamma' X_c \cdot d_t^{post} + \gamma_c + \lambda_t + \varepsilon_{ct}$$

  - county c, year t
  - post-lending cut dummy d_t^{post}
  - controls X_c: former GDR FE, 17 industry shares, export and import share, Landesbank in crisis FE, ln population, population density, ln GDP per capita, 2003 debt index
  - county FE γ_c
  - year FE λ_t

County Regression Results

OUTCOME	(1) GDP	(2) GDP	(3) Empl
$County\ CB\ dep \cdot d^{post}$	-0.008	-0.010	-0.008
$(std.\ dev.\ increase)$	(0.004)	(0.004)	(0.003)
Controls	No	Yes	Yes
Estimator	OLS	OLS	OLS

Number of counties: 385. Controls (interacted with d^{post}): former GDR FE, 17 industrial shares, export and import share, Landesbank in crisis FE.

Support for the Identifying Assumption

- Identifying assumption: Without the lending cut, counties dependent on Commerzbank would have grown in parallel to other counties.
- Results insensitive to the controls.
- Parallel pre-trends. No Pre-Trends
- Counties are balanced on key observables.
  Summary Statistics from the County Panel

County Confidence Intervals Elasticity Map County Effect in Relation

IV Strategy: Overview

- One potential worry is that Commerzbank strategically expanded across Germany. $\rightarrow$ I construct an instrument for county Commerzbank dependence.
- Aim: Isolate variation in the Commerzbank dependence of counties unrelated to endogenous expansion decisions by Commerzbank.
- 1947-1957, Commerzbank was broken up by the Allied occupiers. Temporary head offices were in Düsseldorf, Frankfurt, and Hamburg.
- During the break-up, Commerzbank expanded its branch network around the head offices.

IV Strategy: The Instrument

- The instrument is the county's distance to the closest of three temporary, post-WWII Commerzbank head offices (i.e. the minimum out of the three distances).
- I control for the linear distances to Düsseldorf, Frankfurt, and Hamburg in all the IV specifications, so factors associated with proximity to one of the head offices do not bias the results.
- Controlling for the linear distances removes the correlation between county characteristics and the distance instrument.

Map

County Characteristics and the Distance Instrument

Coefficients on the Distance Instrument

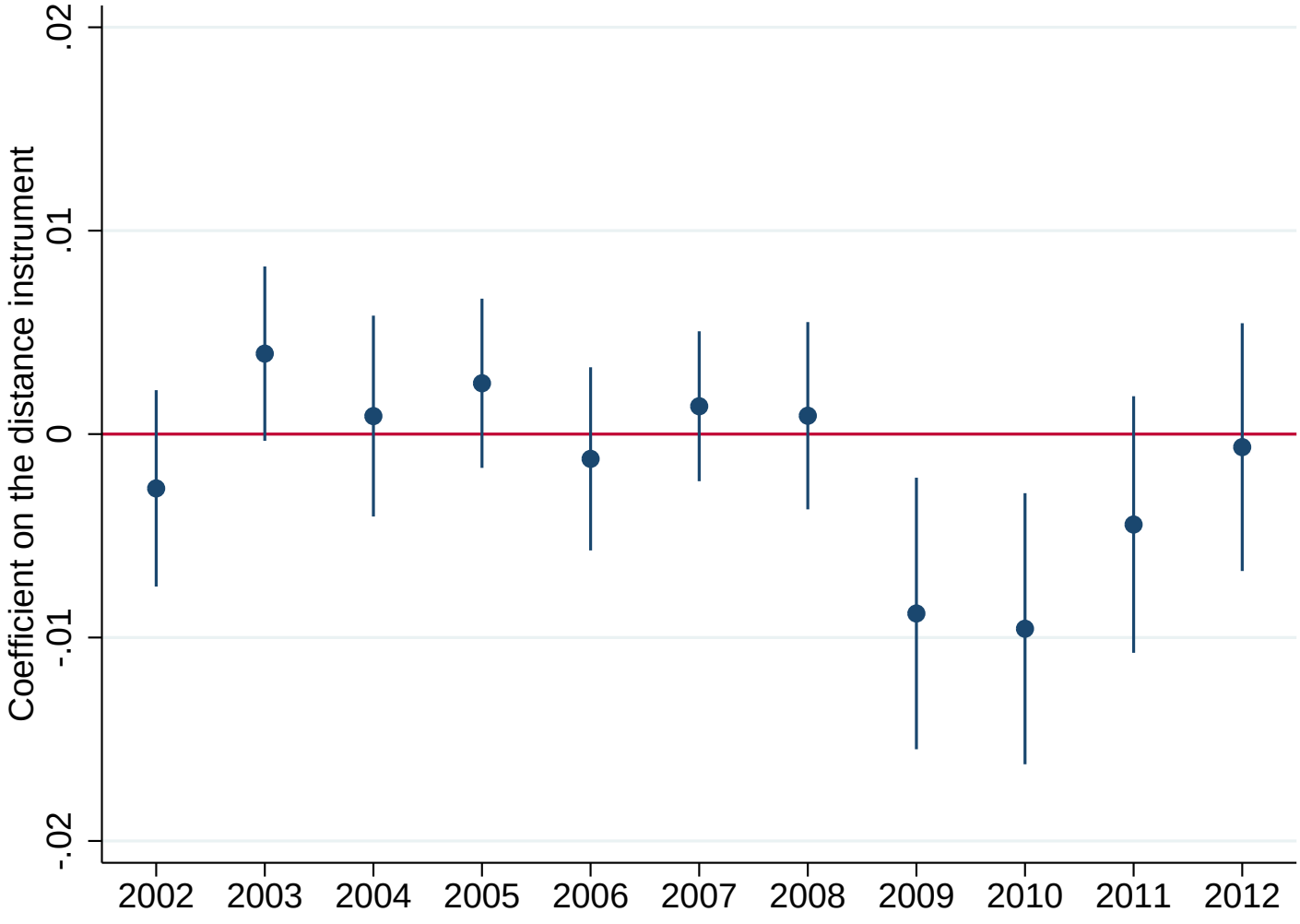
OUTCOMES		(1)	(2)
Professional services share	Coeff	0.028	-0.001
(law, accounting, consulting, advert.)	Std Err	(0.017)	(0.043)
Unemployment rate	Coeff	0.015	0.000
	Std Err	(0.002)	(0.004)
Non-tradable share	Coeff	0.006	-0.005
	Std Err	(0.010)	(0.022)
Linear distances		No	Yes
Former GDR FE		Yes	Yes

County IV Regression Results

OUTCOME	(1) GDP	(2) GDP	(3) Empl
$County\ CB\ dep \cdot d^{post}$	-0.020	-0.022	-0.013
$(std.\ dev.\ increase)$	(0.007)	(0.011)	(0.007)
Linear distances	Yes	Yes	Yes
Controls	No	Yes	Yes
Estimator	IV	IV	IV

Number of counties: 385. Controls (interacted with d^{post}): former GDR FE, 17 industrial shares, export and import share, Landesbank in crisis FE. All IV specifications include the linear distances (interacted with d^{post}). IV first stage t-statistic = 7.0.

County GDP Growth Rate and the Instrument



The specification includes all the county controls (interacted with d^{post}).

Robustness of the County Results

- IV results slightly larger, but not statistically different to OLS.
- The effect of the distance instrument is similar with and without (linear or non-linear) distance controls. The Effect of the Linear Distances 1
- No effect of distance to other large cities or the closest large city. The Effect of the Linear Distances 2
- No effect on household debt or migration. Household Debt
- No effect on a placebo instrument for distance to postwar Deutsche Bank head offices.

Next: Discussion of the Results

1. Commerzbank's lending cut was exogenous to German firms and counties. ✓

2. Data on firm-bank relationships, and firm and county outcomes. ✓

3. The lending cut had real effects on
   - 3.1 Firms. ✓
   - 3.2 Counties. ✓

4. **Discussion of the Results**
   - 4.1 **Indirect Effects**
   - 4.2 **Persistence of the Effects**

The Indirect Effect

The Indirect Effect

- The county effect depends on:
  - the direct effect on firms borrowing from Commerzbank.
  - the response of all other firms $\rightarrow$ the indirect effect.
- Caused by a change in the aggregate economic conditions of the county.

Examples of Indirect Channels

- The indirect effect could improve or worsen outcomes.
- Improve, e.g.:
  - Wages and local input prices fall.
- Worsen, e.g.:
  - Regional spillovers fall, e.g. due to knowledge spillovers or input-output channels (Jaffe et al. 1993, Audretsch & Feldman 1996, Henderson 2003, Ellison et al. 2010, Bloom et al. 2013).
  - County demand falls (Mian & Sufi 2014).

Is There an Indirect Effect?

- Use a larger data set, where the outcome is symmetric employment growth:

$$employment\ growth_{fc}^{2008-12} = \beta \cdot CB\ dep_{fc} + \sigma \cdot \overline{CB\ dep_{fc}} + \Gamma \cdot X_{fc} + \varepsilon_{fc}$$

- β is the **direct** effect: Caused by firms' immediate financial connections to Commerzbank.

- σ is the **indirect** effect: Caused by changes to the county's economy.

- Firm f in county c, includes all firm and county controls.

Estimates of the Indirect Effect

	(1)	(2)
OUTCOME	Empl Growth 2008-12	
$Firm\ CB\ dep$	-0.030	-0.036
	(0.010)	(0.010)
$CB\ dep\ of\ other\ firms\ in\ county$	-0.010	-0.010
$(std.\ dev.\ increase)$	(0.003)	(0.003)
Firm Controls	Yes	Yes
County Controls	No	Yes

Number of firms: 48,101.
Firm controls: ln age, size bin FE, industry FE, export and import share.
County controls: former GDR FE, 17 industrial shares, ln population, ln GDP per capita, population density, 2003 debt index, export and import share, Landesbank in crisis FE.

Results on the Indirect Effect

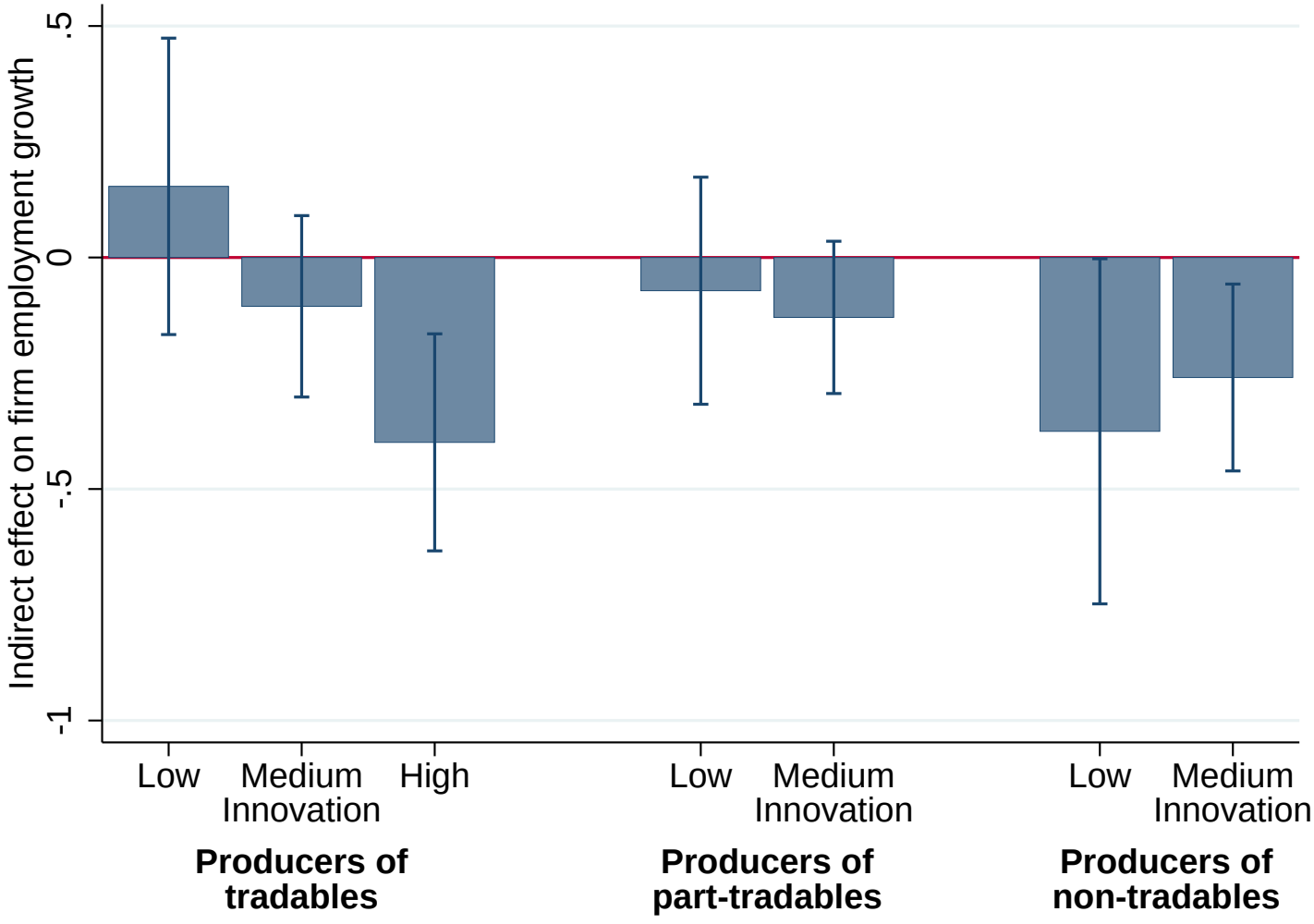
- Std. dev. increase in county Commerzbank dependence lowers employment growth by 1 ppt.
- Indirect effects account for ~60% of the county employment loss.
- Generally relevant finding for how we interpret firm-level studies (Acemoglu 2010).

Testing Channels of the Indirect Effect

- **Agglomeration spillovers** are more important for high innovators, e.g. knowledge spillovers or input-output channels (Audretsch & Feldman 1996, Henderson 2003, Ellison et al. 2010).
  - High innovators: Industry R&D spending / revenue > 2.5%.
  - Low innovators: Classification from Gehrke et al. (2013).
- County **demand** affects non-tradable firms.
  - Tradability: Mian & Sufi (2014) classification.
  - Results are robust to defining tradable producers as exporters.

High Innovators | Low Innovators | Tradability Classification | Industries by Tradability | Sample Percentages | Sample Percentages 2

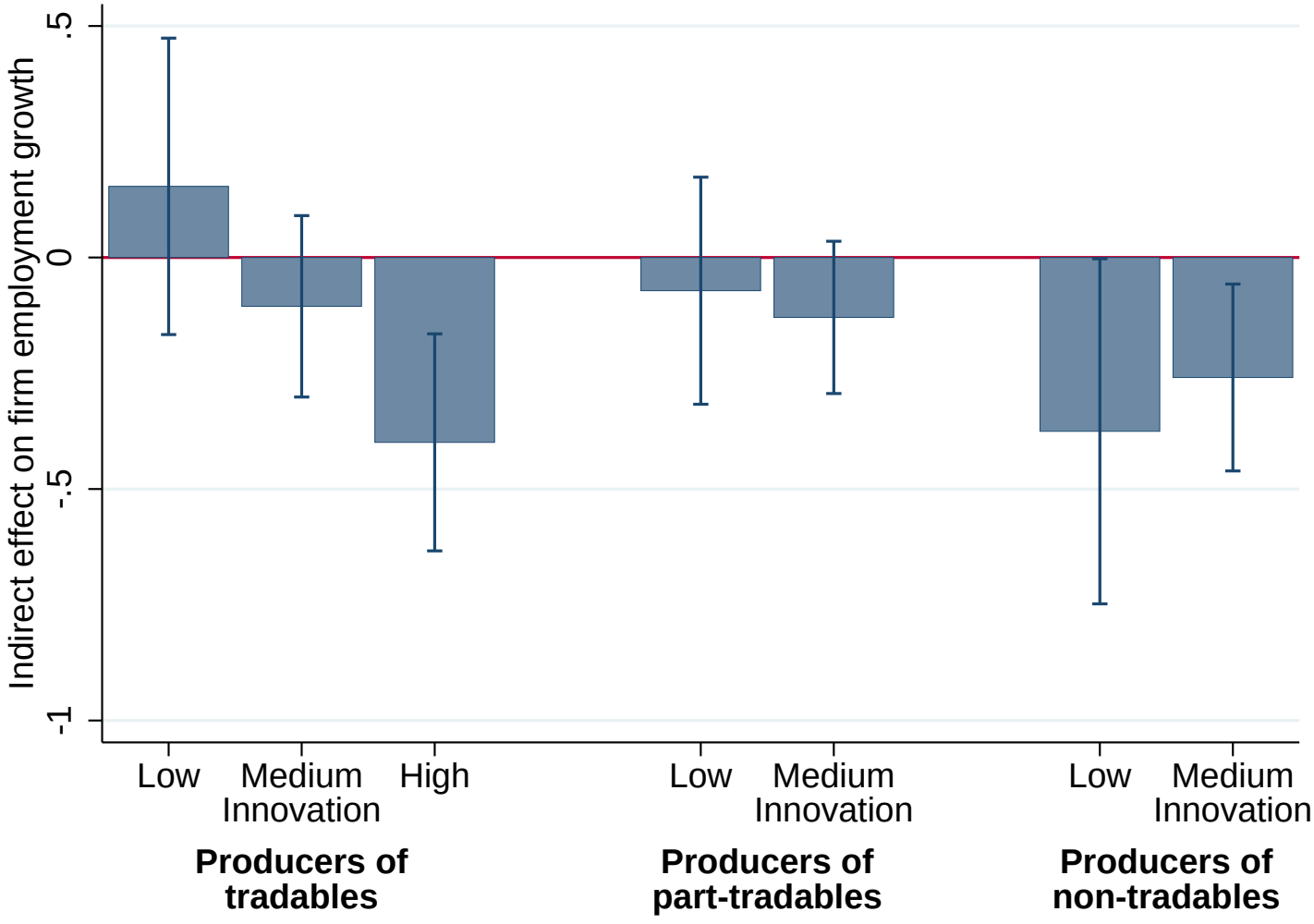
The Indirect Effect by Industry Type



The Indirect Effect on High Innovators

- The CB dep of **other high innovators** drives the indirect effect on high-innovation firms.
- No significant indirect effect from the CB dep of low and medium innovators.
- The effect is **larger in innovation clusters** (Brenner 2006) and counties with an above-median density of high innovators (>6%).
- No effect on low and medium innovators in low- and medium-innovation clusters.

The Indirect Effect by Industry Type



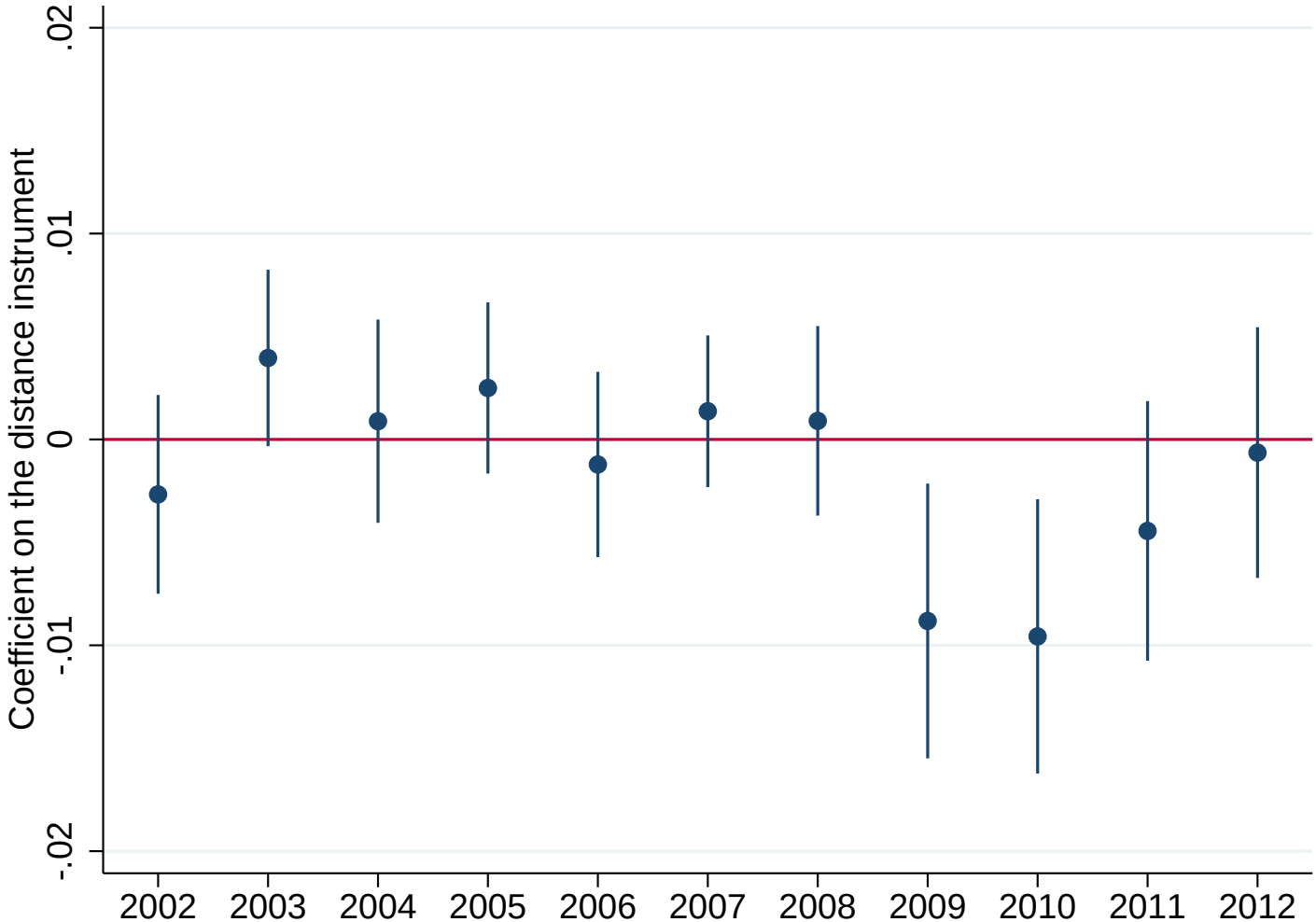
The Indirect Effect on Non-Tradable Producers

- For each additional job in the tradable sector, 1.7 jobs are created in the non-tradable sector.
- Moretti for US cities (2010): 1.6 jobs.

The Persistence of the Effects

No Convergence Within Two Years

County GDP Growth Rate and the Instrument



The specification includes all the county controls (interacted with d^{post}).

Persistence

- Firms reported restrictive bank loan supply only in 2009/10.
- The data reject that there was convergence to the unaffected levels by 2012, for
  - firm employment, capital, value added
  - county GDP, employment Results on Persistence
- The persistent effects differ from:
  - the temporary effect of the trade collapse on exporters.
  - many postwar recessions in developed countries (Friedman 1993, Hall 2010, Fernald & Jones 2014). US GDP
  - standard neoclassical growth theory.

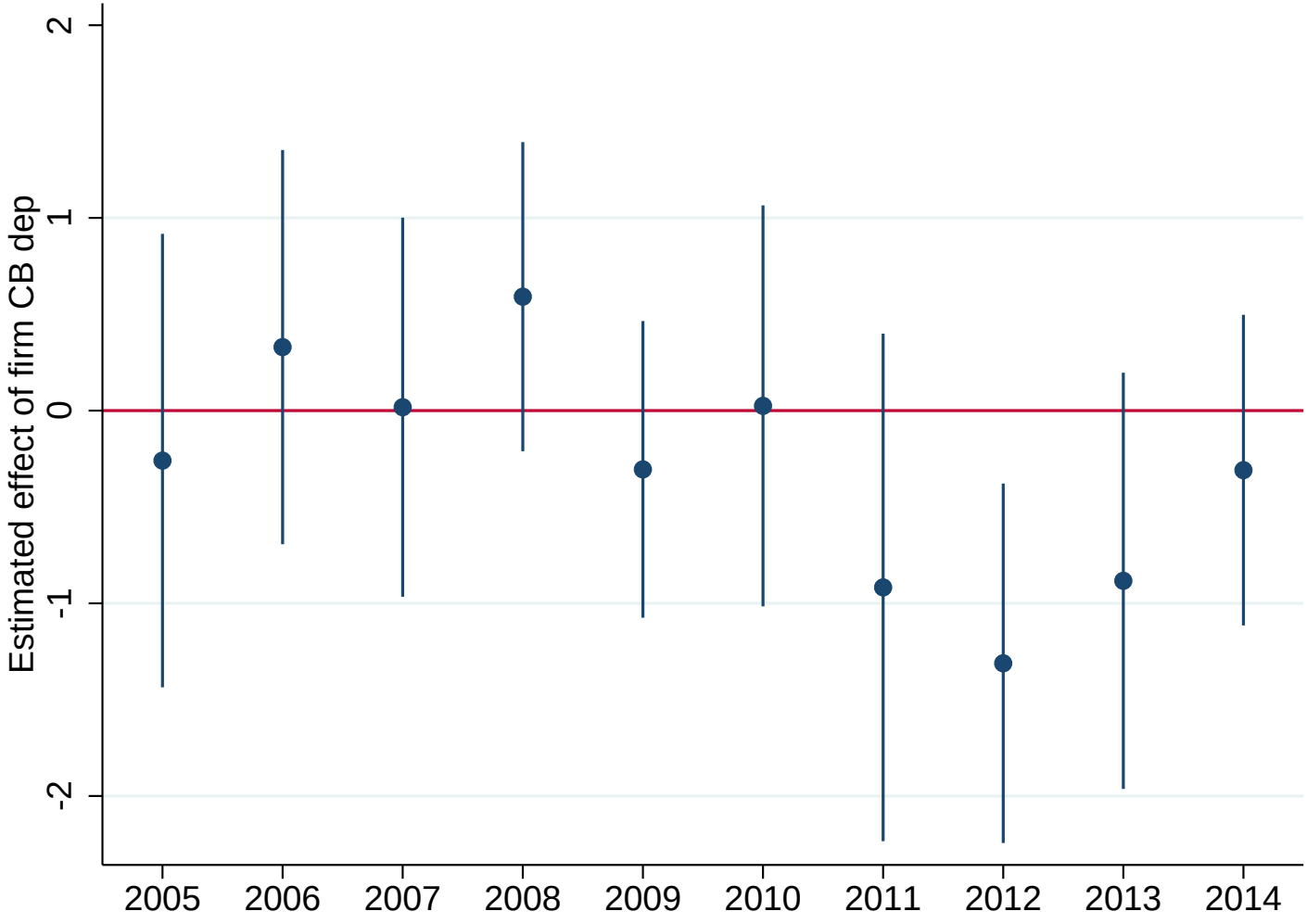
Why Was There No Convergence?

- One potential reason is that the lending cut lowered productivity.
- Innovative firms reduced patenting growth by 55 ppt.

Effect on Patents

The Effect on Patents by Year

Outcome: Number of patents per year



Neg. binomial count models. Controls: ln patents 1990-2004, ln age, size bin FE, industry FE, state FE, export and import share. Only firms with at least one patent 1990-2004.

Why Was There No Convergence?

- One potential reason is that the lending cut lowered productivity.
- Innovative firms reduced patenting growth by 55 ppt.
  Effect on Patents
- Growth accounting (with plausible estimates for capital) suggests county TFP fell. Growth Accounting
- The results imply that lending cuts can reduce productivity:
  - directly, through firm innovation.
  - indirectly, through reduced spillovers among high innovators.
  - indirectly, through low demand (Reifschneider et al. 2015 and Anzoategui et al. 2017).

Conclusion

Conclusion

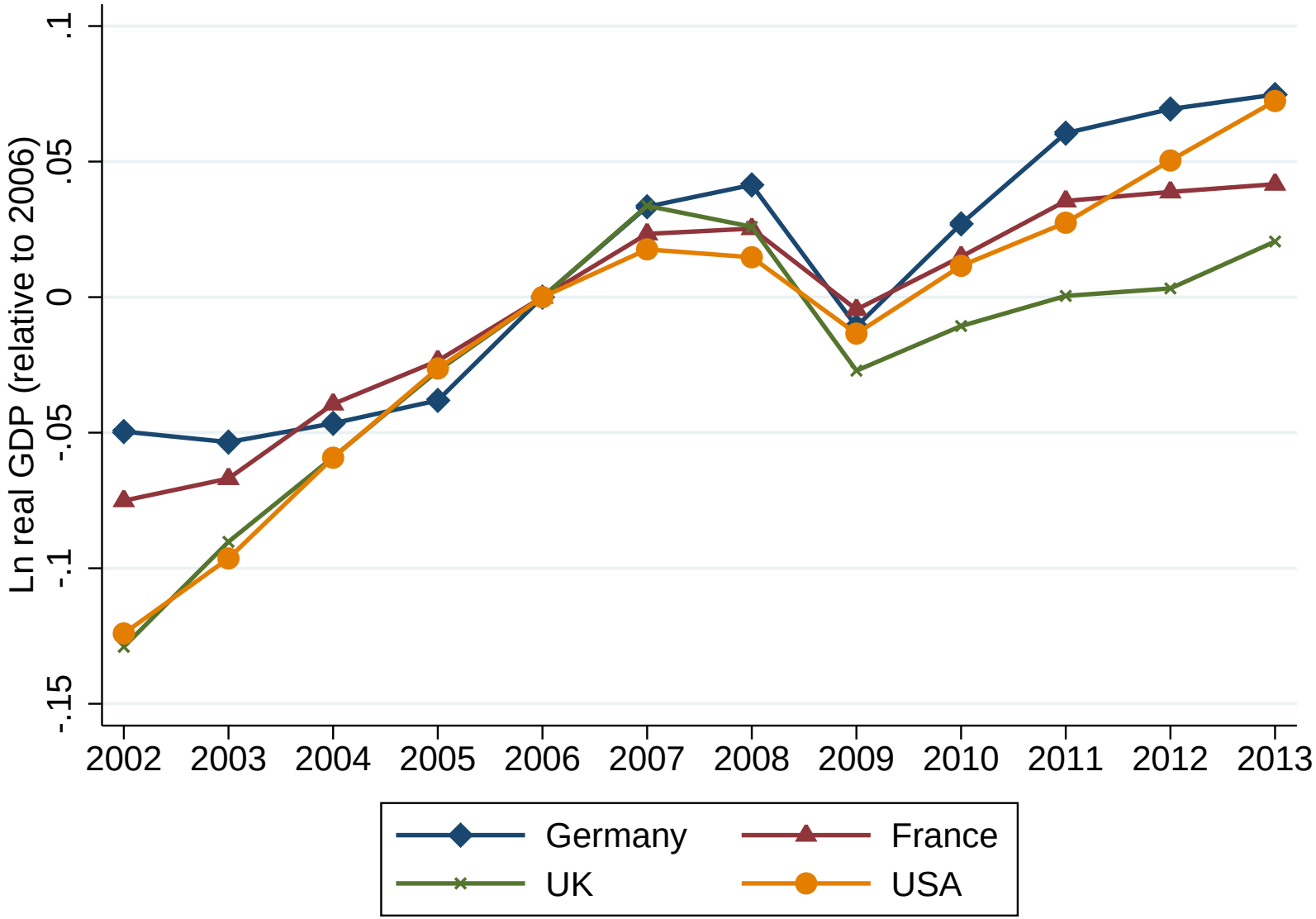
1. Negative indirect effects harmed firms with no direct relationship to Commerzbank, through lower regional demand and spillovers among high-innovators.

2. The recovery from the lending cut was slow. Innovation and productivity fell.

3. The results contribute to the discussion about how the banking crisis shaped the Great Recession.
    - Lending cuts can cause demand and productivity shortfalls.
    - The losses due to temporary lending cuts can persist.
    - Policy should consider targeting indirectly affected firms and intervening even after banks have stabilized.

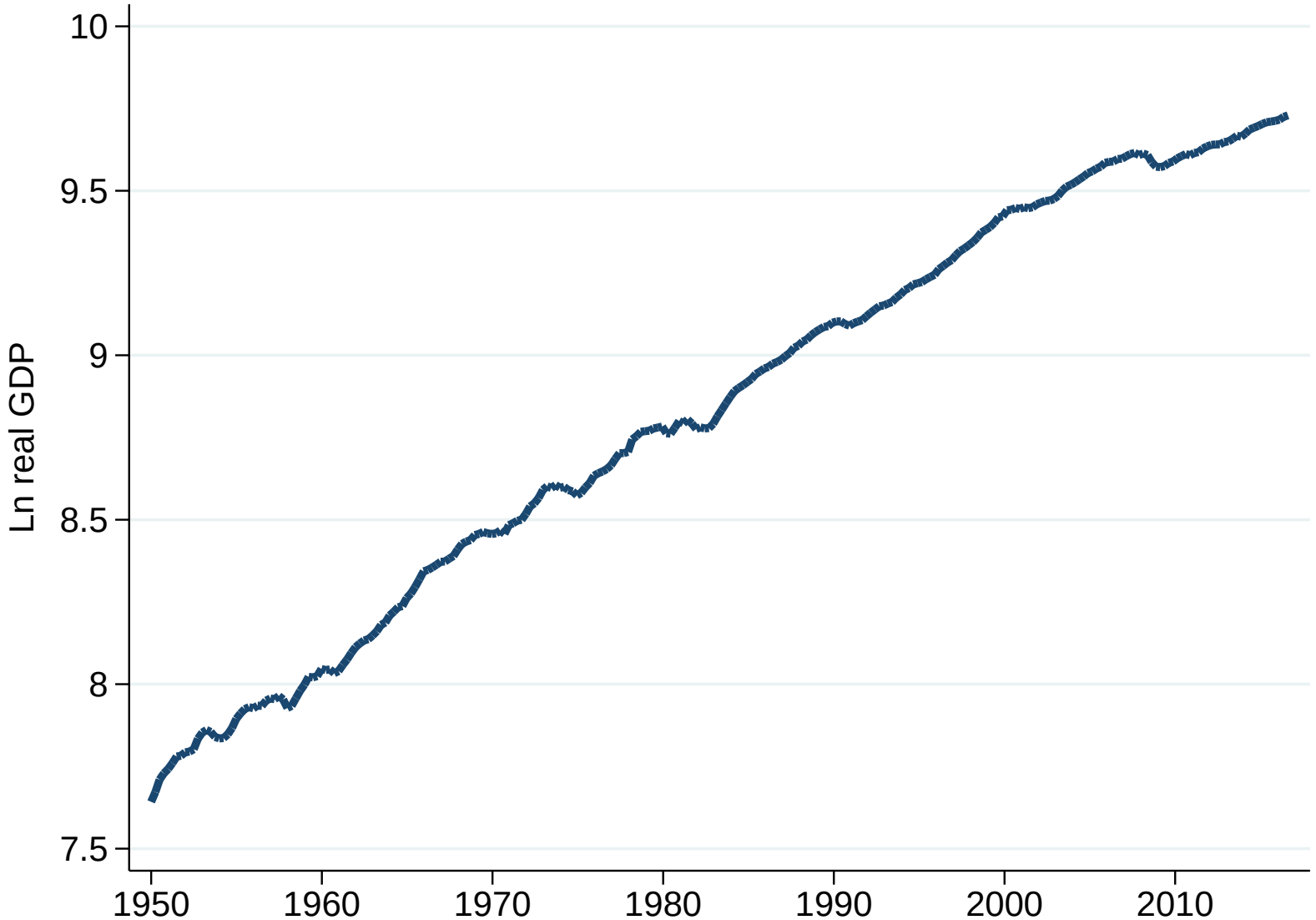
Appendix

GDP in Developed Economies



Back

US GDP 1950-2016



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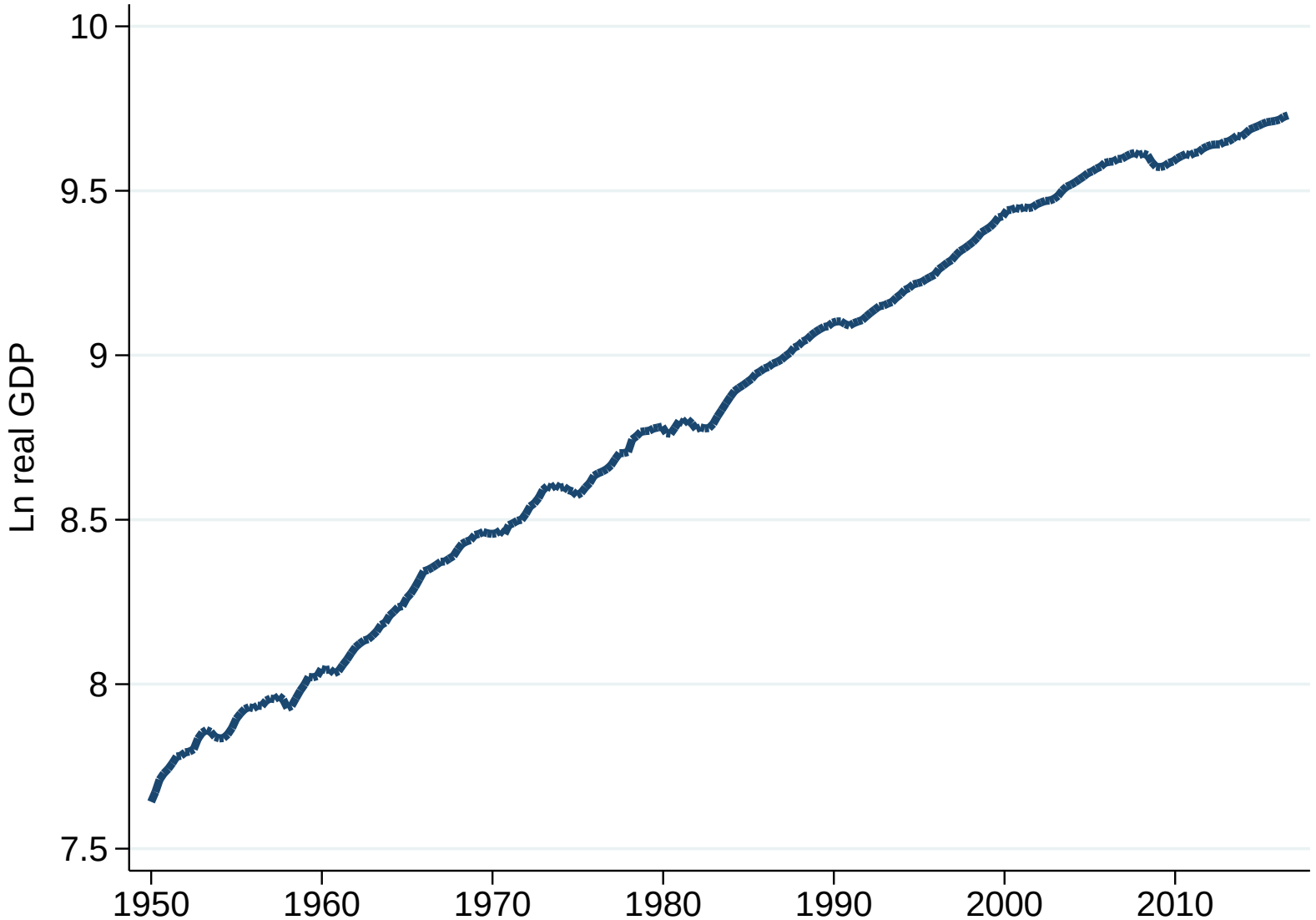
US GDP 1950-2016



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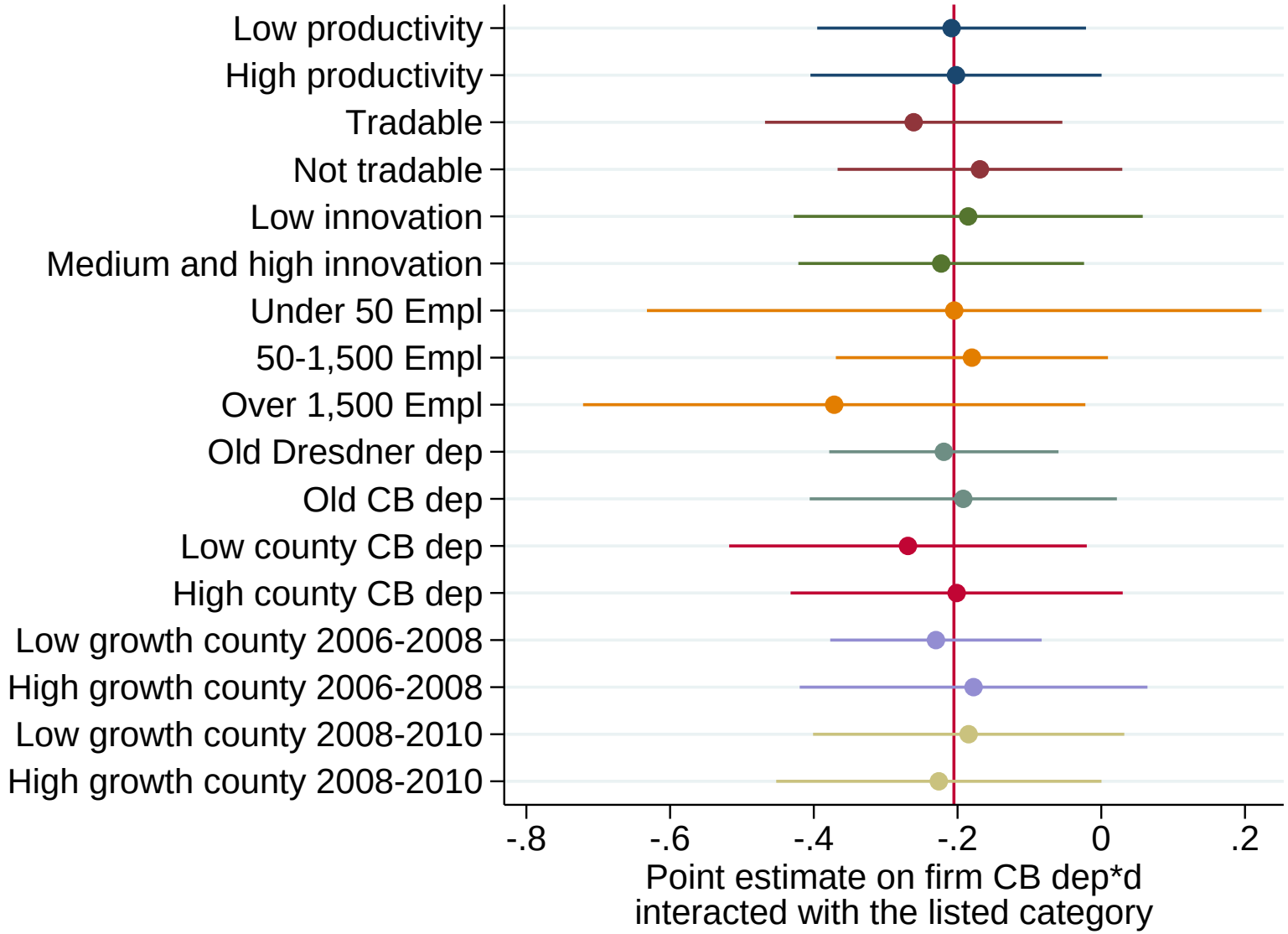
Lending Cut Heterogeneity

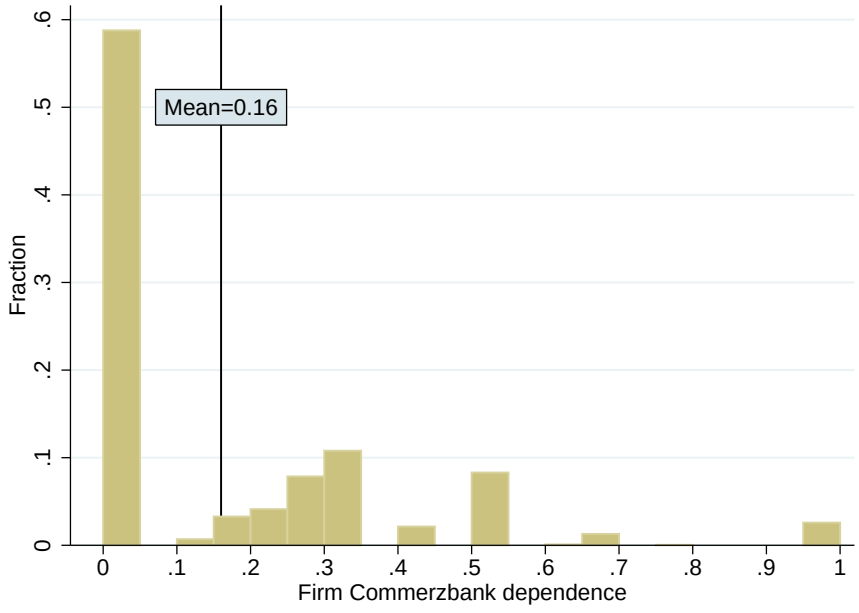


Back

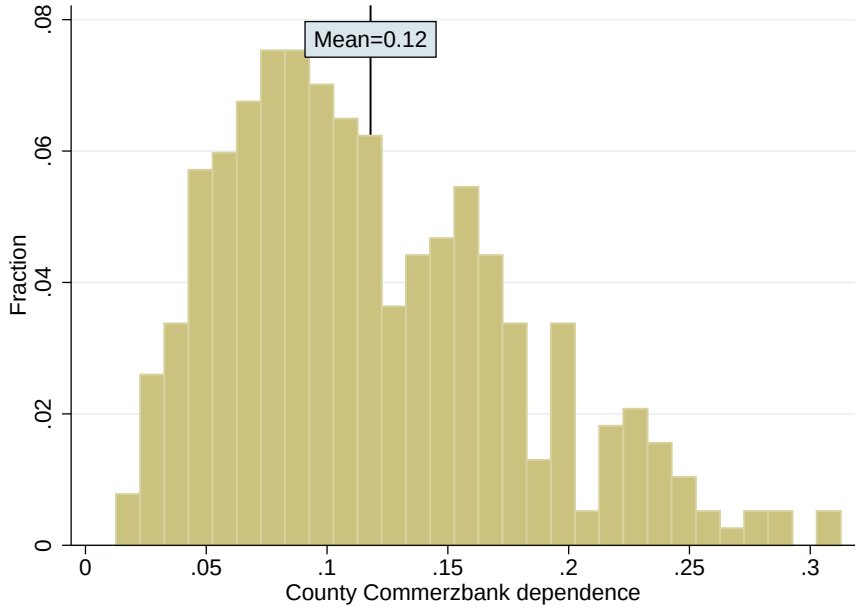
Low/high categories split at the median. Productivity is value added / employment.

Commerzbank Dependence

Firm



County



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Summary Statistics from the Firm Panel

	Range of Commerzbank dependence						
	0	0.01-0.24	0.25-0.32	0.33-0.4	0.41-0.74	0.75-1	Total
CB dep	0 (0)	0.18 (0.02)	0.25 (0)	0.33 (0.01)	0.50 (0.07)	1 (0)	0.16 (0.23)
No of relationship banks	2.4 (1.3)	5.6 (0.7)	4 (0)	3.8 (1.4)	3.1 (1.2)	1.2 (0.4)	3.0 (1.5)
Employment	832 (14,675)	983 (2,587)	841 (4,503)	1,567 (6,603)	729 (2,699)	800 (1,412)	914 (11,593)
Avg Salary	32.5 (60.9)	32.1 (7.8)	30.8 (9.4)	31.7 (9.5)	30.6 (11.0)	33.1 (15.5)	32.0 (47.2)
Capital	44,700 (258,037)	86,334 (255,993)	29,697 (108,209)	145,523 (1,496,141)	36,888 (106,877)	62,554 (134,632)	57,712 (544,583)
Investment rate	0.26 (0.37)	0.21 (0.22)	0.28 (0.32)	0.30 (0.38)	0.33 (0.41)	0.37 (0.42)	0.27 (0.36)
Liabilities	172,542 (4,653,805)	84,363 (278,211)	93,349 (788,451)	217,748 (2,254,805)	93,014 (528,174)	79,575 (169,251)	152,629 (3,657,557)
Bank debt/liabilities	0.50 (0.27)	0.48 (0.25)	0.48 (0.24)	0.43 (0.24)	0.45 (0.26)	0.45 (0.28)	0.48 (0.26)
Firms	1,182	163	151	224	238	53	2,011

Back

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Employment	832 (14,675)	983 (2,587)	841 (4,503)	1,567 (6,603)	729 (2,699)	800 (1,412)	914 (11,593)
Avg Salary	32.5 (60.9)	32.1 (7.8)	30.8 (9.4)	31.7 (9.5)	30.6 (11.0)	33.1 (15.5)	32.0 (47.2)
Capital	44,700 (258,037)	86,334 (255,993)	29,697 (108,209)	145,523 (1,496,141)	36,888 (106,877)	62,554 (134,632)	57,712 (544,583)
Investment rate	0.26 (0.37)	0.21 (0.22)	0.28 (0.32)	0.30 (0.38)	0.33 (0.41)	0.37 (0.42)	0.27 (0.36)
Liabilities	172,542 (4,653,805)	84,363 (278,211)	93,349 (788,451)	217,748 (2,254,805)	93,014 (528,174)	79,575 (169,251)	152,629 (3,657,557)
Bank debt/liabilities	0.50 (0.27)	0.48 (0.25)	0.48 (0.24)	0.43 (0.24)	0.45 (0.26)	0.45 (0.28)	0.48 (0.26)
Firms	1,182	163	151	224	238	53	2,011

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Summary Statistics from the Firm Panel

	Range of Commerzbank dependence						
	0	0.01-0.24	0.25-0.32	0.33-0.4	0.41-0.74	0.75-1	Total
CB dep	0 (0)	0.18 (0.02)	0.25 (0)	0.33 (0.01)	0.50 (0.07)	1 (0)	0.16 (0.23)
No of relationship banks	2.4 (1.3)	5.6 (0.7)	4 (0)	3.8 (1.4)	3.1 (1.2)	1.2 (0.4)	3.0 (1.5)
Employment	832 (14,675)	983 (2,587)	841 (4,503)	1,567 (6,603)	729 (2,699)	800 (1,412)	914 (11,593)
Avg Salary	32.5 (60.9)	32.1 (7.8)	30.8 (9.4)	31.7 (9.5)	30.6 (11.0)	33.1 (15.5)	32.0 (47.2)
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Firms	1,182	163	151	224	238	53	2,011

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Summary Statistics from the County Panel

	Range of Commerzbank dependence						
	0-0.05	0.06-0.10	0.11-0.15	0.16-0.20	0.21-0.25	0.26-0.31	Total
CB dep	0.04	0.08	0.12	0.17	0.23	0.28	0.12
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.06)
Industrial GDP share	0.29	0.29	0.27	0.29	0.22	0.23	0.28
	(0.10)	(0.10)	(0.10)	(0.12)	(0.12)	(0.06)	(0.11)
Export share	4.13	5.10	4.45	4.64	3.74	3.98	4.61
	(2.32)	(2.43)	(2.23)	(2.99)	(2.55)	(2.67)	(2.52)
Import share	2.98	3.46	3.17	2.63	2.37	2.46	3.07
	(2.03)	(2.66)	(2.09)	(1.86)	(1.91)	(2.61)	(2.28)
GDP per worker	54,230	54,548	56,663	55,100	59,128	55,617	55,546
	(5,935)	(6,272)	(9,732)	(11,443)	(16,702)	(10,759)	(9,518)
Household debt index	0.93	0.89	0.94	0.98	1.02	1.13	0.94
	(0.20)	(0.19)	(0.23)	(0.23)	(0.29)	(0.36)	(0.22)
Observations	41	133	102	71	29	9	385

Industrial sectors: mining, manufacturing, utilities, recycling.

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Summary Statistics from the County Panel

	Range of Commerzbank dependence						
	0-0.05	0.06-0.10	0.11-0.15	0.16-0.20	0.21-0.25	0.26-0.31	Total
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	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.06)
Industrial GDP share	0.29	0.29	0.27	0.29	0.22	0.23	0.28
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Household debt index	0.93	0.89	0.94	0.98	1.02	1.13	0.94
	(0.20)	(0.19)	(0.23)	(0.23)	(0.29)	(0.36)	(0.22)
Observations	41	133	102	71	29	9	385

Industrial sectors: mining, manufacturing, utilities, recycling.

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County Summary Statistics

Variable	Mean	Std. dev.
County CB dep	0.12	0.06
2000 Population (in 1000s)	203.28	229.39
2000 Employment (in 1000s)	98.27	126.49
2000 GDP (in year 2010 bn Euro)	6.01	9.12
Former GDR	0.16	0.37
Landesbank in crisis (SH, HH, NW, RP, BW, BY, SN)	0.67	0.47
Distance instrument (in 100 km)	-1.63	0.97
GDP Growth 2008-12	2.66	6.18
Employment Growth 2008-12	2.79	3.22
Observations	385	

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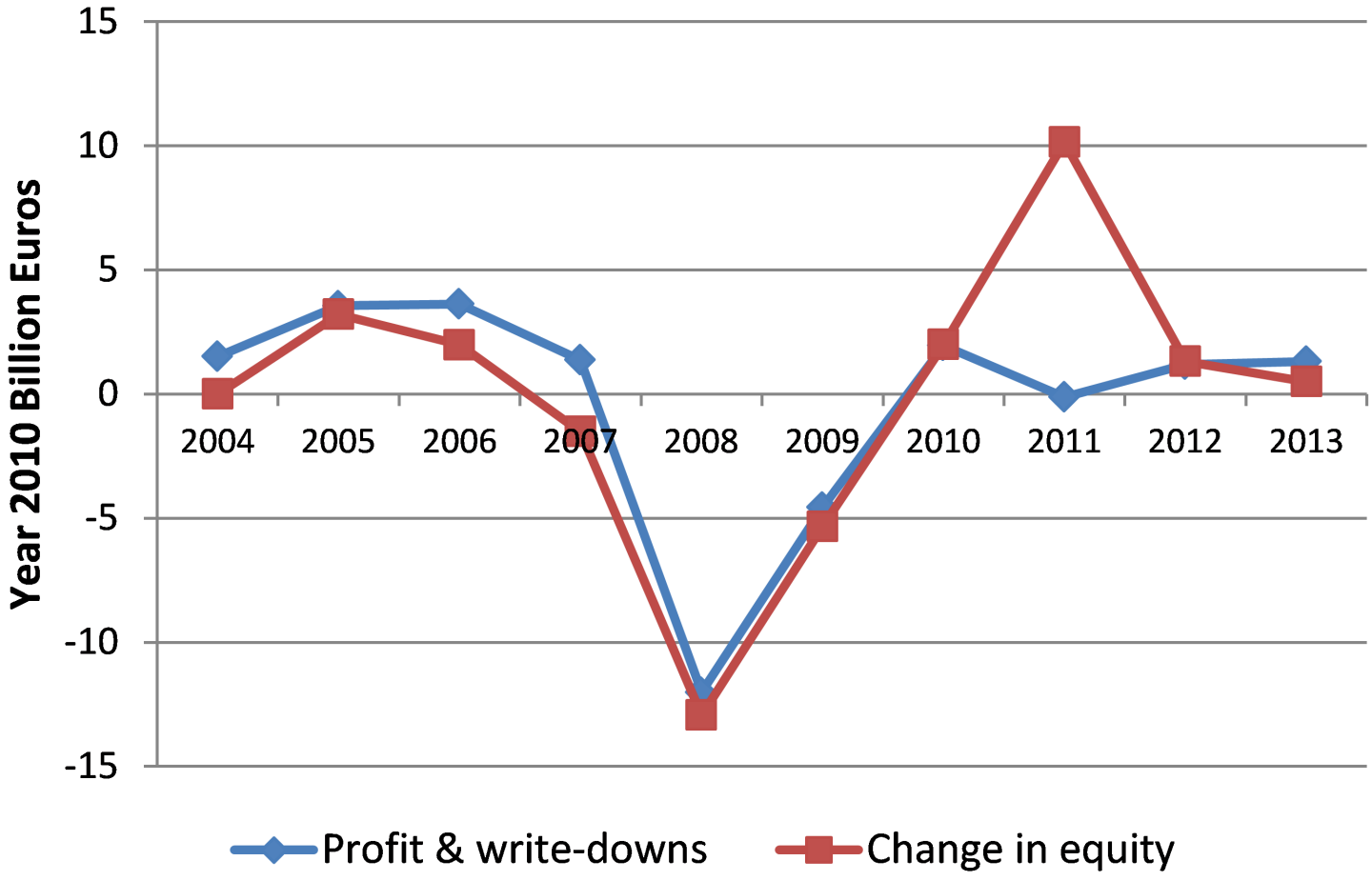
Equity, Profits and Write-downs



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Stability of the German Economy

- The imported lending cut hit a relatively stable economy.
- No housing boom and bust. House Price Index
- No sovereign debt crisis.
- No aggregate banking crisis.
- Stable bond markets.

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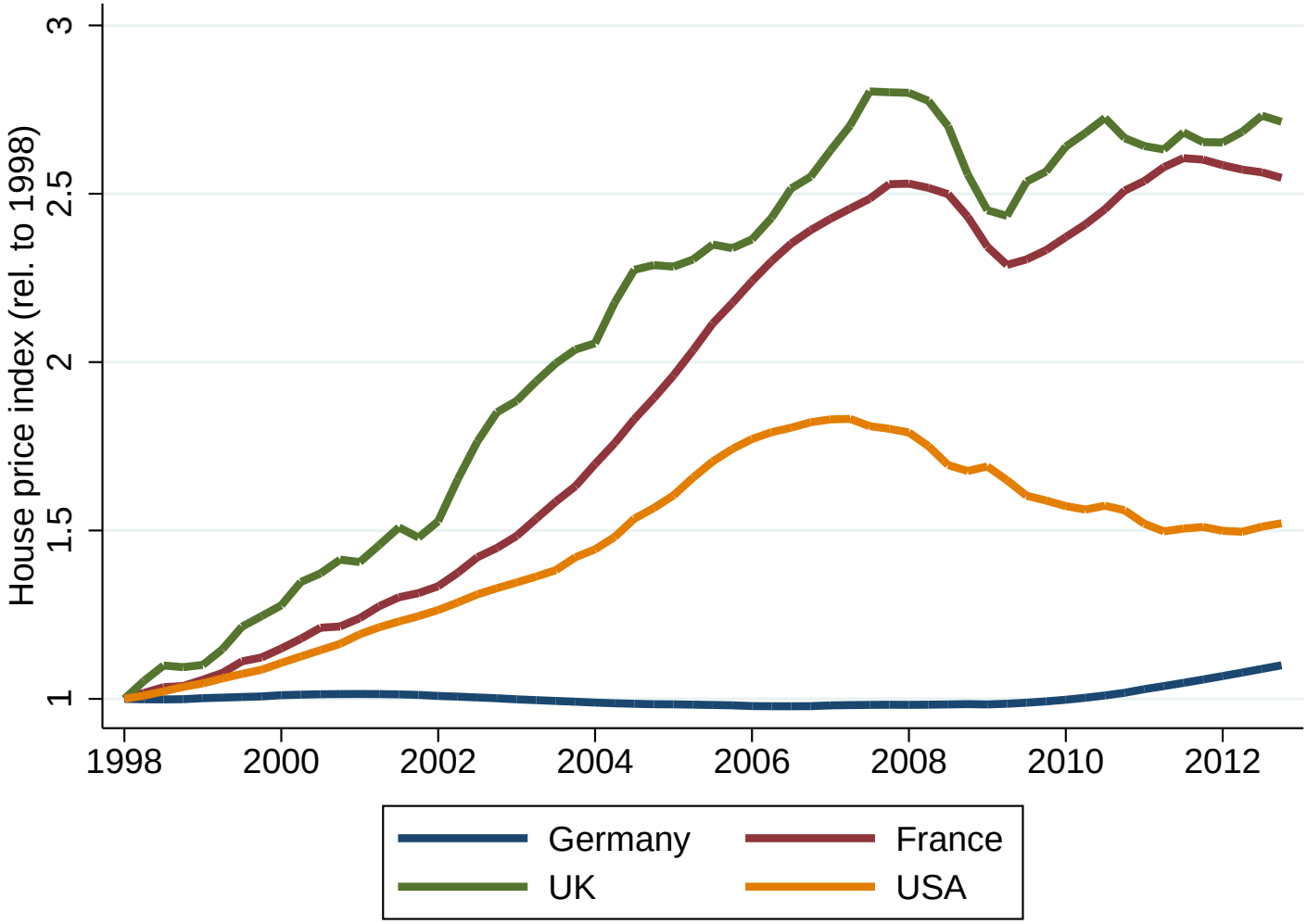
No Housing Boom and Bust in Germany



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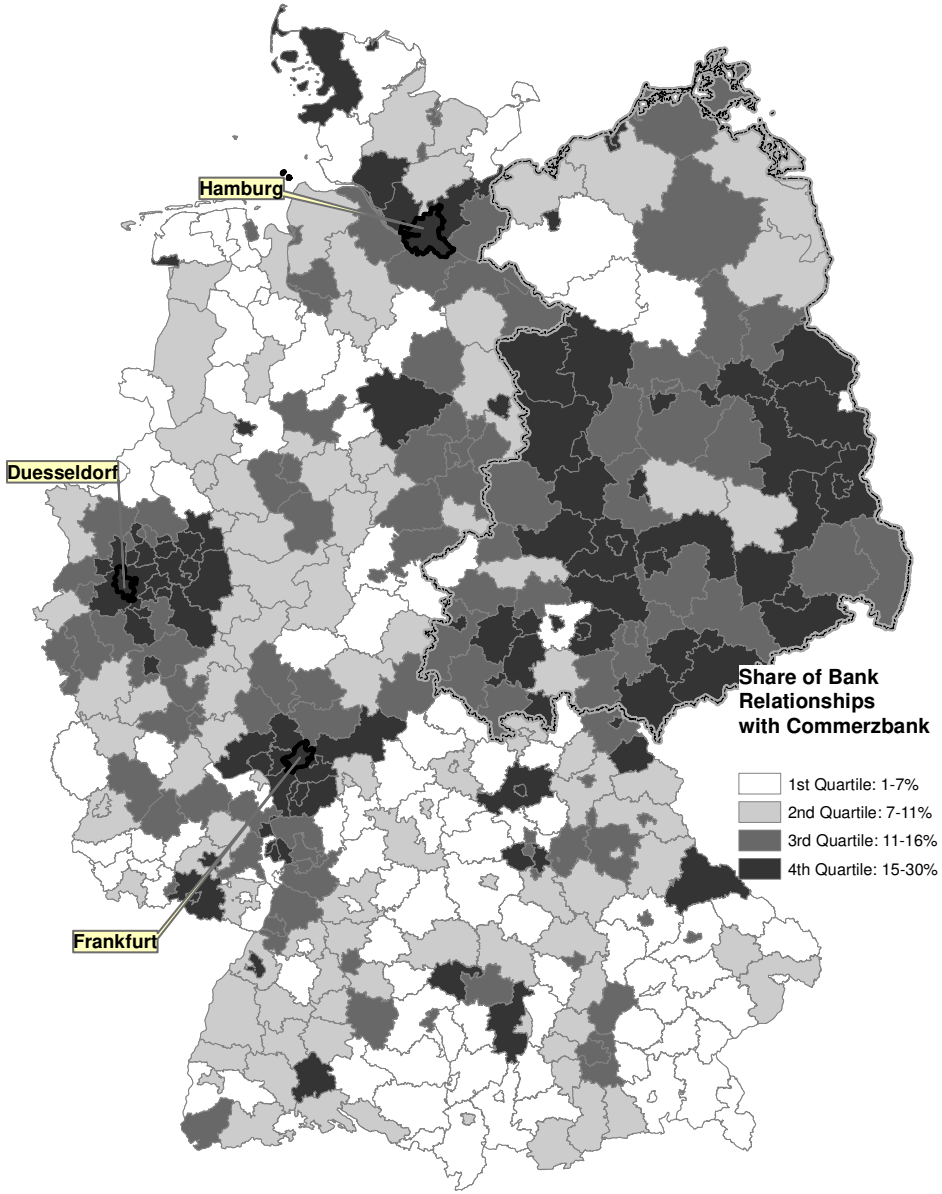
A Map of Commerzbank Dependence



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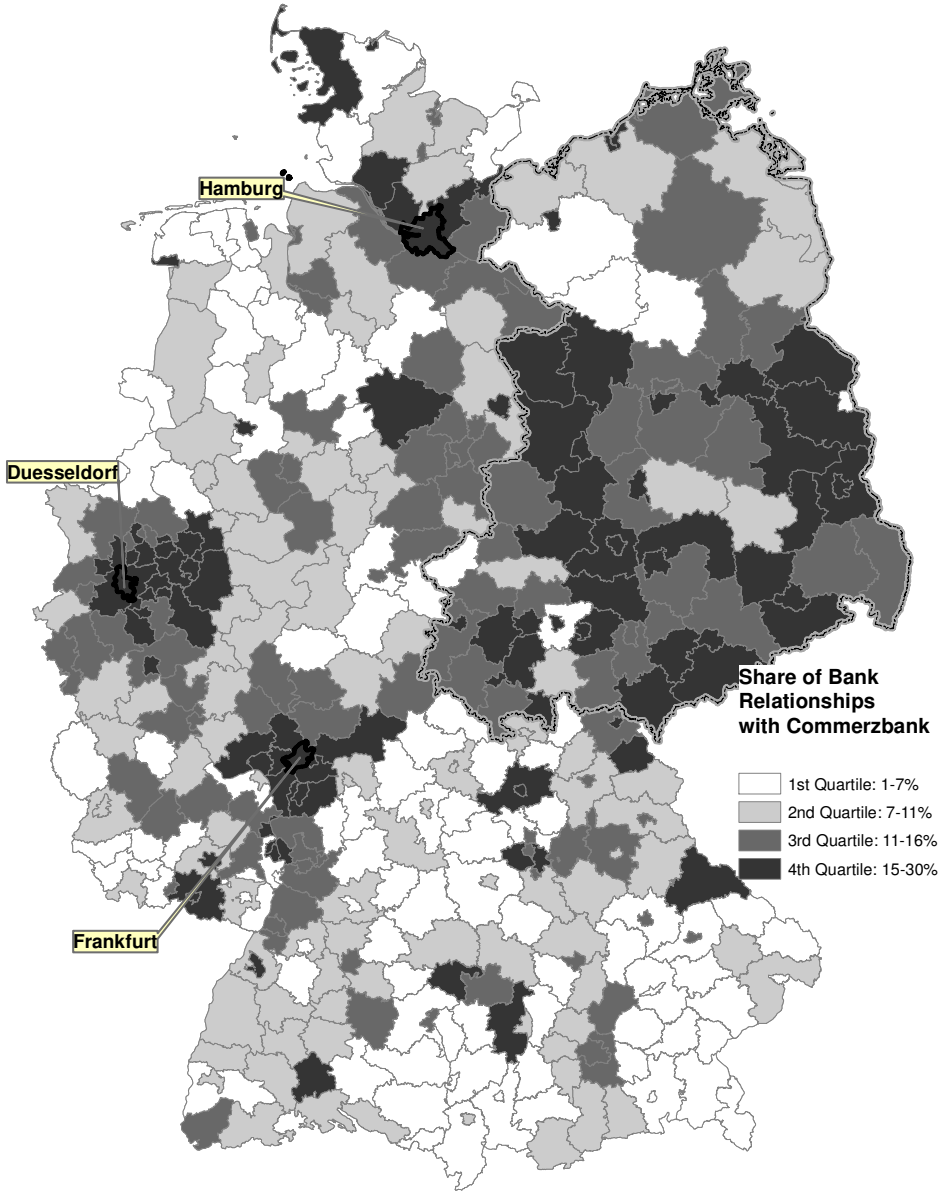
A Map of Commerzbank Dependence



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Firm Survey on Product Demand

Are your business activities constrained by low demand or few orders?

	(1)	(2)	(3)	(4)	(5)	(6)
YEAR	2007	2008	2009	2010	2011	2012
$Firm\ CB\ dep$	-0.191	-0.196	-0.076	-0.121	0.281	0.194
	(0.121)	(0.133)	(0.148)	(0.156)	(0.175)	(0.197)
Observations	980	991	1,032	945	856	808

The coefficients are interpreted as the standard deviation increase in banks' willingness to grant loans from increasing Commerzbank dependence by one. Controls: the outcome variable from 2006, industry, state, size bin (1-49, 50-249, 250-999, and over 1000 employees in the year 2006), ln firm age.

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The Effect on Firm Patents

OUTCOME	(1) Growth rate of patents	(2) Patents post lending cut	(3) Patents pre lending cut
$Patenting \cdot Firm\ CB\ dep$	-0.548	-0.770	0.206
	(0.245)	(0.409)	(0.409)
$Non\text{-}patenting \cdot Firm\ CB\ dep$	0.037		
	(0.065)		
$Ln\ Patents$ 1990-2004		0.671	0.687
		(0.088)	(0.116)
Observations	2,011	382	382
Estimator	OLS	Neg bin	Neg bin

Controls: ln age, size bin FE, industry FE, county/state FE, export and import share.

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Result on Large Firms

- Empl < 1,500 (N = 1,858)
  - Bank debt / liabilities = 0.49
  - Bank debt / assets = 0.32
  - Effect of full CB dep on employment = -0.052
- Empl $\geq$ 1,500 (N = 153)
  - Bank debt / liabilities = 0.34
  - Bank debt / assets = 0.19
  - Effect of full CB dep on employment = -0.065
- Consistent with evidence from Spain, e.g. Bentolila et al. 2017

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Firm Regression Results by Bin of CB dep

OUTCOME	(1) Empl	(2) Empl	(3) Empl
$Firm\ CB\ dep\ bin \cdot d^{post}$	0.007	-0.017	-0.065
	(0.016)	(0.008)	(0.018)
Controls	Yes	Yes	Yes
Range of CB dep in bin	0.01-0.25	0.26-0.50	0.51-1.00

Number of firms: 2,011. Controls (interacted with d^{post}): ln age, size bin FE, industry FE, county FE, export and import share.

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Firm Regression Results: No Pre-Trends

	(1)	(2)
$Firm\ CB\ dep \cdot d^{08}$	0.028	-0.004
	(0.018)	(0.023)
Controls	No	Yes

Data in columns 1 and 2 for 2007-2008. Number of firms: 2,011. Outcome: Employment. Controls (interacted with year FE): ln age, size bin FE, industry FE, county FE, export and import share.

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County Regression Results: No Pre-Trends

	(1)	(2)
$County\ CB\ dep \cdot d^{05-08}$	-0.000	
$(std.\ dev.\ increase)$	(0.003)	
$County\ CB\ dep \cdot d^{03-06}$		0.004
$(std.\ dev.\ increase)$		(0.003)
Controls	Yes	Yes
Estimator	OLS	OLS

Data in column 1 for 2000-2008, in column 2 for 2000-2006. Number of counties: 385. Outcome: GDP. Controls (interacted with year FE): former GDR FE, 17 industrial shares, export and import share, Landesbank in crisis FE, population density, ln GDP, ln population, 2003 debt index.

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County Confidence Intervals

- Std. dev. increase in county CB dep leads to change in GDP:
  - OLS: [-1.8%,0.2%]
  - IV: [-4.4%,-0.04%]

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GDP to Bank Debt Elasticity

- Will be an overestimate, since bank debt is not the only channel (int. rates, loan length, uncertainty etc.)
- Implied elasticity (from county OLS regression coefficients) = % change GDP / % change bank debt = -0.141 / -0.205 = 0.689
- Implied Euro-for-Euro effect = elasticity * (GDP / bank credit to private non-fin. sector) = 0.689 * 1.138 = 0.784
- BIS: bank credit to private non-fin. sector, as % of GDP, in 2008 = 87.9

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County GDP Effect in Relation

- Standard deviation of county growth 2008-12: ~ 6%.
- 5th to 95th percentile of country growth: -7.25% to 11.76%
- OLS point estimate on average county: ~ -2% (-16.5%*0.12).

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Growth Accounting 2008-2012

- Output per worker fell by 1.8% (IV estimate). No data on county capital.
- If capital-labor ratio grew in parallel for all firms with no Commerzbank relationship, TFP fell by 1.4%.
- To keep TFP constant, capital would have had to fall by 5.6%. Implausibly large given historical movements.
- After 5/6 recessions in postwar Germany, TFP caught up to its pre-recession trend within two years (except 1993).
- Conventional TFP overestimates productivity losses in recessions due to decreases in capacity utilization.
  - Focus on 2008-2012 differences, since there were no effects on growth in 2011 and 2012.
  - Use adjustment factor for input use based on Fernald (2014), 1.07.

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County Characteristics and the Distance Instrument

Coefficients on the Distance Instrument

OUTCOMES		(1)	(2)
Professional services share	Coeff	0.028	-0.001
(law, accounting, consulting, advert.)	Std Err	(0.017)	(0.043)
Unemployment rate	Coeff	0.015	0.000
	Std Err	(0.002)	(0.004)
Non-tradable share	Coeff	0.006	-0.005
	Std Err	(0.010)	(0.022)
Linear distances to postwar head offices		No	Yes
Former GDR FE		Yes	Yes

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The Effect of the Linear Distances to Cities 1

Outcome: ln GDP

City	(1) Düsseldorf	(2) Frankfurt	(3) Hamburg	(4) Berlin
$Distance\ instrument \cdot d^{post}$	-18.309	-14.493	-18.165	-17.279
	(3.253)	(4.205)	(4.050)	(3.850)
$Distance\ to\ city \cdot d^{post}$	0.845	-4.218	1.166	3.016
	(2.618)	(3.111)	(1.821)	(2.510)

Distance in 100,000 km. Controls (interacted with d^{post}): former GDR FE, 17 industrial shares, ln population, ln GDP per capita, population density, 2003 debt index, export and import share, Landesbank in crisis FE.

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The Effect of the Linear Distances to Cities 2

Outcome: ln GDP

City	(1) Dresden	(2) Munich	(3) Cologne	(4) Essen
$Distance\ instrument \cdot d^{post}$	-17.950	-17.420	-16.857	-19.595
	(3.635)	(3.932)	(3.605)	(3.017)
$Distance\ to\ city \cdot d^{post}$	-2.071	-0.146	-0.385	1.945
	(2.795)	(1.858)	(2.789)	(2.458)

Distance in 100,000 km. Controls (interacted with d^{post}): former GDR FE, 17 industrial shares, ln population, ln GDP per capita, population density, 2003 debt index, export and import share, Landesbank in crisis FE.

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Household Debt

Outcome: Growth Rate of Household Debt 2007-2012

OUTCOME	(1) Total debt growth 2007-12	(2) Total debt growth 2007-12	(3) Mortgage debt growth 2007-12
$County\ CB\ dep$	0.000	0.007	0.000
$(std.\ dev.\ increase)$	(0.016)	(0.018)	(0.015)
Observations	6,423	6,423	6,423
R^2	0.053	0.069	0.113
County controls	Yes	Yes	Yes
Individual controls	No	Yes	Yes

County controls: 17 industry shares, ln population, ln GDP per capita, population density, 2003 debt index. Individual controls (from 2007): sex, employment status, the former GDR, the number of children and adults in the household, education, age, income.

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Household Debt

Outcome: Dummy for Debtor (2007 mean = 0.4)

OUTCOME	(1) Debtor 2008	(2) Debtor 2009	(3) Debtor 2010	(4) Debtor 2011	(5) Debtor 2012
$County\ CB\ dep$	0.002	0.005	-0.003	0.003	0.006
$(std.\ dev.\ increase)$	(0.008)	(0.007)	(0.007)	(0.008)	(0.010)
Observations	10,829	9,992	9,206	8,520	7,409
R^2	0.395	0.399	0.404	0.289	0.288
County controls	Yes	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes	Yes

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% of Industry Type

Industry type	% of sample
Tradable, low inno	2
Tradable, med inno	29
Tradable, high inno	8
Part-tradable, low inno	11
Part-tradable, med inno	25
Non-tradable, low inno	5
Non-tradable, med inno	20

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Average CB Dep by Industry Type

Industry type	Avg firm CB dep	% of sample
Tradable, low inno	0.130	2
Tradable, med inno	0.155	29
Tradable, high inno	0.191	8
Part-tradable, low inno	0.137	11
Part-tradable, med inno	0.134	25
Non-tradable, low inno	0.098	5
Non-tradable, med inno	0.088	20

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High-Innovation Industries (WZ2008)

20.2	Manufacture of pesticides and other agrochemical products
21	Manufacture of basic pharmaceutical products and preparations
25.4	Manufacture of weapons and ammunition
26	Manufacture of computer, electronic and optical products
30.3	Manufacture of air and spacecraft and related machinery
30.4	Manufacture of military fighting vehicles
20.1	Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms
20.4	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
20.5	Manufacture of other chemical products (explosives, glues, essential oils, man-made fibres)
27	Manufacture of electrical equipment (electric motors, generators, transformers and electricity distribution and control apparatus)
28	Manufacture of machinery and equipment (e.g. engines, turbines, fluid power equipment, gears, furnaces, solar heat collectors, lifting and handling equipment, power-driven hand tools, non-domestic cooling and ventilation equipment, machinery for mining, quarrying and construction)
29.1	Manufacture of motor vehicles
29.3	Manufacture of parts and accessories for motor vehicles
30.2	Manufacture of railway locomotives and rolling stock
33.2	Installation of industrial machinery and equipment

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Low-Innovation Industries (WZ2008)

8.1	Quarrying of stone, sand and clay
9	Mining support service activities (for petroleoum, natural gas and other mining and quarrying)
16.1	Sawmilling and planing of wood
23.7	Cutting, shaping and finishing of stone
25.1	Manufacture of structural metal products
35.3	Steam and air conditioning supply
36	Water collection, treatment and supply
37	Sewerage
38.2	Waste treatment and disposal
39	Remediation activities and other waste management services
41.1	Development of building projects
43.9	Other specialised construction activities
45.1	Sale of motor vehicles
46.5	Wholesale of information and communication equipment
46.9	Non-specialised wholesale trade
47.3	Retail sale of automotive fuel in specialised stores
49.3	Other passenger land transport
49.4	Freight transport by road and removal services
50	Water transport (passenger and freight)
52.1	Warehousing and storage
53.2	Other postal and courier activities
56.1	Restaurants and mobile food service activities
59.2	Sound recording and music publishing activities
68.1	Buying and selling of own real estate
70.1	Activities of head offices
74.1	Specialised design activities
74.2	Photographic activities
78	Employment activities (employment placement and agency)
80	Security and investigation activities
81.1	Combined facilities support activities
81.3	Landscape service activities
82	Office administration, office support, and other business support

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Industry Tradability Classification

- Based on Mian and Sufi (2014)
- T1: Tradable if the sum of its exports is at least USD 10,000 per worker or USD 500 million in total (using US industry data).
- NT1: Restaurants and retail are non-tradable.
- T2/NT2: Herfindahl index in the top quartile produce tradables; in the bottom quartile non-tradables. (Non-tradable industries are highly dispersed, because they need to produce locally in the markets they serve, while tradable industries tend to be concentrated.)
- If industries remain unclassified, I call them producers of part-tradables.

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Industries by Tradability

NT1	Restaurants
NT1	Grocery and department stores
NT1	Other general merchandise stores
NT1	Clothing stores
NT2	Lawn and garden equipment stores
NT2	Farm product raw material wholesalers
NT2	Nonmetallic mineral mining and quarrying
NT2	Florists
PT	Management of companies and enterprises
PT	Architectural engineering and related services
PT	Machinery equipment and supplies merchant wholesalers
PT	Motor vehicle and motor vehicle parts and supplies merchant wholesalers
T1	Plastics product manufacturing
T1	Printing and related support activities
T1	Motor vehicle parts manufacturing
T1	Animal slaughtering and processing
T2	Securities and commodity exchanges
T2	Pipeline transportation of crude oil
T2	Cut and sew apparel manufacturing
T2	Motion picture and video industries

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Firm-Level Specification on Persistence

- I test formally whether firms recovered by 2012.
- Panel specification:

$$
\begin{aligned}
ln\ y_{fct} = & \\
& \beta^{09-11} \cdot CB\ dep_{fc} \cdot d_t^{09-11} + \\
& \beta^{12} \cdot CB\ dep_{fc} \cdot d_t^{12} + \\
& \kappa_c \cdot d_t^{post} + \Gamma'\, X_{fc} \cdot d_t^{post} + \gamma_{fc} + \lambda_t + \epsilon_{fct}
\end{aligned}
$$

- $\beta^{12} = 0$ implies recovery to the unaffected level by 2012.

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Firm-Level Results on Persistence

OUTCOME	(1) Empl	(2) Empl	(3) Cap	(4) Val add
$Firm\ CB\ dep \cdot d^{09-11}$	-0.040	-0.049	-0.118	-0.064
	(0.019)	(0.014)	(0.045)	(0.025)
$Firm\ CB\ dep \cdot d^{12}$	-0.057	-0.066	-0.166	-0.053
	(0.035)	(0.038)	(0.063)	(0.032)
Controls	No	Yes	Yes	Yes

Number of firms: 2,011. Controls (interacted with d^{post}): ln age, size bin FE, industry FE, county FE, export and import share.

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County-Level Results on Persistence

OUTCOME	(1) GDP	(2) Empl	(3) GDP	(4) Empl
$County\ CB\ dep \cdot d^{09-11}$	-0.008	-0.008		
$(std.\ dev.\ increase)$	(0.004)	(0.003)		
$County\ CB\ dep \cdot d^{12}$	-0.017	-0.009		
$(std.\ dev.\ increase)$	(0.004)	(0.003)		
$Distance\ instrument \cdot d^{09-11}$			-17.427	-9.477
			(8.087)	(5.129)
$Distance\ instrument \cdot d^{12}$			-21.116	-10.601
			(8.502)	(5.051)
Controls	Yes	Yes	Yes	Yes

Number of counties: 385. Controls (interacted with d^{post}): former GDR FE, 17 industrial shares, export and import share, Landesbank in crisis FE. Distance in 100,000 km. Columns (3) and (4) include the linear distances (interacted with d^{post}).

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