How do banks propagate economic shocks?

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Motivation
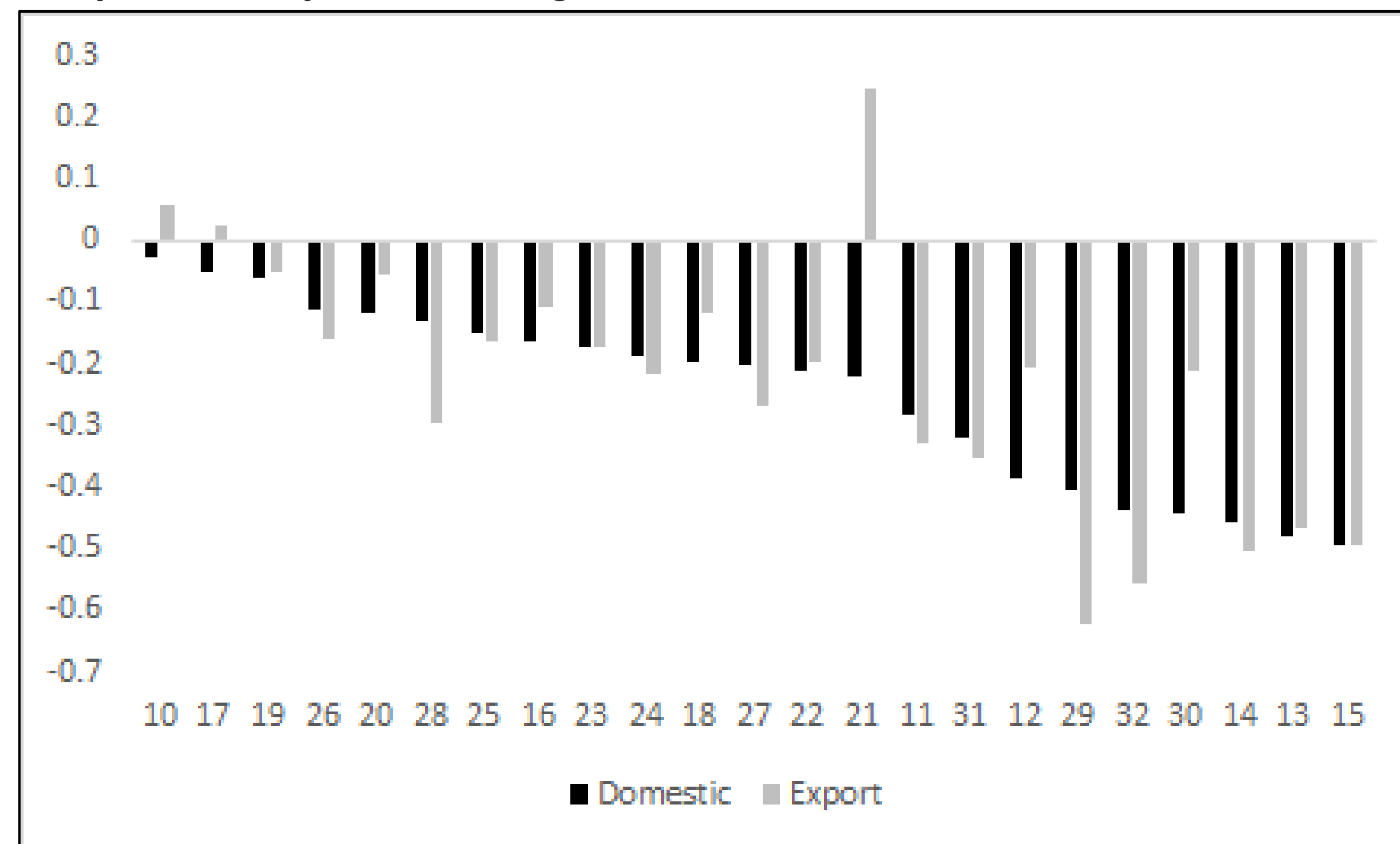
COVID-19 led to a significant drop in revenues

year-on-year change in industry revenues across time

Motivation

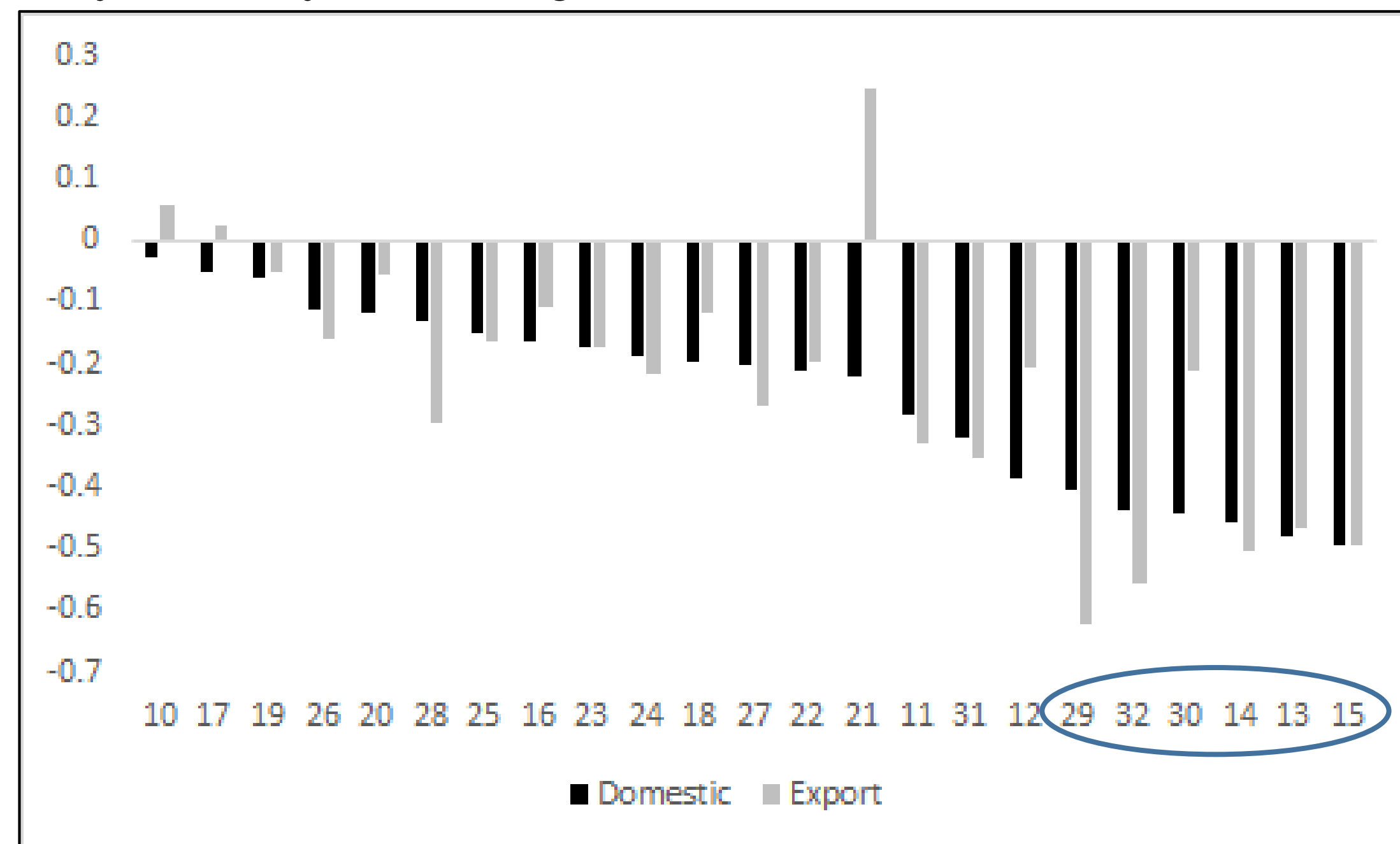COVID-19 led to a larger drop in revenues of some industries

year-on-year change in revenues across industries

Motivation

COVID-19 led to a larger drop in revenues of some industries

year-on-year change in revenues across industries

most affected industries

15 – leather and related products

13 – textiles

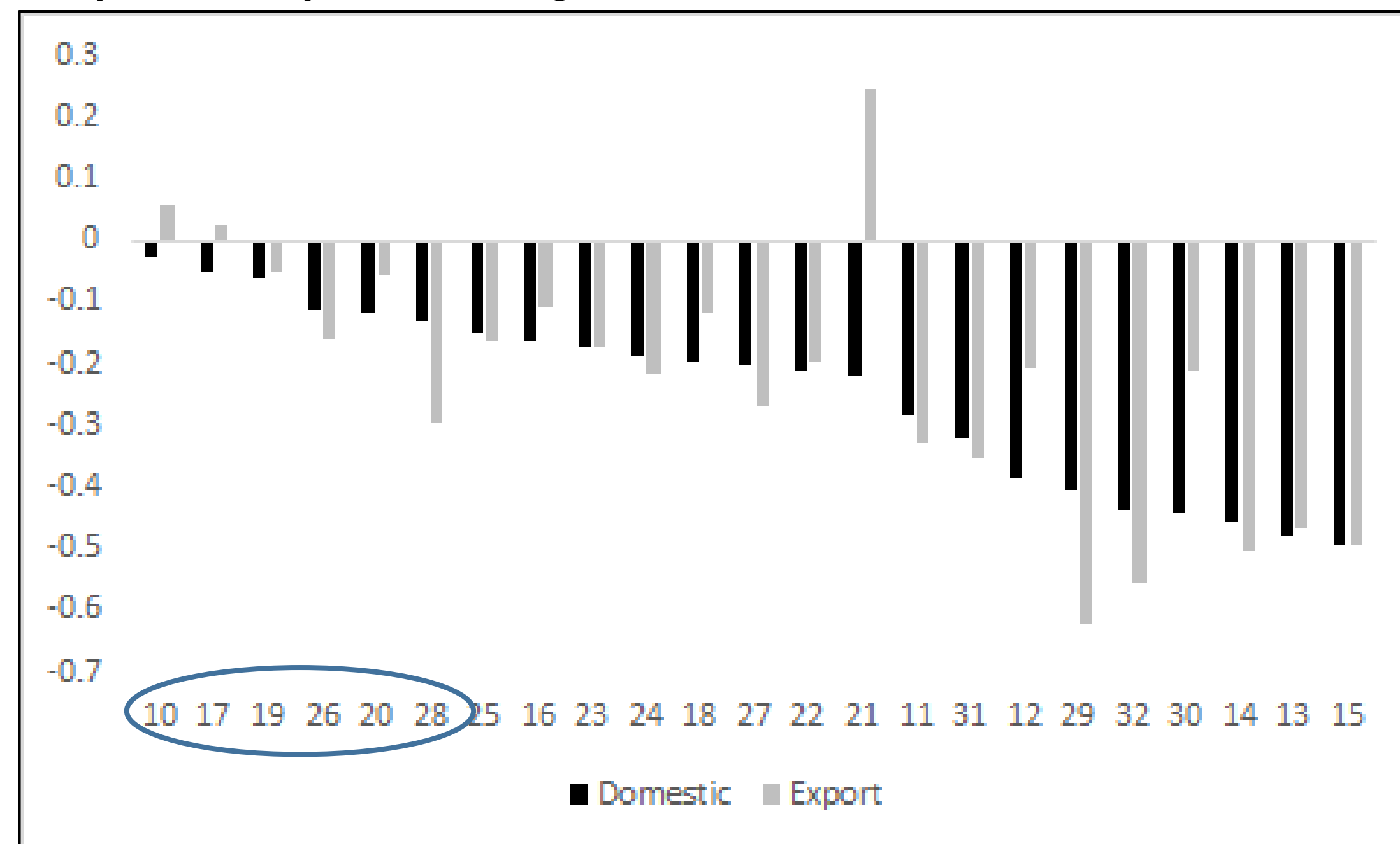14 – wearing apparel

30 – other transport equipment

32 – other (jewellery, toys, musical inst.)

29 – motor vehicles and trailers

Motivation

COVID-19 led to a larger drop in revenues of some industries

year-on-year change in revenues across industries

least affected industries

10 – food products

17 – paper and paper products

19 – refined petroleum products

26 – computer, electronic and optical prod.

20 – chemicals and chemical products

28 – machinery and equipment

Motivation

Idea:

<u>Banks' exposure to the shock</u>: ex ante heterogeneity in the amount of loans issued to the affected industries

Research questions:

1) Did banks transmit the negative shock to the rest of the economy?

2) Are firms affected through their banks?

Overview of Results

- Banks with a larger exposure to the negative shock supplied significantly less loans during the COVID-19 pandemic

  - A 1 percentage point increase in the exposure led to a 6.64 percent reduction in the loan amount

- Negative shock is transmitted from affected industries to unaffected industries via banks

  - Banks decreased their loans to firms operating in unaffected industries as well

Overview of Results

- Firms, on average, could not avoid a reduction in their total loans

  - Firms with a 1 percentage point higher exposure experienced a significant drop in their loans by 4 percent

- Large firms could avoid the reduction – they switch to other banks

  - Firms with more than 500 employees

- Firms that had an existing relationship with a state-owned bank could borrow from state-owned banks

  - State-owned banks intermediate government support to the firms

Related Literature

- Transmission of negative shocks via banks

  - Bank liquidity shocks (Gan, 2007; Khwaja and Mian, 2008; Paravisini, 2008; Chava and Purnanandam, 2011; Dursun-de Neef, 2019)

  - Interbank linkages of banks (Iyer and Peydro, 2011; Iyer et al., 2014; Cingano et al., 2016)

  - Spillover of shocks across geographies (Imai and Takarabe, 2011; Koetter et al., 2020; Berrospide et al.; 2016)

- Propagation of industry-level shocks

  - Input-output linkages (Acemoglu et al., 2012, 2016; Barrot and Sauvagnat, 2016; Atalay, 2017; Caliendo et al., 2018; Carvalho et al., 2021)

Outline

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Empirical Framework

Main Results

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Empirical Framework

- COVID-19 pandemic is used as an exogenous negative shock on industry revenues

- Bank-specific exposure

  - ex ante heterogeneity in the amount of short-term loans issued to affected industries

- Diff-in-diff analysis

  - <u>challenge</u>: disentangle demand and supply side effects

  - firm-time fixed effects (Khwaja and Mian, 2008)

Data

- Industry-level shock

  - industry revenues (Turkish Statistical Institute)

  - credit card spending (Banks Association of Turkey)

- Impact on banks´ loan supply

  - monthly bank-firm level loan data from the credit register provided by the Central Bank of the Republic of Turkey

- Firm balance sheets and firm-level annual employment

  - collected by Revenue administration and Social Security Institute
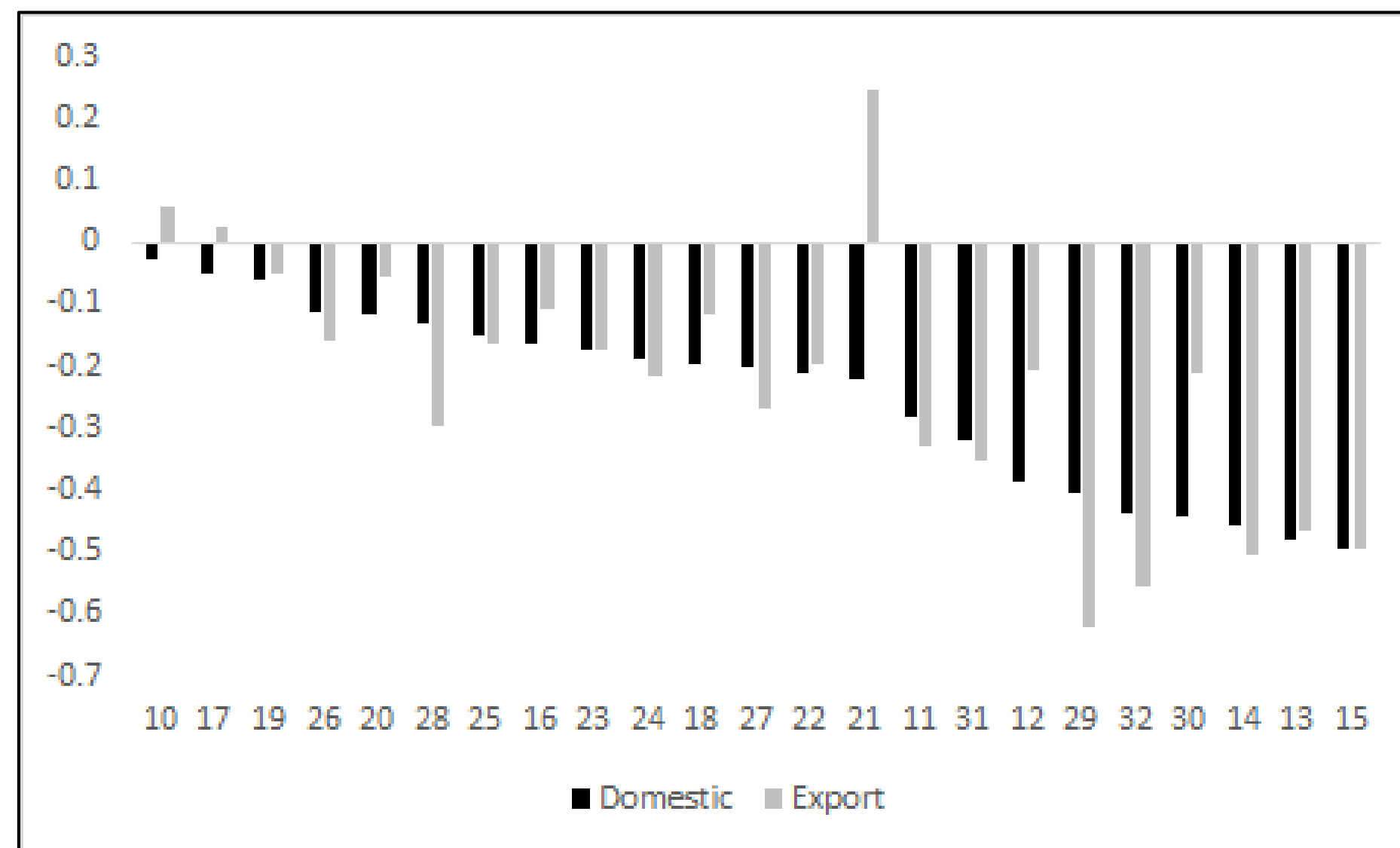
Industry-level shock

- Tradable sectors

    - monthly revenue indexes at the NACE-2 digit industrial level

    - year-on-year changes in domestic and export revenues (deflated by PPI)

Industry-level shock

- Tradable sectors

  - average change in revenues in April and May (deflated by PPI)

Industry-level shock

- Non-tradable sectors

  - daily credit card spending in 250 spending categories for all provinces

  - year-on-year changes in monthly credit card spending (deflated by CPI)

Industry-level shock

- Non-tradable sectors

    - average decline in credit card spending in April and May (deflated by CPI)
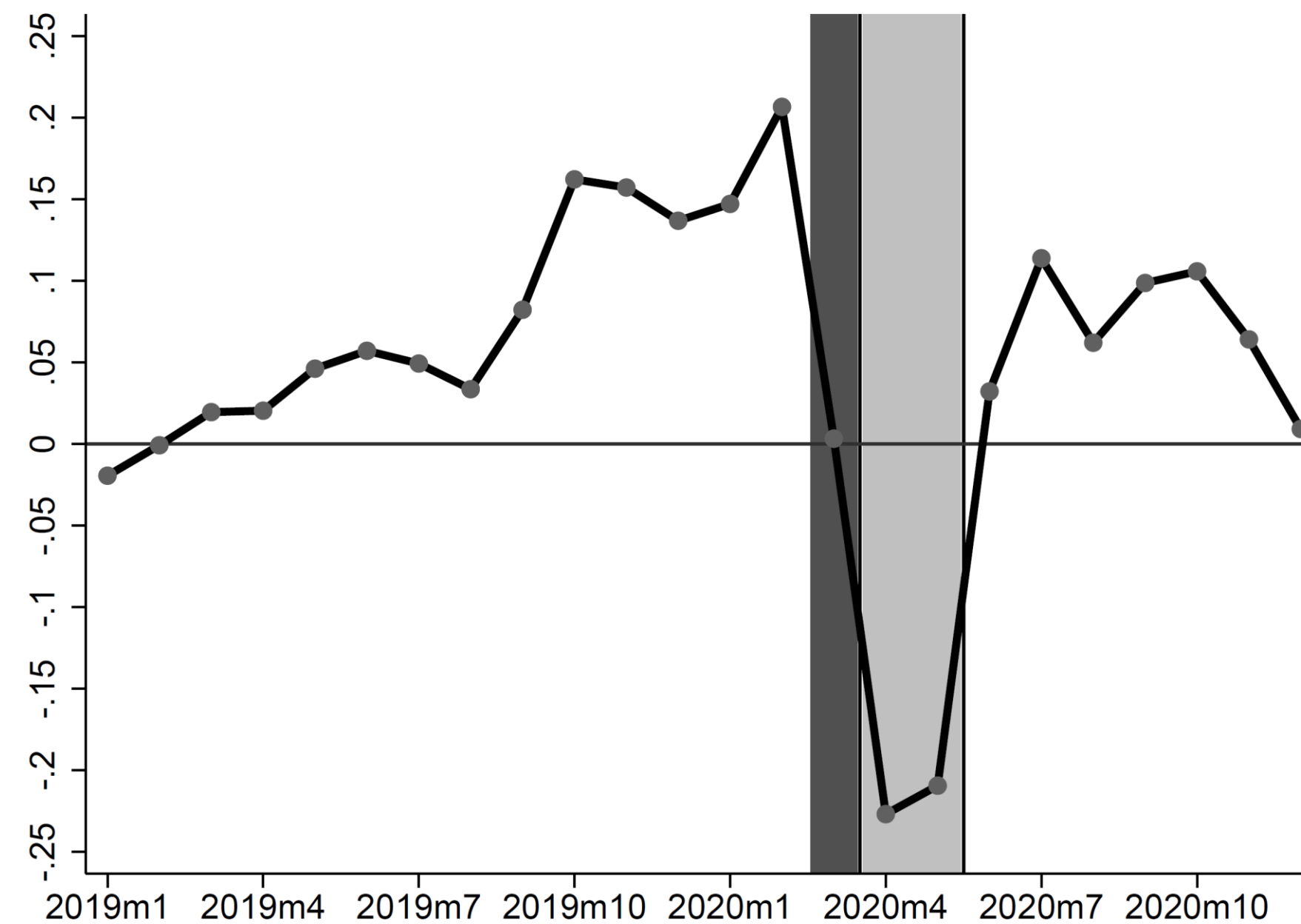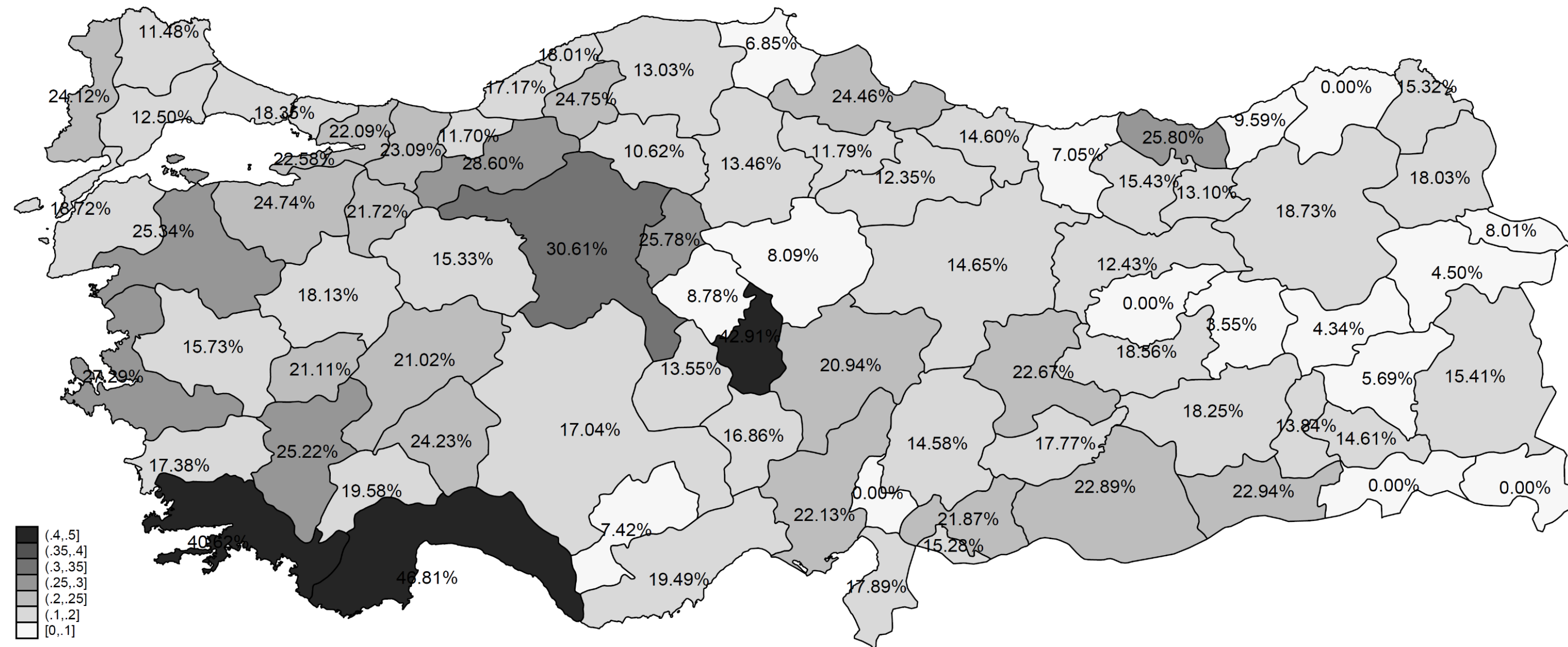
Industry-level shock

- Non-tradable sectors

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Industry-level shock

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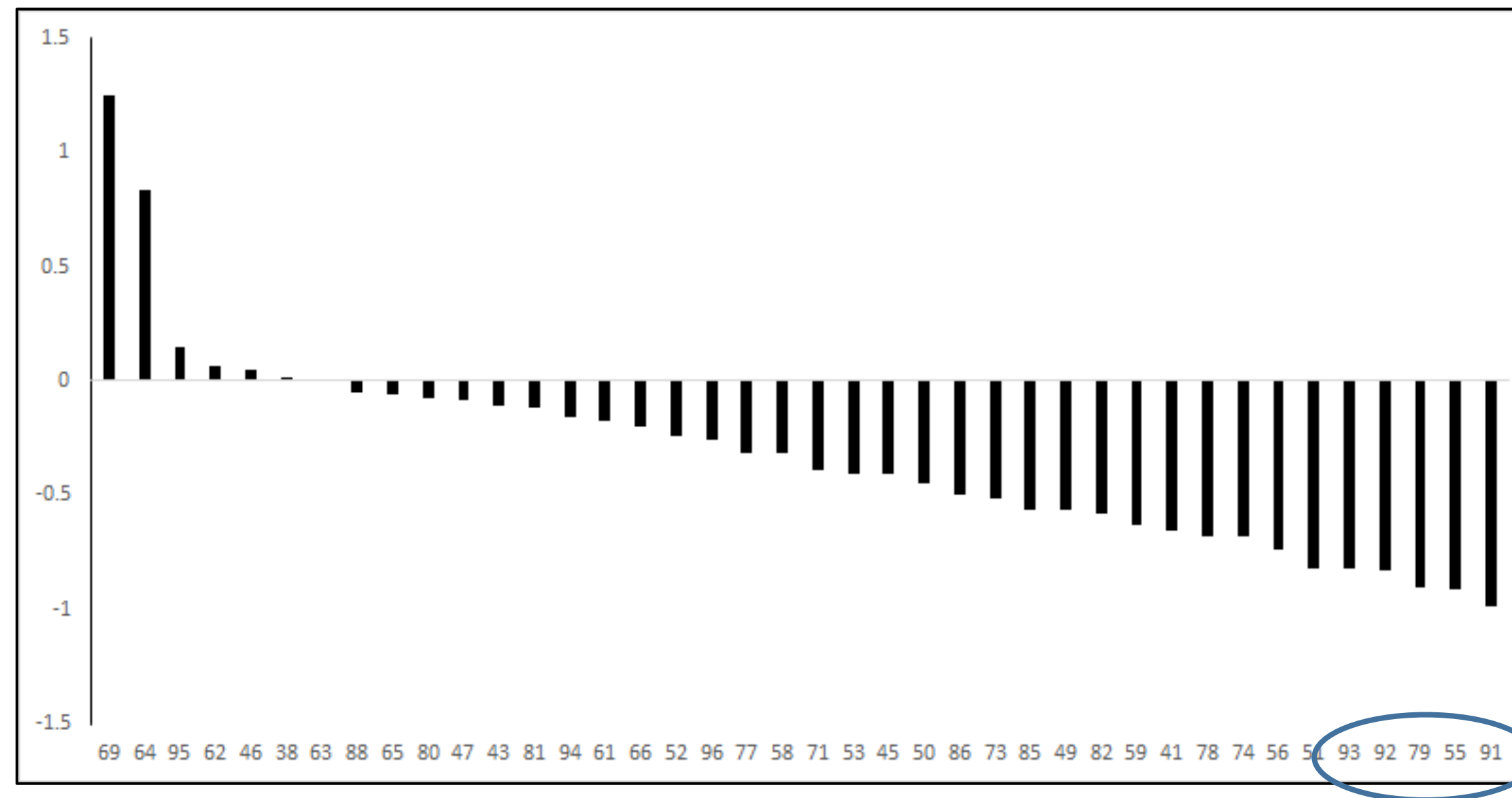
most affected industries

91 – Libraries, museums, etc.

55 – Hotels and similar

79 – Travel agencies
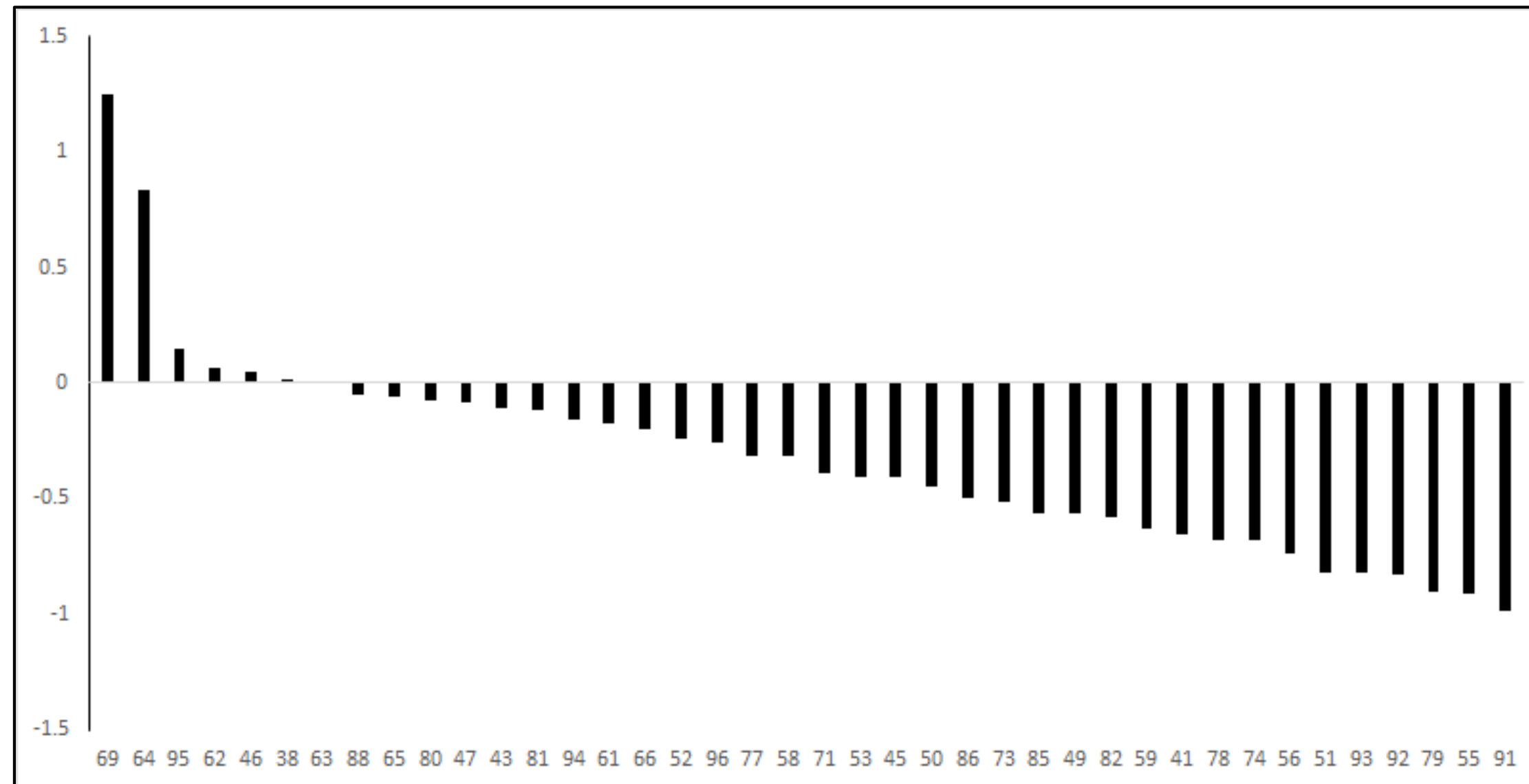
92 – Gambling and betting

93 – Sports, amusement and recreation

Industry-level shock

- Non-tradable sectors

    - average change in credit card spending in April and May (deflated by CPI)
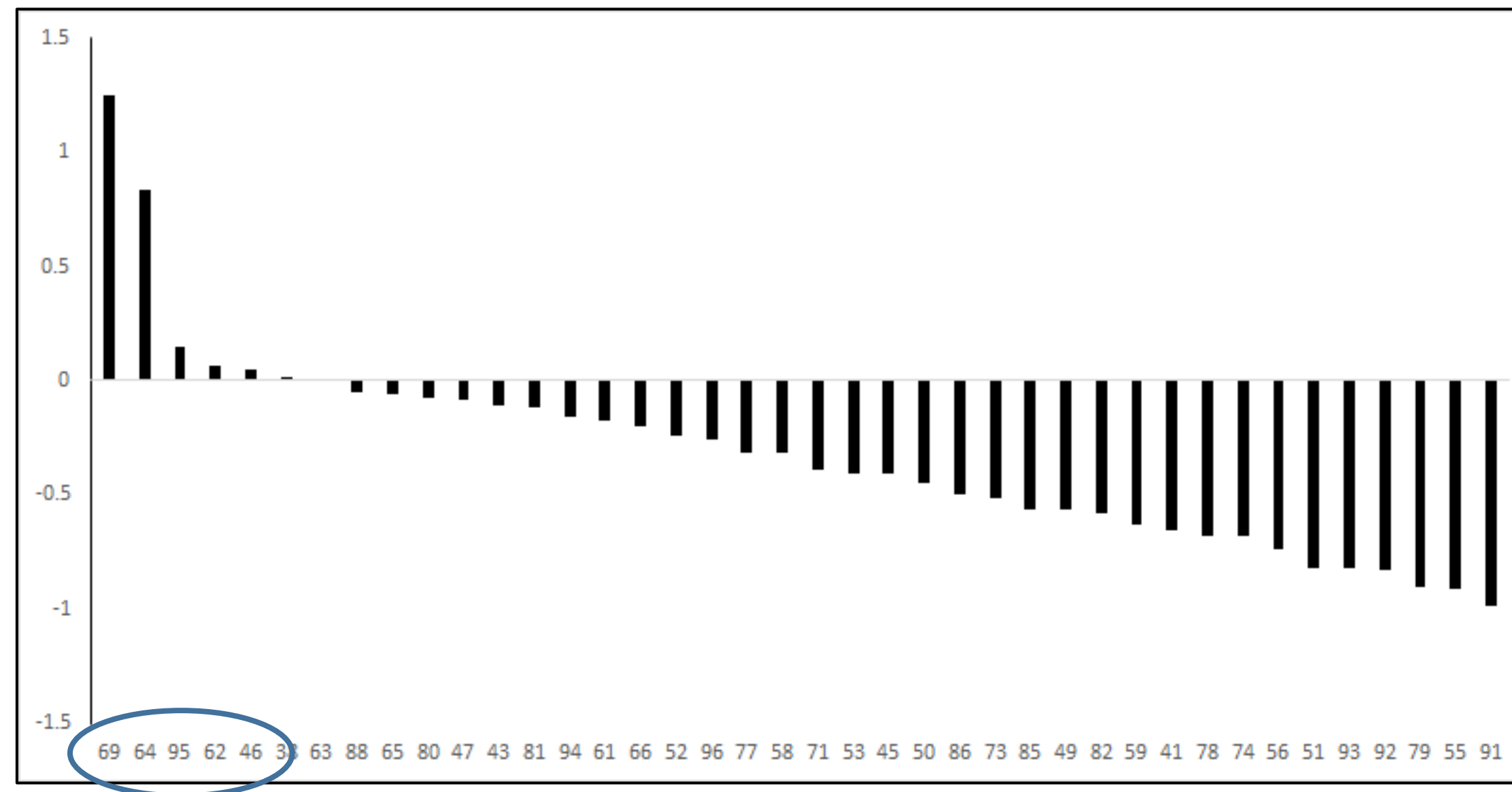
least affected industries

69 – Legal and accounting

64 – Financial service activities

95 – Repairs

62 – Computer programming and consultancy

46 – Wholesale trade

Bank-level exposure

- Weighted sum of exposure to each industry

$$Exposure_i = \sum_n \frac{Loans_{i,n}}{Loans_i} Exposure_{i,n},$$

Bank-level exposure

- Weighted sum of exposure to each industry

$$Exposure_i = \sum_n \left(\frac{Loans_{i,n}}{Loans_i} \right) Exposure_{i,n},$$

pre-pandemic short-term loan portfolio shares calculated in December 2019

Bank-level exposure

- Weighted sum of exposure to each industry

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exposure of bank *i* to industry *n*

Bank-level exposure

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- tradable sectors

$$Exposure_{i,n} = \frac{DomesticSales_{i,n}}{AllSales_{i,n}} Exposure_n^d + \frac{Exports_{i,n}}{AllSales_{i,n}} Exposure_n^e,$$

Bank-level exposure

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decline in domestic revenues

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decline in domestic revenues   decline in export revenues

Bank-level exposure

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$$Exposure_{i,n} = \frac{DomesticSales_{i,n}}{AllSales_{i,n}} Exposure_n^d + \frac{Exports_{i,n}}{AllSales_{i,n}} Exposure_n^e,$$

- non-tradable sectors

$$Exposure_{i,n} = \sum_p \frac{Loans_{i,n,p}}{Loans_{i,n}} Exposure_{n,p},$$

decline in credit card spending in industry *n* and province *p*

Empirical Methodology

- Diff-in-diff estimation method

$$log(Loans_{i,j,t}) = \alpha Exposure_i \times Post_t + \delta_{j,t} + \delta_{i,j} + u_{i,j,t},$$

- time period: January 2019 – September 2020 (excluding March 2020)

Empirical Methodology

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- Diff-in-diff estimation method

firm x year-month fixed effects

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- to control for loan demand: firm x year-month fixed effects (Khwaja and Mian, 2008)

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- bank x firm fixed effects

- standard errors are clustered at the bank x year-month level

Final Sample

- We focus on privately-owned commercial banks (27 banks)

  - exclude state-owned banks: less binding financial constraints and intermediate government support during the pandemic

- Firm x year-month fixed effects

  - only multi-bank firms are included (176,628 firms)

- In total, 7,998,882 monthly bank-firm observations
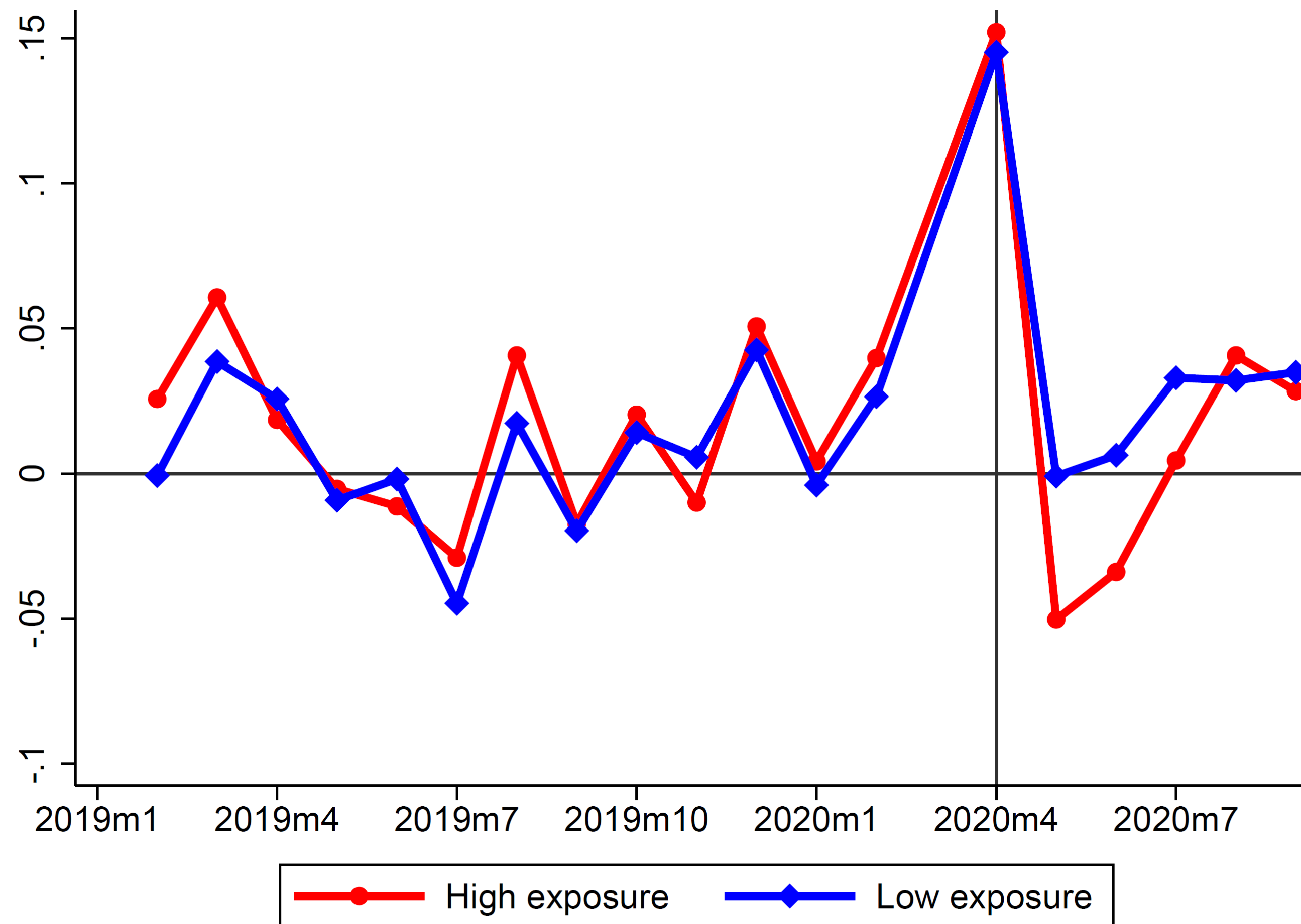
Outline

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Main Results

log change in average loans by bank exposure

Main Results

	Total loans (1)	Short-term loans (2)	Long-term loans (3)
A- Main effect			
Post x exposure	-6.42929***	-7.52732***	-8.94413***
	(0.74741)	(0.92541)	(0.88764)
R-squared	0.913	0.870	0.944
N	7,998,882	6,461,979	3,236,316
B- Monthly effects			
April x exposure	-3.70352**	-2.84975**	-8.19529***
	(1.79474)	(1.34877)	(1.85545)
May x exposure	-5.89784***	-5.57519***	-9.04003***
	(1.21049)	(1.49419)	(1.06114)
June x exposure	-7.46207***	-8.66790***	-8.76738***
	(1.14931)	(1.34791)	(1.48603)
July x exposure	-7.40921***	-9.51883***	-8.67894***
	(1.26175)	(1.27889)	(1.56651)
August x exposure	-7.54376***	-9.87282***	-9.17271***
	(1.38666)	(1.24974)	(1.92158)
September x exposure	-7.15358***	-9.63658***	-10.23669***
	(1.34657)	(1.24181)	(2.16601)
R-squared	0.913	0.870	0.944
N	7,998,882	6,461,979	3,236,316

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

- Higher exposure leads to a significant reduction in banks' loan supply
- 1 p.p. increase in the exposure led to a 6.64 percent reduction

- Both short- and long-term loans are affected

Main Results
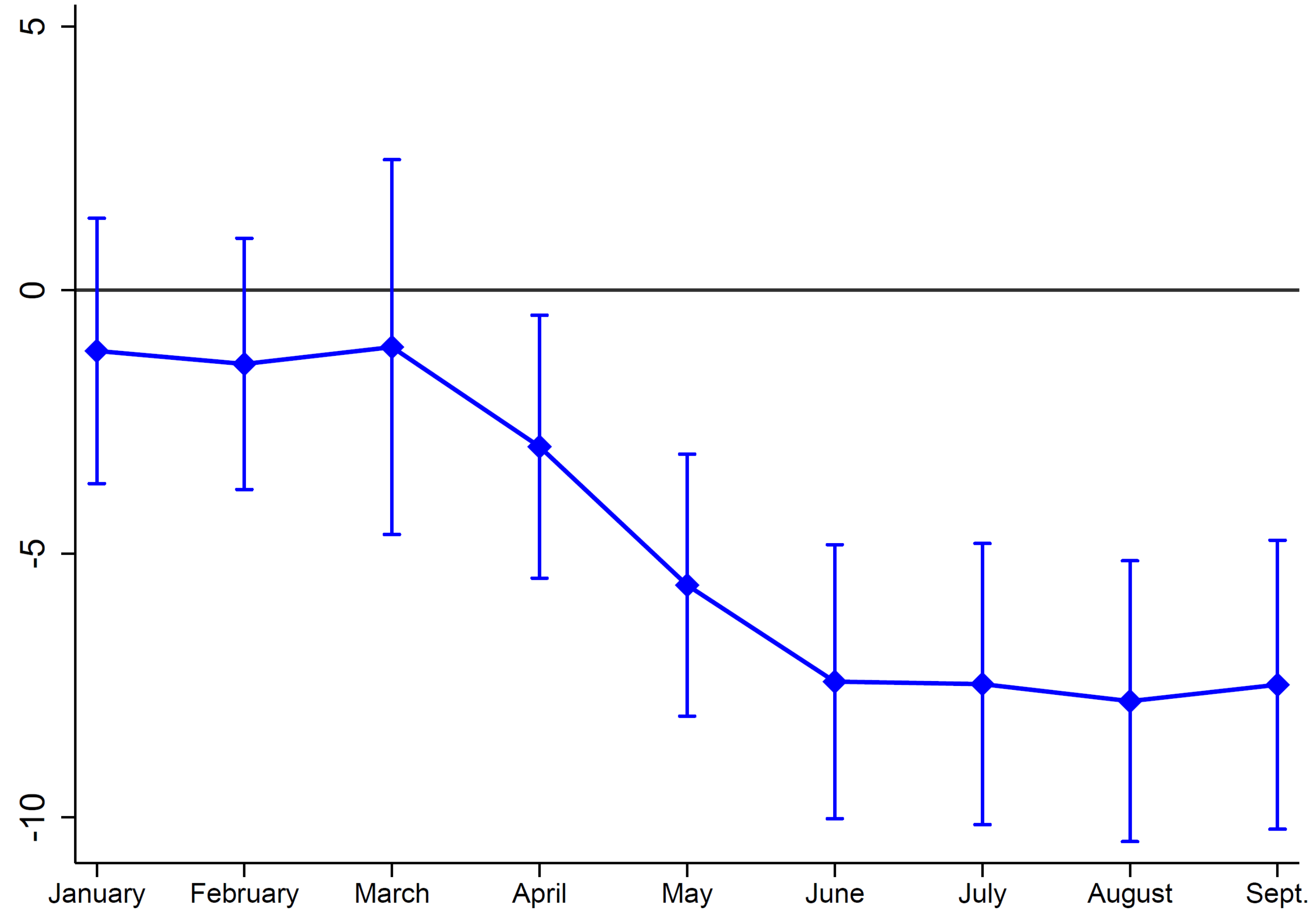
Main Results

- Less- vs more-affected industries

	Less-affected industries			More-affected industries		
	Total loans	Short-term loans	Long-term loans	Total loans	Short-term loans	Long-term loans
	(1)	(2)	(3)	(4)	(5)	(6)
Post x exposure	-6.67450***	-7.41333***	-9.87973***	-6.24386***	-7.48094***	-8.62280***
	(0.71450)	(0.97230)	(0.97822)	(0.74711)	(0.87599)	(0.84906)
R-squared	0.903	0.865	0.934	0.915	0.871	0.946
N	3,277,346	3,277,346	3,277,346	2,645,843	2,645,843	2,645,843

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

- Reduction in banks' loan supply is of similar size across firms in less- and more-affected industries

Main Results

- whether firm size matters

	Total loans			
	Employment < 250 (1)	Employment ≥ 250 (2)	Employment ≥ 500 (3)	Employment ≥ 1000 (4)
Post x exposure	-6.73936*** (0.79145)	-3.11367*** (0.49973)	-3.04048*** (0.55829)	-2.50322*** (0.68268)
R-squared	0.907	0.912	0.870	0.909
N	7,763,268	235,614	180,421	17,475

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

- Bank are more hesitant to decrease their loans to larger firms

Firm-level Regression

- Diff-in-diff estimation method

industry x province x year-month fixed effects

$$log(Loans_{j,t}) = \alpha Exposure_j \times Post_t + \delta_j + \delta_{n,p,t} + u_{j,t},$$

- time period: January 2019 – September 2020 (excluding March 2020)

- Post = 1 from April 2020 onwards and 0 otherwise

- industry x province x year-month fixed effects

- firm fixed effects

- standard errors are clustered at the firm level

Firm-level Regression

- Diff-in-diff estimation method

$$log(Loans_{j,t}) = \alpha Exposure_j \times Post_t + \delta_j + \delta_{n,p,t} + u_{j,t},$$

firm j's exposure to the shock via its banks

- firm-level exposure:

$$Exposure_j = \sum_i \frac{Loans_{i,j}}{Loans_j} Exposure_i,$$

Firm-level Results

	Total loans (1)	Bank exposure (2)	Number of banks (3)	State-owned share (4)
A- Main effect				
Post x exposure	-3.84251***	-0.06805***	-1.77516***	0.16367***
	(0.30315)	(0.00391)	(0.21662)	(0.05008)
R-squared	0.899	0.889	0.920	0.826
N	5,549,367	5,549,367	5,549,367	5,549,367
B- Monthly effects				
April x exposure	-1.40784***	-0.01092***	-1.31427***	0.25999***
	(0.30325)	(0.00288)	(0.20355)	(0.04706)
May x exposure	-2.88282***	-0.04352***	-1.45548***	0.19783***
	(0.33849)	(0.00394)	(0.21955)	(0.05182)
June x exposure	-4.33092***	-0.07036***	-1.64166***	0.17653***
	(0.33653)	(0.00418)	(0.23412)	(0.05411)
July x exposure	-4.84365***	-0.08703***	-2.01625***	0.13821**
	(0.34527)	(0.00497)	(0.23990)	(0.05548)
August x exposure	-4.78704***	-0.09603***	-2.02324***	0.12058**
	(0.35277)	(0.00511)	(0.24915)	(0.05663)
September x exposure	-4.91509***	-0.10355***	-2.23281***	0.08314
	(0.35841)	(0.00507)	(0.26065)	(0.05730)
R-squared	0.899	0.889	0.920	0.826
N	5,549,367	5,549,367	5,549,367	5,549,367

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

- Firms could not avoid a reduction in their total loans
- 1 p.p. increase in firms' exposure led to an almost 4 percent drop

Firm-level Results

- Government support through state-owned banks

	Without state-owned bank relationship				With state-owned bank relationship			
	Total loans (1)	Bank exposure (2)	Number of banks (3)	State-owned share (4)	Total loans (5)	Bank exposure (6)	Number of banks (7)	State-owned share (8)
Post x exposure	-4.81021*** (0.41575)	-0.05220*** (0.00432)	-0.70027*** (0.21013)	-0.09137* (0.05413)	-2.81100*** (0.39893)	-0.09716*** (0.00777)	-3.20009*** (0.48500)	0.46799*** (0.10247)
R-squared	0.847	0.904	0.919	0.409	0.903	0.825	0.900	0.727
N	3,540,952	3,540,952	3,540,952	3,540,952	1,990,869	1,990,869	1,990,869	1,990,869

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

- Firms with an existing relationship with a state-owned bank experienced a significant increase in the share of its loans from state-owned banks

- As a result, they had a significantly less reduction in their total loans

Firm-level Results

- Less- vs more-affected industries

	Less-affected industries				More-affected industries			
	Total loans	Bank exposure	Number of banks	State-owned share	Total loans	Bank exposure	Number of banks	State-owned share
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post x exposure	-4.13593***	-0.07474***	-1.40268***	0.17505**	-3.61572***	-0.09562***	-2.15948***	0.28156***
	(0.51824)	(0.00609)	(0.36960)	(0.08019)	(0.48439)	(0.01252)	(0.38424)	(0.09071)
R-squared	0.898	0.858	0.922	0.924	0.791	0.876	0.920	0.821
N	2,086,085	2,086,085	2,086,085	2,086,085	2,067,175	2,067,175	2,067,175	2,067,175

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

- Firms in both types of industries experienced a significant reduction in their loan supply

Firm-level Results

- Whether firm size matters

	Total loans			
	Employment < 250 (1)	Employment ≥ 250 (2)	Employment ≥ 500 (3)	Employment ≥ 1000 (4)
Post x exposure	-3.90016*** (0.30860)	-4.67089*** (1.75140)	-2.69234 (2.95507)	-2.10404 (2.99810)
R-squared	0.895	0.805	0.908	0.907
N	5,470,850	71,126	27,680	10,717

*** p<0.01, ** p<0.05, * p<0.1

- Large firms could switch to other banks and avoid a reduction in their total loans

Firm-level Results

- Impact on firm sales

	All (1)	Tradable industries (2)	Non-tradable industries (3)
Q2 x industry exposure	-0.72816***	-0.83989***	-0.72757***
	(0.00890)	(0.02680)	(0.00943)
Q3 x industry exposure	-0.12301***	-0.03103	-0.13033***
	(0.00878)	(0.02467)	(0.00935)
Q2 x exposure	-0.89483***	0.10173	-1.54909***
	(0.27749)	(0.46102)	(0.34408)
Q3 x exposure	-0.82129***	-1.03885**	-0.76715**
	(0.28178)	(0.47216)	(0.34855)
R-squared	0.921	0.915	0.945
N	575,151	145,897	429,254

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

- Higher exposure to the shock led to a significant drop in firm sales

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- Negative shocks affecting certain industries can be transmitted to the rest of the economy through banks

  - identification: exogeneity and heterogeneity of industry-level shocks caused by the COVID-19 pandemic

  - highlight the interconnectedness of the economy through financial intermediaries

- Large firms could avoid the shock by switching to less-exposed banks

- Firms that had a relationship with a state-owned bank could alleviate it by borrowing from state-owned banks