

# COVID-19, Lockdowns and International Trade: Evidence from Firm-Level Data

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# Motivation

## COVID-19, lockdowns, health conditions and trade

- The COVID-19 pandemics, the ensuing health crisis and the lockdowns imposed to contain infections impacted international trade flows.
- Lockdowns may exist for different motives (e.g. pandemics, extreme climate events, social unrest), and health crises may have different causes.
- Measuring the impact of lockdowns and health crisis is relevant for policy action and mitigation.

Research question: **Quantify the impact of lockdowns and health conditions on international trade flows.**

# Motivation

## Adaptability of firms, households and international traders to circumstances

- The long duration of the pandemics (several waves of infection) prompted adaptation strategies by firms, households and international trade operators.
- Assessing the resilience of international traders to shocks is relevant for policy action.
- Earlier studies could not address this question. More data became available as the pandemics unfolded.

Research question: **Assess the time-varying impact of lockdowns on firm-level export and import flows (on a quarterly basis).**

# Motivation

## Heterogeneity in terms of firms' size

- The strong heterogeneity in terms of the size of firms operating in foreign markets is likely to interact with their response under lockdown conditions.
- Larger traders may have a wider portfolio of clients and suppliers that allows to sustain the operation under lockdowns.
- But smaller traders, dealing with more limited shipments, may be more agile in overcoming transport restrictions associated with lockdowns.

Research question: **Assess the differential impact of lockdowns by firms' size category.**

# Motivation

## Heterogeneity in terms of firms' engagement in GVCs

- During the past decades the organization of production at the global level went through deep transformations and became based on GVCs.
- If lockdowns trigger disruptions in transportation systems or in the operation of key component suppliers, the impact is large and propagates through the production chain (cascading effect).

Research question: **Assess differential impact of lockdowns for firms more engaged in GVC and also for those operating in sectors with a higher import content.**

# Motivation

## Different impacts across trade partner countries

- Some trade partners may be more important in terms of origin of value added incorporated in exports, thus leading to different impacts of stringency measures on trade flows.
- The geographic location is likely to affect the options in terms of logistics and means of transport, which interact with lockdown measures that reduce mobility.

Research question: **Assess the differential impact of lockdowns across trade partner countries.**

**Nature of the paper  $\implies$  empirical exercise**

## Trade data

- The database used includes export and import transactions reported by firms from January 2020 to June 2021 (Statistics Portugal).
- A transaction record includes the firm tax identification, the three digit firm code of Nomenclature of Economic Activities, the eight digit product code of Combined Nomenclature, the value of the transaction (expressed in current euros) and the destination or origin country.
- The firm-level data used covers more than 96% of total exports and more than 92% of total imports in this period.



## Trade data

<b>Firm-level (Jan. 2020 - June 2021)</b>	Exports	Imports
Number of firms	35,731	130,760
Number of partner countries		
- mean	3.4	1.8
- standard deviation	6.8	2.5
- median	1.0	1.0
Flows (Thousand Euros)		
- mean	2,293.6	755.0
- standard deviation	34,067.2	20,813.2
- median	6.2	0.3

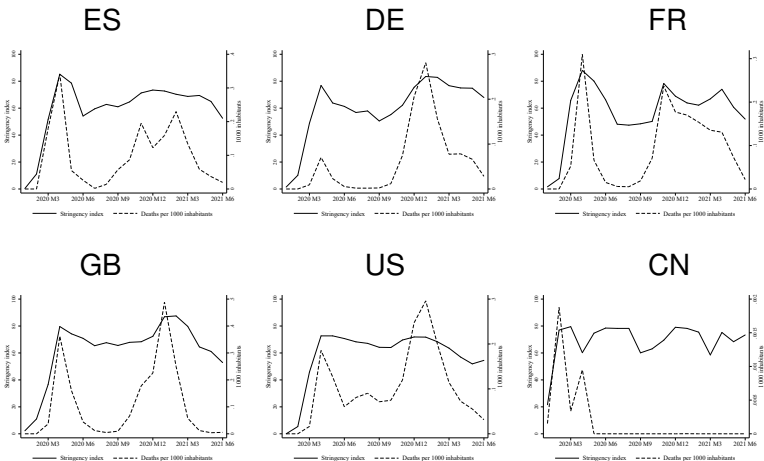
## Lockdowns and COVID deaths data

### Data on stringency of lockdowns

- Stringency of containment measures in each trade partner (Oxford COVID-19 Government Response Tracker).
- The COVID-19 Government Response Stringency Index is computed as a simple additive score of nine indicators measured on an ordinal scale, rescaled to vary from 0 (no restrictions) to 100 (full lockdown). Indicators trace policies such as school closures, workplace closing, stay-at-home requirements and travel bans.
- Deaths per 1000 inhabitants due to COVID-19 (John Hopkins University).

Database

# Stringency index and deaths per 1000 inhabitants by partner country



Sources: Lockdown stringency index (Covidtracker BSG-Oxford) and deaths per 1000 inhabitants due to COVID-19 (John Hopkins University).

# Regressions

$$\left[ \ln(\text{TradeFlow}_{ijt_n}) - \ln\left(\frac{\sum_{k=2017}^{2019} \text{TradeFlow}_{ijtk}}{3}\right) \right] \times 100 = \alpha + \beta X_{jt} + \gamma_i + \delta_j + \lambda_t + \epsilon_{ijt} \quad (1)$$

$\text{Exports}_{ijt_n}$  ( $\text{Imports}_{ijt_n}$ ): Exports (Imports) of firm  $i$  for (from) country  $j$  in month  $t$  of year  $n$  (2020 and 2021) in relation to the average of the same month in the three years,  $k$ , before the pandemics (2017, 2018 and 2019)

$X_{jt}$ : Stringency index; deaths per thousand inhabitants in country  $j$  in month  $t$  of the period January 2020 - June 2021

# Results I

## Stringency of lockdowns and firms' exports

VARIABLES	(1) HDFE	(2) HDFE	(3) HDFE
Deaths per thousand	-31.197*** (3.806)		-25.250*** (3.994)
Stringency index		-0.213*** (0.031)	-0.149*** (0.032)
Constant	16.755*** (0.367)	26.449*** (1.745)	24.712*** (1.764)
Observations	447,535	447,535	447,535
Adjusted R-squared	0.117	0.117	0.117
Firm FE	YES	YES	YES
Country FE	YES	YES	YES
Time FE	YES	YES	YES

Robust standard errors in parentheses

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

# Results I

## Stringency of lockdowns and firms' imports

VARIABLES	(1) HDFE	(2) HDFE	(3) HDFE
Deaths per thousand	-28.265*** (3.667)		-22.013*** (3.901)
Stringency index		-0.196*** (0.029)	-0.133*** (0.031)
Constant	5.749*** (0.357)	14.999*** (1.699)	13.088*** (1.727)
Observations	522,687	522,687	522,687
Adjusted R-squared	0.120	0.120	0.120
Firm FE	YES	YES	YES
Country FE	YES	YES	YES
Time FE	YES	YES	YES

Robust standard errors in parentheses

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

## Robustness checks

- We use lagged stringency index as regressor - results of the 1-lag specification remain significant and qualitatively unchanged and 2-lags are not significant at a 5% significance level.
- We use Google Mobility Reports as alternative measure of mobility constraints - coefficients are positive as higher mobility is equivalent to lower restrictions.

▶ Robustness tests – Exports - lags and Google Mobility indicators

▶ Robustness tests – Imports - lags and Google Mobility indicators

▶ Correlation between stringency index and Google mobility indices

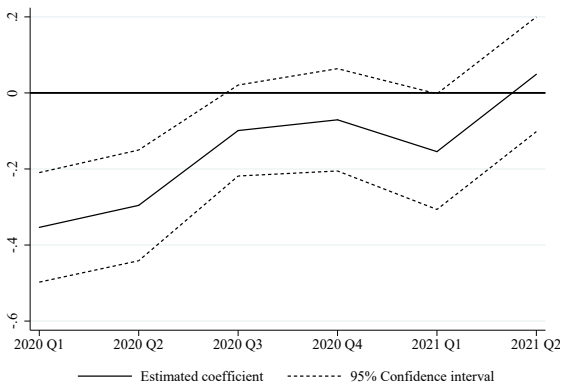
## Robustness checks

- We construct sub-indices with the same methodology of the overall stringency index: one excluding dimensions that are not expected to interfere with traders' activity and one keeping only dimensions closely related to mobility.
- The coefficients are qualitatively similar to those obtained in the baseline specification, thus sustaining our conclusions. ▶ Robustness tests – alternative indices of lockdowns' stringency



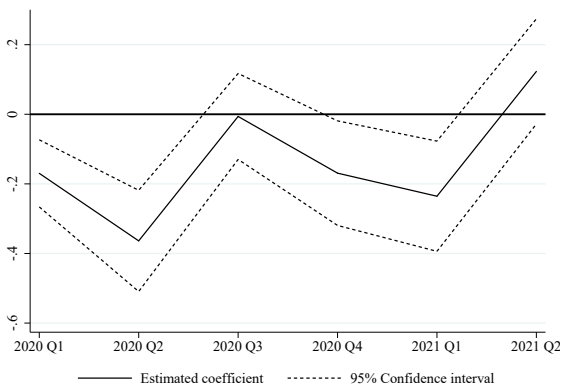
## Results II

### Impact of lockdowns on exports in each quarter of 2020 and 1<sup>st</sup> half of 2021



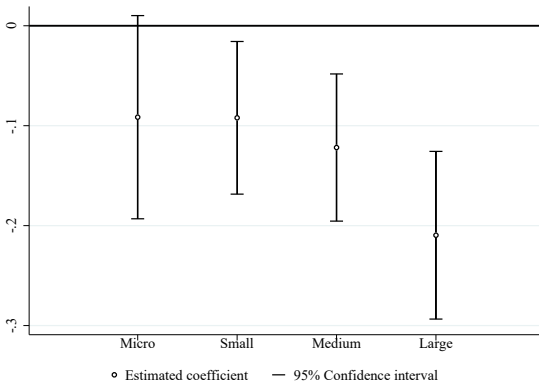
## Results II

### Impact of lockdowns on imports in each quarter of 2020 and 1<sup>st</sup> half of 2021



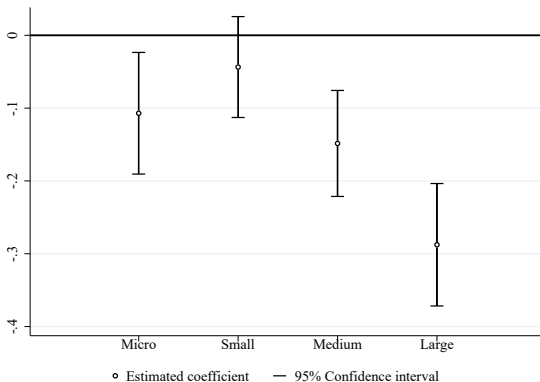
# Results III

## Impact of lockdowns on exports by firm size



# Results III

## Impact of lockdowns on imports by firm size



## Results IV

### Impact for firms with and without foreign capital

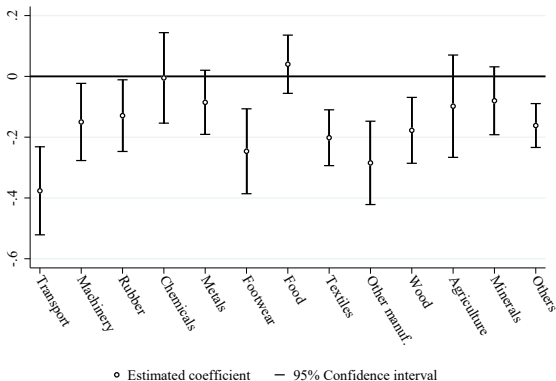
VARIABLES	(1) Exports	(2) Imports
Deaths per thousand		
No foreign capital	-32.523*** (4.516)	-27.058*** (4.493)
With foreign capital	-7.394 (6.815)	-7.846 (5.999)
Stringency		
No foreign capital	-0.100*** (0.034)	-0.125*** (0.033)
With foreign capital	-0.241*** (0.042)	-0.163*** (0.039)
Constant	22.643*** (1.846)	11.263*** (1.828)
Observations	412,949	476,874
R-squared	0.133	0.136
Firm FE	YES	YES
Country FE	YES	YES
Time FE	YES	YES

Robust standard errors in parentheses

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

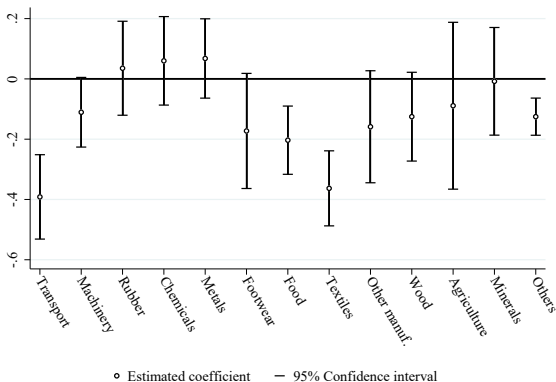
## Results V

## Impact of lockdowns on exports by sector



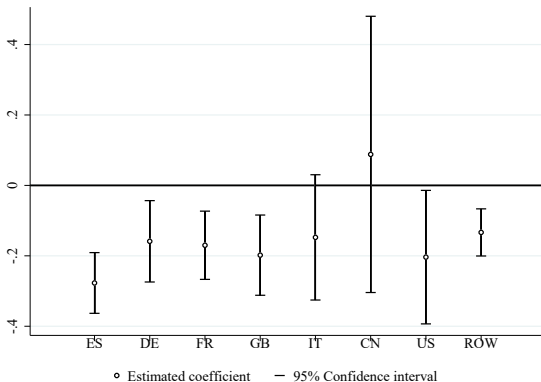
## Results V

## Impact of lockdowns on imports by sector



## Results VI

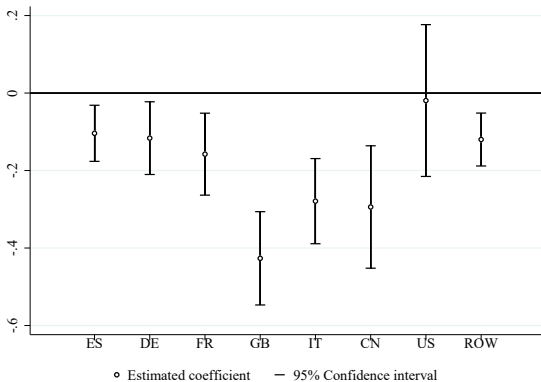
### Impact of stringency of lockdowns on export flows by destination country





## Results VI

## Impact of stringency of lockdowns on export flows by origin country



## Concluding remarks

- The effects of lockdowns on trade flows are sizeable and similar for exports and imports.
- The quarterly impact of lockdowns on trade has diminished as of the second half of 2020, signaling strong adaptability by firms to operate under adverse circumstances.
- The third wave of the pandemics in late 2020 and early 2021, brought about a stronger impact of lockdowns, but such effect wore off in the second quarter of 2021.

## Concluding remarks

- The detrimental impact of lockdowns increases with firm size, both in exports and imports.
- Firms with foreign capital, industries with high import content and the trade partners that are more important as sources of value added are also those where the negative impact of lockdowns on trade is larger.

*Thank you!*  
*Muito obrigada!*

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## Stringency of lockdowns, retail and transit-station Google mobility and firms' **exports**

VARIABLES	(1) HDFE	(2) HDFE	(3) HDFE	(4) HDFE
Deaths per thousand	-29.957*** (3.842)	-30.252*** (3.856)	-20.911*** (4.169)	-16.336*** (4.340)
Stringency – 1 month lag	-0.069** (0.032)			
Stringency – 2 months lag		0.058* (0.032)		
Transit-station mobility			0.211*** (0.033)	
Retail mobility				0.229*** (0.031)
Constant	20.330*** (1.681)	13.513*** (1.772)	21.721*** (0.910)	21.018*** (0.719)
Observations	447,529	420,868	435,280	435,544
Adjusted R-squared	0.117	0.119	0.119	0.119
Firm FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES

Robust standard errors in parentheses

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

## Stringency of lockdowns, retail and transit-station Google mobility and firms' imports

VARIABLES	(1) HDFE	(2) HDFE	(3) HDFE	(4) HDFE
Deaths per thousand	-24.736*** (3.708)	-29.394*** (3.721)	-11.654*** (4.232)	-14.362*** (4.383)
Stringency – 1 month lag	-0.218*** (0.029)			
Stringency – 2 months lag		-0.025 (0.030)		
Transit-station mobility			0.236*** (0.033)	
Retail mobility				0.143*** (0.030)
Constant	17.538*** (1.619)	6.724*** (1.710)	9.022*** (0.890)	6.091*** (0.722)
Observations	522,684	492,133	490,747	490,738
Adjusted R-squared	0.120	0.122	0.120	0.120
Firm FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES

Robust standard errors in parentheses

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

## Correlation between the stringency index and the transit-station and retail mobility (in percentage)

	Transit-station mobility	Retail mobility
All countries	-60.34	-62.62
Portugal	-86.81	-67.66
Spain	-73.06	-70.98
Germany	-85.48	-75.26
France	-84.70	-83.18
United Kingdom	-94.63	-80.58
United States	-91.74	-72.87

Note that there is no information for China in Google Mobility Reports.

[← Return](#)

## Alternative indices of lockdowns' stringency

VARIABLES	(1) Exports	(2) Exports	(3) Imports	(4) Imports
Deaths per thousand	-24.878*** (4.032)	-28.665*** (3.898)	-19.184*** (3.960)	-24.444*** (3.739)
C1,C2,C5,C6,C7,C8 index	-0.128*** (0.028)		-0.152*** (0.026)	
C6,C7,C8 index		-0.061*** (0.023)		-0.087*** (0.021)
Constant	22.008*** (1.212)	19.499*** (1.075)	12.231*** (1.188)	9.917*** (1.068)
Observations	447,562	447,562	522,699	522,699
R-squared	0.139	0.139	0.145	0.145
Firm FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES

Robust standard errors in parentheses

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

← Return

The C1,C2,C5,C6,C7,C8 index comprises school closures (C1), workplace closing (C2), public transportation (C5), stay at home order (C6), restrictions on internal movement (C7) and international travel controls (C8). The C6,C7,C8 index includes the last three indicators.