The viral effects of foreign trade and supply networks in the euro area

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Abstract: Containment measures of COVID-19 have generated a chain of supply and demand shocks around the globe with heterogeneous fallout across industries and countries. We quantify their transmission via foreign trade with a focus on the euro area where deep firm integration within regional supply chains and strong demand linkages act as a magnification mechanism. We estimate that spillover effects in the euro area from suppression measures in one of the five main euro area countries range between 15-28% the size of the original shock; negative foreign demand shocks depress euro area aggregate activity by about a fifth the size of the external shock and a fourth of the total effect is due to indirect propagation through euro area supply chain. Last, reopening to regional tourism softened the contraction of aggregate activity due to travel and tourism bans by about a third in the euro area. Our findings suggest that enhanced coordination of recovery plans would magnify their beneficial effects.

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Motivation

The urge of:

- assessing the economic fallout in the EA of COVID-19 and of policies to contain its spreading

- Inform the high-level policy debate at the ECB and in Europe on rapidly evolving topics:
  - Jan 2020 the exposure of EA economy to China's lockdown
  - Feb-Mar 2020 the impact of Italy's lockdown on the rest of the EA
  - April 2020 spillovers and the propagation power of shocks originated by containment measures in several large EA economies
  - May-Aug 2020 bans on hospitality travel and tourism beneficial effects from reopening Schengen Borders
  - October 2020 2nd wave economic impacts, enlightens current debate based on previous analysis

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Approach

- Find a single overarching framework suitable to address multiple questions
- Highlights the power of supply network and demand linkages in the EA in propagating shocks
- Allow the decomposition of the full shock transmission into :
  - direct effects on trading partners and indirect spillovers on third countries via trading partners;
  - direct impact on industries concerned by suppression measures and chain effects on upstream and downstream industries through lower inputs demand and supply
- Overcome the limitations of sheer analysis of net trade exposure (neglecting indirect and domestic transmission mechanism of the shocks)

A glance at literature review
we are not alone but we were among the firsts

Altomonte C., Coali A., O.G., 2020. Back to the future: The forward-looking consequences of covid-19 across eu regions. Comp-net policy briefs No. 10.

Barrot, J.N., Grassi, B., Sauvagnat, J., 2020. Sectoral effects of social distancing.

Bodenstein, M., Corsetti, G., Guerrieri, L., 2020. Social distancing and supply disruptions in a pandemic .

Bonadio, B., Huo, Z., Levchenko, A.A., Pandalai-Nayar, N., 2020. Global supply chains inthe pandemic.

Brodeur, A., Gray, D.M., Islam, A., Bhuiyan, S., 2020. A literature review of the economics of covid-19 .

Di Nino V, Veltri B., September 2020. The viral effects of foreign trade and supply network in the euro area, ECB EB article issue 6 and forthcoming Compnet Policy note.

Farhi, E., Baqaee, D.R., 2020. Supply and demand in disaggregated keynesian economies with an application to the covid-19 crisis.

Javorcik, B., 2020. Global supply chains will not be the same in the post-covid-19 world.COVID-19 and Trade Policy: Why Turning Inward Won't Work , 111.

Maliszewska, M., Mattoo, A., Van Der Mensbrugghe, D., 2020. The potential impact ofcovid-19 on gdp and trade: A preliminary assessment.

Navaretti, G.B., Calzolari, G., Dossena, A., Lanza, A., Pozzolo, A.F., 2020. In and out lockdowns: Identifying the centrality of economic activities. Covid Economics , 189–20

Inter-Country Input-Output Tables (ICIOT)

ICIOT with G countries and N sectors

		Outputs			Final Demand				Total Output
		1	2	...	G	1	2	...	G	
Inputs	1	Z11	Z12	...	Z1G	Y11	Y12	...	Y1G	X1
	2	Z21			Z2G	Y21			...	X2
	...	...	...		...	...				...
	G	ZG1	ZG2	...	ZGG	YG1	YG2	...	YGG	XG
Value added		VA1	VA2	...	VAG					
Total Output		X1	X2	...	XG					

- GDP = total production– total intermediate input
- Exports = all production except for domestic sector
- Imports = all inputs except from domestic production

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Shocks to the ICIOT

ICIOT with G countries and N sectors

		Outputs				Final Demand				Total Output
		1	2	…	G	1	2	…	G	
Inputs	1	Z11	Z12	…	Z1G	Y11	Y12	…	Y1G	X1
	2	Z21			Z2G	Y21			…	X2
	…	…	…		…	…				…
	G	ZG1	ZG2	…	ZGG	YG1	YG2	…	YGG	XG
Value added		VA1	VA2	…	VAG					
Total Output		X1	X2	…	XG					

Example Shock
- Round 1: production shock to country 1, simultaneous intermediate demand shock
- Round 2: production shock to all affected countries, depending on intermediate shortage

Lockdown measures and supply shock in the EA

Aim of exercise

- Show how lockdown-induced supply shocks transmits within EA

Strategy

- Shock biggest EA countries individually and measure effect on others
  - First: production and intermediate demand
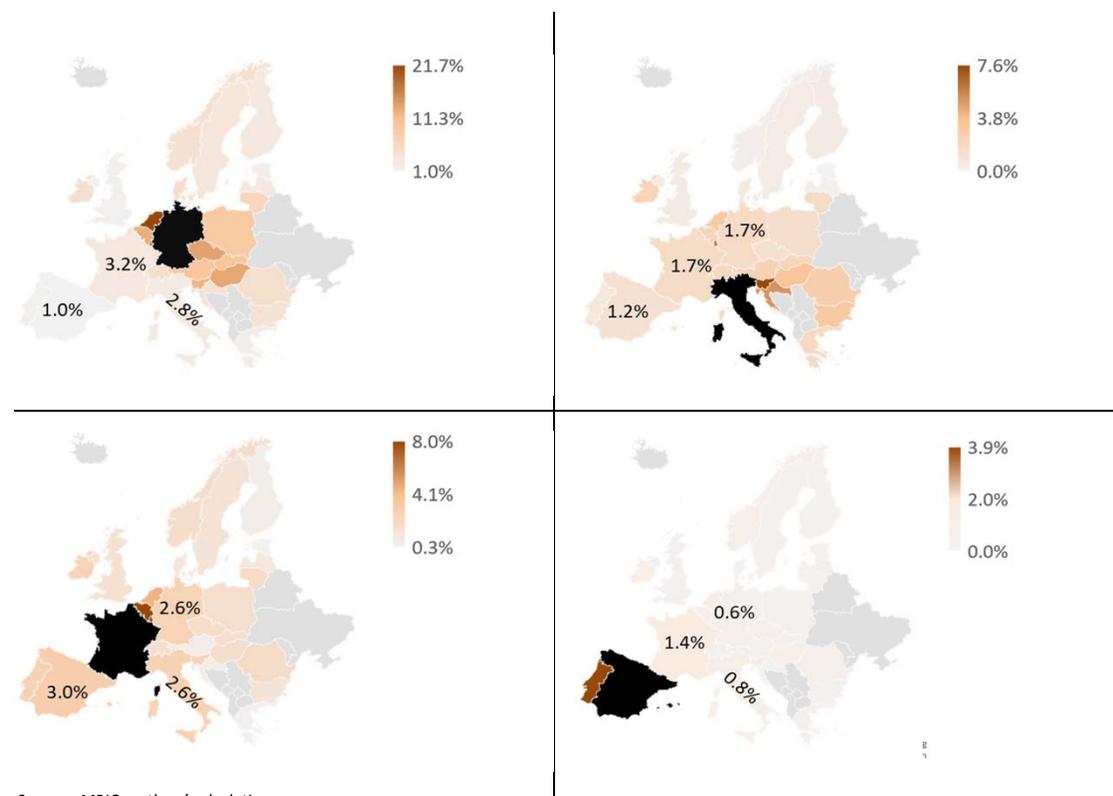 - Second: production in affected countries

Calibration

- sectoral distribution: based on ECB internal assessments

Shocks by NACE category (most shocked sector = 100)

Sector	Germany	France	Italy	Spain	The Netherlands
Agriculture	25.0	6.2	25.0	15.0	25.0
Industry (excluding manufacturing and construction)	75.0	9.9	75.0	15.0	75.0
Manufacturing	75.0	35.8	75.0	31.3	75.0
Construction	75.0	100.0	75.0	73.1	75.0
Retail trade, transport, accommodation and food service activities	100.0	64.2	100.0	98.5	100.0
Private services	47.5	22.1	25.0	41.5	51.6
Public administration	25.0	18.5	25.0	-3.0	25.0
Arts, entertainment, recreation and other activities	75.0	70.4	75.0	100.0	75.0

*Source: ECB staff calculations. Note: The shock in the most severely hit sector resulting
from containment measures is indexed to 100, shocks in the other sectors are a percentage of this. Private
services include several activities: information and communication, financial and insurance activities, real estate
activities and professional, scientific, administrative and technical activities.*
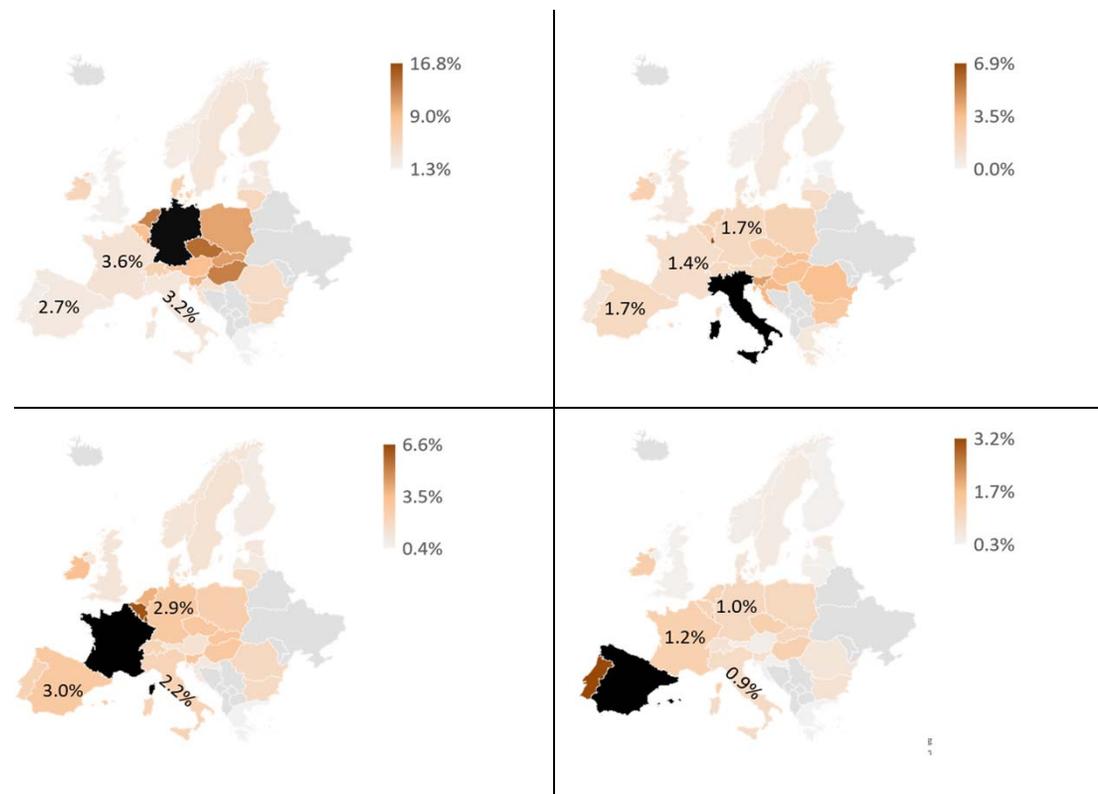
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EA Big 5 Shock
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Supply shock transmits most strongly to neighbours…

Sources: MRIO, authors' calculations

… and partners in production chains

Demand shock transmission somewhat more even…

Sources: MRIO, authors' calculations

… and related to originating country economic size

Most affected sectors are those EA country specialise in...

Relatively most affected sectors by supply shock

No	Germany shock	France shock	Italy shock	Spain shock	Netherlands shock
1	Coke, Petroleum, Fuel	Construction	Leather & Footwear	Hotels and restaurants	Mining & Quarrying
2	Transport equipment manufacturing	Air transport	Textiles	Activities of households as employers	Coke, Petroleum, Fuel
3	Electrical and optical equipment	Retail trade	Activities of households as employers	Air transport	Wholesale trade
4	Rubber & Plastics	Wholesale trade	Inland transport	Retail trade	Chemical products
5	Chemical products	Motor vehicles	Mining & Quarrying	Motor vehicles	Water transport
6	Basic and fabricated metal	Water transport	Hotels and restaurants	Other community, social, and personal services	Renting of M&Eq and other business activities
7	Motor vehicles	Inland transport	Retail trade	Wholesale trade	Rubber & Plastics
8	Machinery	Other supporting transport activities	Wholesale trade	Other supporting transport activities	Other supporting transport activities
9	Other supporting transport activities	Other community, social, and personal services	Water transport	Inland transport	Retail trade
10	Water transport	Hotels and restaurants	Basic and fabricated metal	Construction	Motor vehicles

Sources: MRIO, authors' calculations
Note: Relatively most affected sectors are those that experience the greatest contraction in GVA from the supply shock.

...and those with cross-cutting linkages in the economy

Foreign demand weakness and transmission to EA

Aim of exercise

- Evaluate fallouts on EA aggregate activity from global income shocks

Setup

- Shock to extra EA countries calibrated on IMF GDP forecast (WEO April-July 2020).

- Revisions pre-during pandemic = Magnitude and distribution across countries

Two step evaluation

- First: repercussions on exported domestic production of demand shocks outside EA (*direct*)

- Second: spillover on intermediate demand in affected countries (*indirect*)

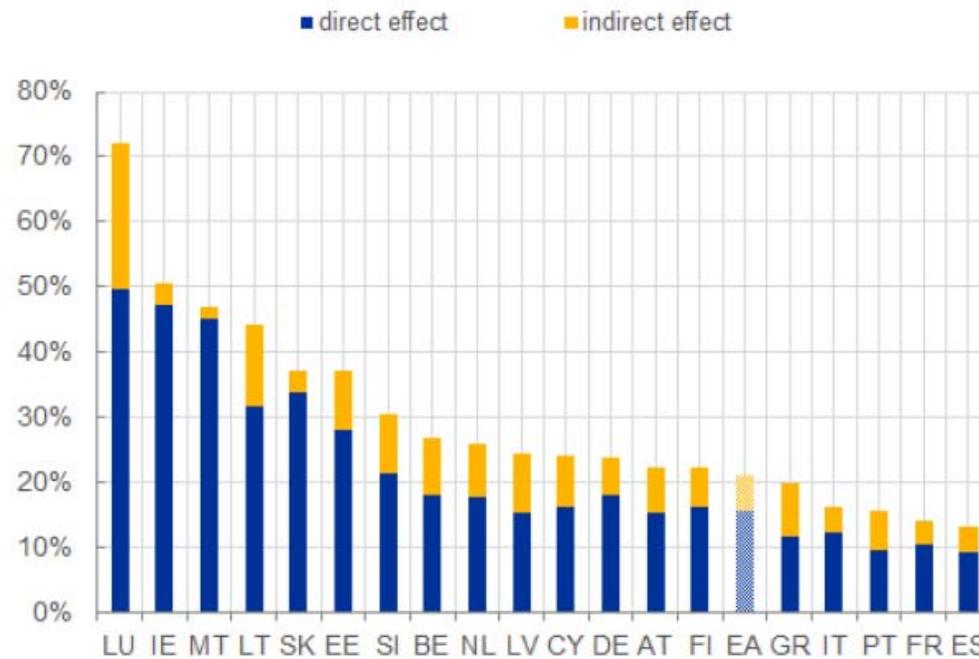**Effect of 10% foreign demand shock on EA GDP**
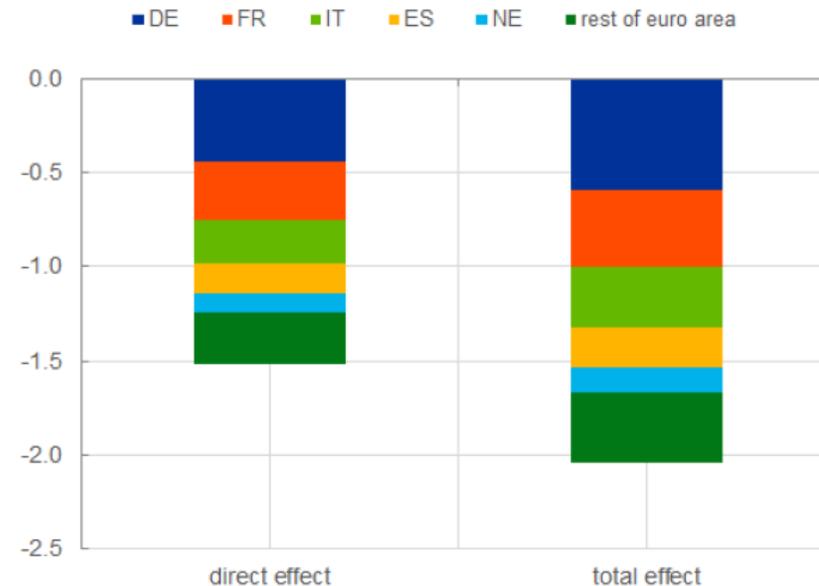
Sources: MRIO, authors' calculations
Note: Note: the calibration of foreign demand shocks are based on January and July 2020 IMF (World Economic Outlook) predictions of GDP in 2020 and aggregated weighting single country shock by their bilateral share in total extra EA exports

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More open economies are most affected

Effect on individual countries aggregate activity, relative to demand shock

Sources: MRIO, authors' calculations
Note: the calibration of foreign demand shock is based on July 2020 IMF (World Economic Outlook) predictions of GDP in 2020 and aggregated with weighted by bilateral share of each country in total extra EA exports (-9.7%). Luxembourg, the most exposed EA country, suffer a contraction in its aggregate activity equal to 70% the size of the original shock, about a third of it is due to indirect, internal EA supply linkages

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Hospitality and tourism shock and the EU mitigation policies

Aim of exercise

- Assess how shocks in individual sectors are transmitted through trade & GVC within EA

- Estimate effect of policy response within EA

Setup

- Global shocks to production of specific sectors (travel, accommodation, food services)

- Policy response: decrease shock for EU-EU ties (Schengen reopening in Summer)

Calibration

- Global shock calibrated to spring estimates of world tourism organization; no differential distribution across countries as the ICIOT account for the economic relevance of these industries in single economies.

Effect on aggregate activity relative to biggest shock (Greece)
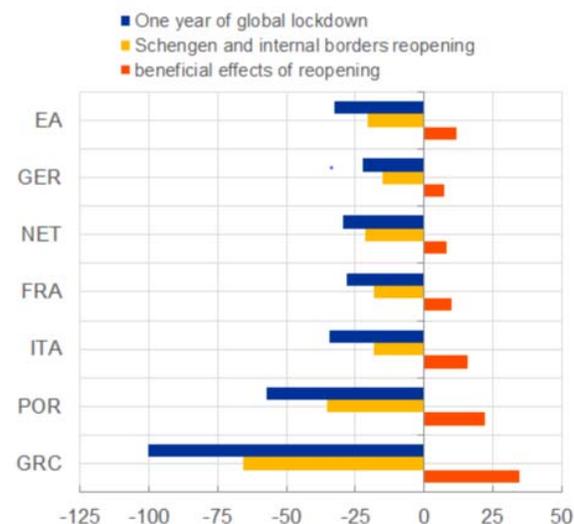
Sources: MRIO, authors' calculations
Note: Blue bars show the effects of tourism and travel bans
protracted for one year globally, yellow bars the case of Schengen borders
and hospitality places re-opening. The benefits from easing the restrictions
are reported relative to the most negatively affected country (e.g. Greece)

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Rethinking global production chain

While GVCs showed limits during the pandemic…

- …alternative production models for instance reshoring outsourced components and tasks cannot represent a solution.

- …less diversification across sources heightens the consequences of supply disruptions on GDP and do not reduce the likelihood of their occurrence.

- …reshoring implies replacing the most efficient producers worldwide with the most efficient at home, production costs rise and funnels higher consumption prices.

- …in cases of production curtailments, firms in the network will receive preferential treatments over others and be the last to experience shortages of intermediates; to such extent activity within network may prove more resilient to heightened risks of disruptions

Rethinking global production chain - a financial perspective

GVCs represent a financial safety net for participating companies.

- In times of crises the weakest links can be rescued, merged or acquired, avoiding that value of firms to be lost in bankruptcies.

- The financial holding can avoid that temporary conditions of illiquidity turn into credit crunches and more favorable payment conditions can be set up for suppliers in the network.

- Absent production networks, firms must rely exclusively on external sources; and economies endowed with strong and advanced financial system would hold a comparative advantages over others.

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Conclusions

- Spillover through supply linkages hit hardest GVC partners and neighbour countries, spillover through demand linkages depend on the size of the originating country.

- The propagation within the EA of shocks originated in one of the five largest member countries is 15-28%.

- The degree of interconnectedness, centrality and size of the EA country originating the COVID-19 shocks determine the magnitude of economic fallouts on the rest of the EA.

- Coordinated responses through targeted fiscal and monetary measures are in the self-interest of EA countries to minimize the feedback loop effects of COVID-19

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Conclusions

- Foreign demand weakness depresses EA aggregate activity by about 1/5 the size of the foreign shock; 1/4 of it is indirect internal transmission due to fall in demand for intermediate and final goods.

- Thereby, stimulating domestic demand is advisable also in response to subdued foreign demand.

- Reopening the Schengen borders reduced by 1/3 the economic damages from hospitality and travel restrictions, all the more in EA touristic destinations that often suffer also from structural economic fragilities.

- The 2nd wave of contagions and late reintroduced mobility restrictions expose EA touristic economies to harshest economic consequences.