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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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
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


### Inter-Country Input-Output Tables (ICIOT)

#### ICIOT with G countries and N sectors

<table>
<thead>
<tr>
<th></th>
<th>Outputs</th>
<th>Final Demand</th>
<th>Total Output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>...</td>
</tr>
<tr>
<td>1</td>
<td>Z11</td>
<td>Z12</td>
<td>...</td>
</tr>
<tr>
<td>2</td>
<td>Z21</td>
<td>Z2G</td>
<td>...</td>
</tr>
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<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>G</td>
<td>ZG1</td>
<td>ZG2</td>
<td>...</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Value added</th>
<th>Total Output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VA1</td>
<td>X1</td>
</tr>
<tr>
<td></td>
<td>VA2</td>
<td>X2</td>
</tr>
<tr>
<td></td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td></td>
<td>VAG</td>
<td>XG</td>
</tr>
</tbody>
</table>

- **GDP** = total production – total intermediate input
- **Exports** = all production except for domestic sector
- **Imports** = all inputs except from domestic production
# Shocks to the ICIOT

ICIOT with G countries and N sectors

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Outputs</th>
<th>Final Demand</th>
<th>Total Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Z11</td>
<td>Y11</td>
<td>X1</td>
</tr>
<tr>
<td>2</td>
<td>Z12</td>
<td>Y12</td>
<td>X2</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>G</td>
<td>Z1G</td>
<td>Y1G</td>
<td>XG</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Value added</th>
<th>G sectors</th>
<th>Total Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>VA1</td>
<td>VA2</td>
<td>...</td>
</tr>
<tr>
<td>X1</td>
<td>X2</td>
<td>...</td>
</tr>
</tbody>
</table>

**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 transmit 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)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Germany</th>
<th>France</th>
<th>Italy</th>
<th>Spain</th>
<th>The Netherlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>25.0</td>
<td>6.2</td>
<td>25.0</td>
<td>15.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Industry (excluding manufacturing and construction)</td>
<td>75.0</td>
<td>9.0</td>
<td>75.0</td>
<td>15.0</td>
<td>75.0</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>75.0</td>
<td>35.0</td>
<td>75.0</td>
<td>31.3</td>
<td>75.0</td>
</tr>
<tr>
<td>Construction</td>
<td>75.0</td>
<td>100.0</td>
<td>75.0</td>
<td>73.1</td>
<td>75.0</td>
</tr>
<tr>
<td>Retail trade, transport, accommodation and food service activities</td>
<td>100.0</td>
<td>64.2</td>
<td>100.0</td>
<td>96.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Private services</td>
<td>47.5</td>
<td>22.1</td>
<td>25.0</td>
<td>41.5</td>
<td>51.6</td>
</tr>
<tr>
<td>Public administration</td>
<td>25.0</td>
<td>18.5</td>
<td>25.0</td>
<td>-3.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Arts, entertainment, recreation and other activities</td>
<td>75.0</td>
<td>70.4</td>
<td>75.0</td>
<td>100.0</td>
<td>75.0</td>
</tr>
</tbody>
</table>

*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.*
Supply shock transmits most strongly to neighbours...

... and partners in production chains

Sources: MRIO, authors' calculations
Demand shock transmission somewhat more even...

... and related to originating country economic size

Sources: MRIO, authors’ calculations
Most affected sectors are those EA country specialise in...

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

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
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.
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)
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.
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.
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.