Discussion of "Sectoral Effects of Social Distancing"

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Motivation and question

- Covid-19 -> restrictions on economic activity
- Question: What are the output losses generated by social distancing (in France)?

Preview of results

- Six weeks of social distancing brings GDP down by 5.6%.
- Upstream sectors are more affected in terms of value added.

Overview

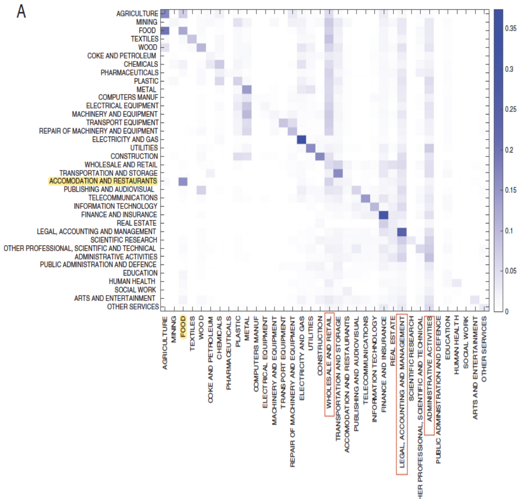
- The French production network
- Static network model
- Construction of labor supply shock by sector
- Estimate the effect of such shocks on the value added of each sector.

Some questions to think about

- Good:
  - Covid-19 a heterogenous shock
- Not so good/other things to consider:
  - Demand shocks
  - Sector-level productivity shocks
  - Static -> dynamic
  - Nominal rigidities
  - Other aggregate effects: unemployment, inflation,...
  - International trade

Main features of the French production network

- Use 2015 domestic input–output table, A38, from INSEE.
- Construct the production network: 36×36 matrix, Γ_{ij}: expenditure share.



French production network: Network statistics

- Upstreamness of a sector: how far from final demand
- Centrality: importance of a sector as a supplier

Table 4
Sector characteristics and network statistics

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Secteur	Sector Characteristics		Network Statistics	
	Final Demand	Employment	Upstreamness	Network Centrality
AGRICULTURE	2.7%	1.1%	2.09	0.032
MINING	0.1%	0.0%	2.43	0.002
FOOD	2.3%	4.6%	1.52	0.070
TEXTILES	0.4%	0.5%	1.43	0.007
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MACHINE AND EQUIPMENT	0.7%	1.3%	1.25	0.015
TRANSPORT EQUIPMENT	1.3%	4.6%	1.14	0.052
FURNITURE	1.1%	1.7%	1.59	0.029
ELECTRICITY AND GAS	0.7%	1.4%	2.36	0.043
UTILITIES	0.7%	0.6%	2.17	0.020
CONSTRUCTION	6.5%	8.4%	1.35	0.112
WHOLESALE AND RETAIL	12.8%	11.8%	1.46	0.167
TRANSPORT AND LOGISTICS	5.1%	3.6%	1.92	0.080
HOTEL RESTAURANTS	4.0%	3.0%	1.48	0.042
AUDIOVISUAL	0.9%	1.3%	1.75	0.022
TELECOMMUNICATIONS	0.5%	1.0%	2.05	0.022
IT SERVICES	1.6%	2.2%	1.61	0.034
FINANCE AND INSURANCE	3.5%	2.7%	2.36	0.091
REAL ESTATE	1.4%	10.1%	1.37	0.128
CONSULTING	4.4%	2.5%	2.40	0.097
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Moyenne	2.8%	2.8%	1.64	0.044
Min	0.0%	0.0%	1.00	0.002
Max	12.8%	11.8%	2.43	0.167

Model

- $1, \cdots, n$ perfectly competitive industries, each producing a distinct product.
- In each sector i, representative firm produces according to:

$$y_i = z_i \left(\alpha_i^{\frac{1}{\theta}} h_i^{\frac{\theta-1}{\theta}} + \sum_{j=1}^{n} \tilde{\Gamma}_{ij}^{\frac{1}{\theta}} x_{ij}^{\frac{\theta-1}{\theta}} \right)^{\frac{\theta}{\theta-1}} ;$$

  - h_i : labor
  - x_{ij} : quantity of good j used for production of good i.
  - $\alpha_i, \tilde{\Gamma}_{ij}$: technology parameters
  - θ : elasticity of substitution among inputs.

Model

Representative household

- CES preferences over n goods:
  $C(f_1, \cdots, f_n) = \left(\sum_i \beta_i^{\frac{1}{\sigma}} f_i^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}$;
  - f_i : quantity of good i consumed
  - β_i : good i's share in its utility function
  - σ : elasticity of substitution
- Price index associated to bundle of goods consumed by HH:
  $P = \sum_i \beta_i p_i^{1-\sigma} = 1$.
- Supplies h_i units of labour inelastically to each sector.
- GDP $= \sum$value of final demand $= \sum$ value of final expenditures $= \sum$value added
- $GDP \equiv PC = \sum_i p_i f_i = \sum_i \frac{w_i h_i}{p_i y_i} p_i y_i.(?)$

Competitive equilibrium

- All firms maximize profits, taking the factor and intermediate good prices as given;
- RH maximizes its utility; and
- all good and factor markets clear.

A representative firm's problem in sector i

RF in industry i maximizes profits:

$$\pi_i = \max_{y_i, h_i, \{x_{ij}\}} \left\{ p_i y_i - w_i h_i - \sum_{j=1}^{n} p_j x_{ij} \right.$$

$$\left. \text{subject to } y_i = z_i \left(\alpha_i^{\frac{1}{\theta}} h_i^{\frac{\theta-1}{\theta}} + \sum_{j=1}^{n} \tilde{\Gamma}_{ij}^{\frac{1}{\theta}} x_{ij}^{\frac{\theta-1}{\theta}} \right)^{\frac{\theta}{\theta-1}} \right\}.$$

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Share of expenditure on each input satisfies:

$$\frac{w_i h_i}{p_i y_i} = \alpha_i z_i^{\theta-1} \left(\frac{w_i}{p_i} \right)^{1-\theta},$$

$$\frac{p_j x_{ij}}{p_i y_i} = \tilde{\Gamma}_{ij} z_i^{\theta-1} \left(\frac{p_j}{p_i} \right)^{1-\theta} \forall j.$$

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E.g. Cobb Douglas ($\theta \to 1$), expenditure shares independent of prices

A representative household's problem

Final demand arises from:

$$\max_{f_i} \left\{ C\left(f_1, \cdots, f_n\right) : \sum_i p_i f_i = \sum_i w_i h_i + \sum_i \pi_i \right\}.$$

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Expenditure share on each good satisfies:

$$\frac{p_i f_i}{PC} = \beta_i \left(\frac{p_i}{P}\right)^{1-\sigma}$$

Cost minimization and market clearing

- Cost minimization yields:

$$p_i^{1-\theta} = \alpha_i \left(\frac{w_i}{z_i} \right)^{1-\theta} + \sum_j \tilde{\Gamma}_{ij} \left(\frac{p_j}{z_i} \right)^{1-\theta}.$$

- Market clearing: $y_i = f_i + \sum_j x_{ij}$.
- Equilibrium is characterized by a system of $5n + n^2$ equations.

Calibration

- Elasticies between final goods and intermediates: $\sigma = 3, \theta = 0.5$ from the literature.
- The remaining $2n + n^2$ parameters, $\beta_i, \alpha_i, \tilde{\Gamma}_{ij}$ are calibrated internally to match the $2n + n^2$ data moments of:
  - final demand share
  - labor share of income
  - (i, j) element of production network

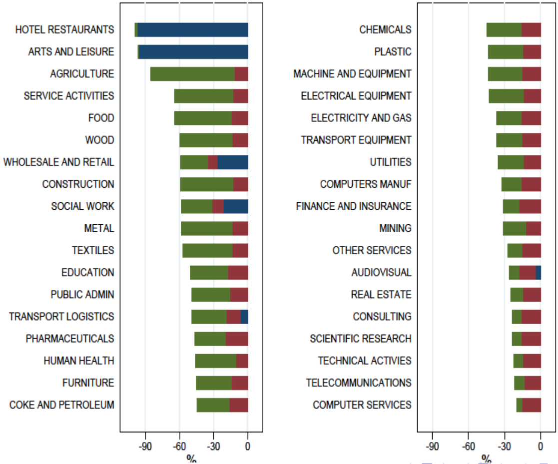
Construction of labor supply shocks

- Total effect of social distancing: Drop in active workforce of 52%.
  1. Administrative closings
     - Finest sector classification (A732) -> list of non-essential industries (decree of March 14, 2020) -> active workforce 0.
     - Get aggregate share of inactive workforce at A38 level using 2016 census data.
  2. Childcare imposed by closure of nurseries and schools
     - Use 2016 census data (A38) to identify the share of working people with dependents <16.
  3. Confinement (cannot telework)
     - survey data.

Disaggregated labor supply shocks

Decrease in active workforce caused by social distancing measures

This figure shows the effects of social distancing measures on the workforce by sector (in %). Blue bars represent the decline in the active workforce due to administrative closings. Red bars, the additional effect linked to school closings. Green bars, the residual effect related to confinement.



Results: Effect of social distancing on value added by sector

Value added growth for 6 weeks of social distancing (%)

This figure shows the effects of social distancing on value added growth for each sector (in %). Blue bars represent the decline in the active workforce due to administrative closings. Red bars, the additional effect linked to school closings. Green bars, the residual effect linked to confinement.

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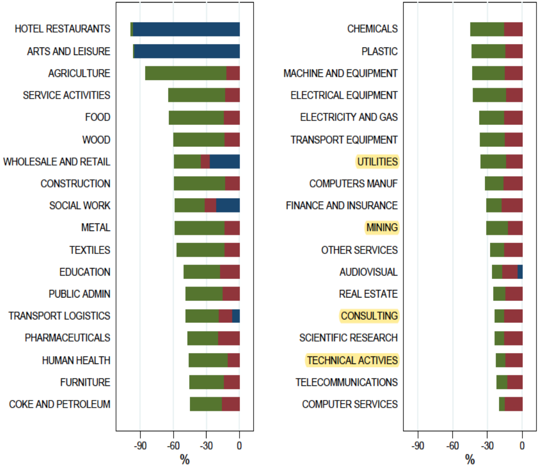

Upstreamness

- Apart from those sectors directly affected by the shock, most affected sectors: more upstream sectors.

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Effect on GDP

Effect of 6 weeks of social distancing on GDP

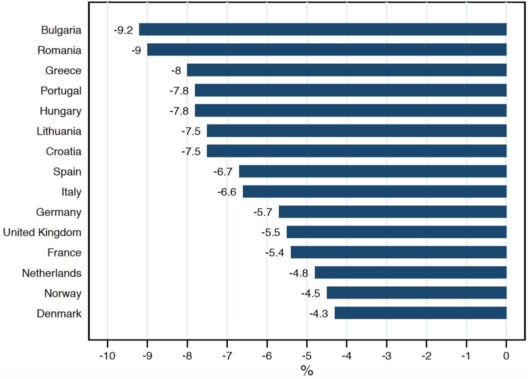
	Administrative closings	Administrative closings + School closings	Administrative closings + School closings + Confinement
GDP growth	-0.9%	-2.5%	-5.6%

Extension to other European countries

- Same shock; differences due to sectoral composition and propensity to telework

GDP drop by country for 6 weeks of social distancing

This figure shows the effects of social distancing on the GDP growth of European countries (in %). We assume that all countries apply the same restrictions, and that social distancing is in place for 6 weeks in each country. Only the sectoral composition and the propensity to telework vary.



Revisiting the shortcomings of this paper

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- Add other shocks?
- E.g. Baqaee and Farhi (2020): nonlinearities in disaggregated economies
    - Neoclassical: 1,2; S-O nonlinearities; GDP
    - New Keynesian: 1-5; : F-O nonlinearities; GDP, unemployment, inflation