

Critical Firms in the COVID Crisis

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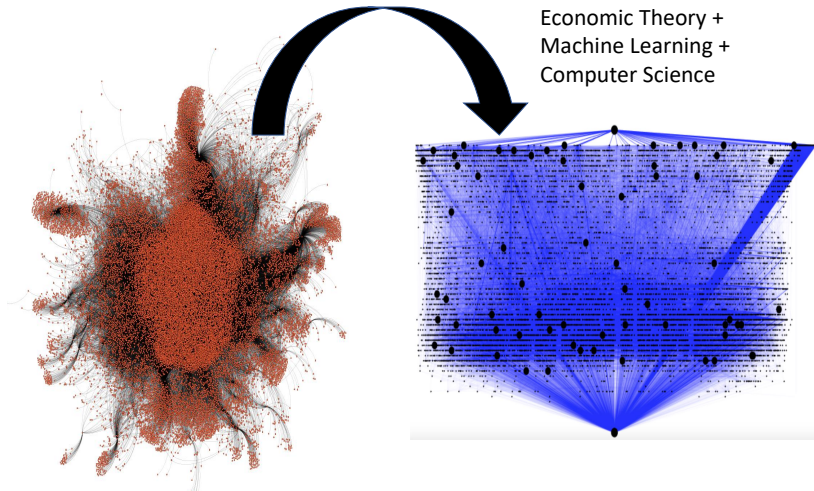
¹University of Cambridge & CEPR

²University of Cambridge

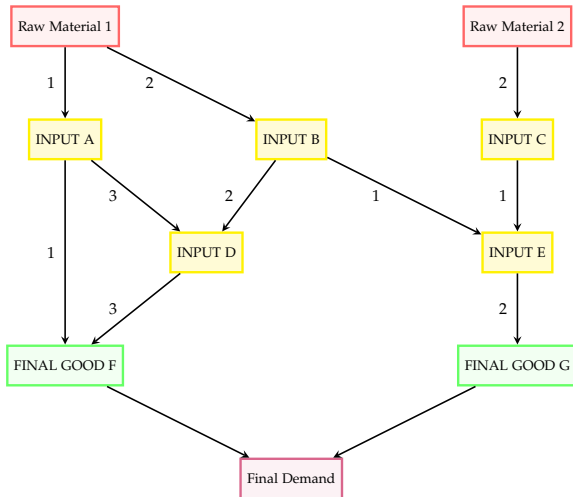
³University of Cambridge

Cambridge, May 2020

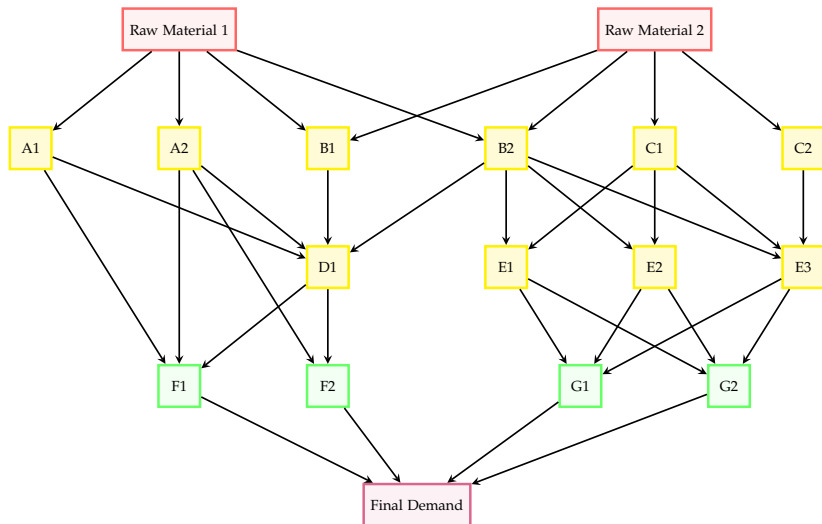
Objective



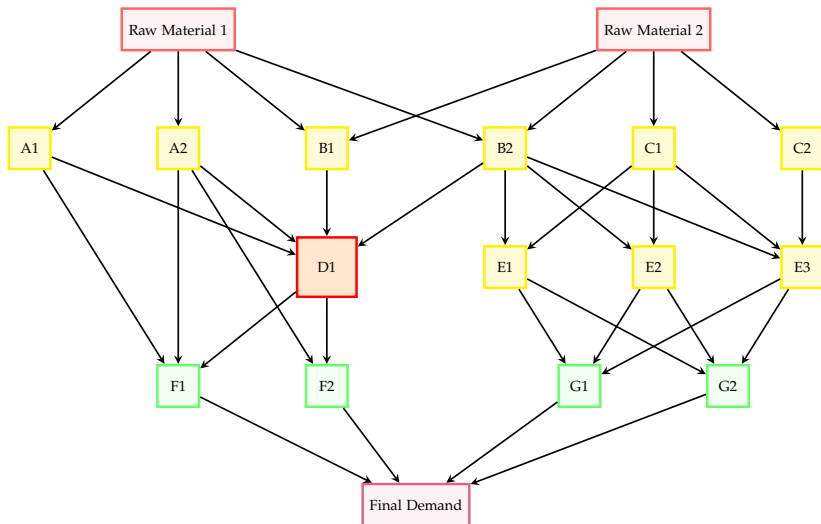
Leontief Production



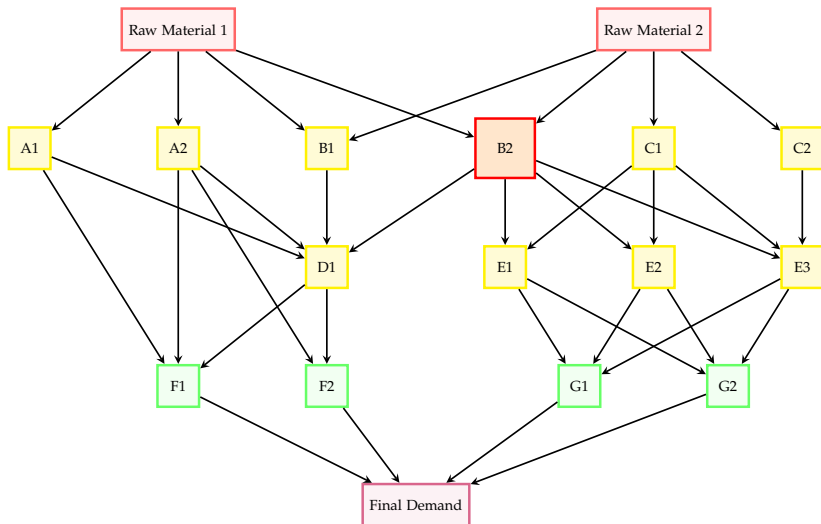
Supply Network



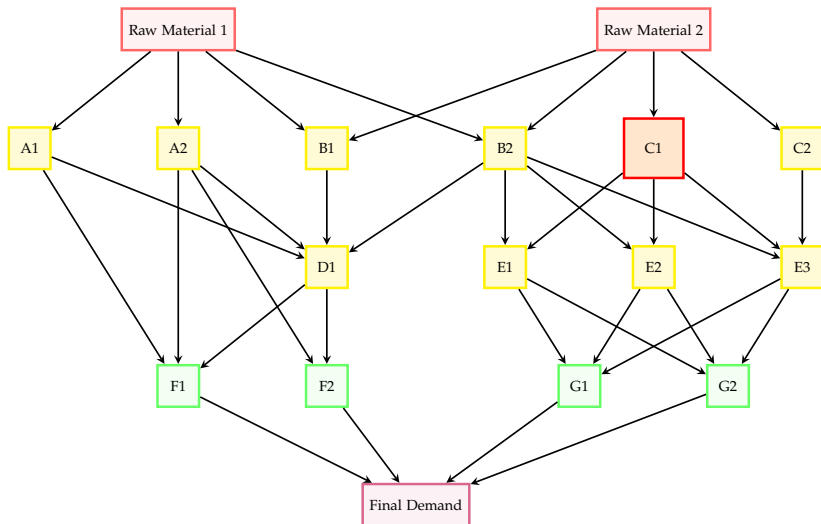
Critical Firms



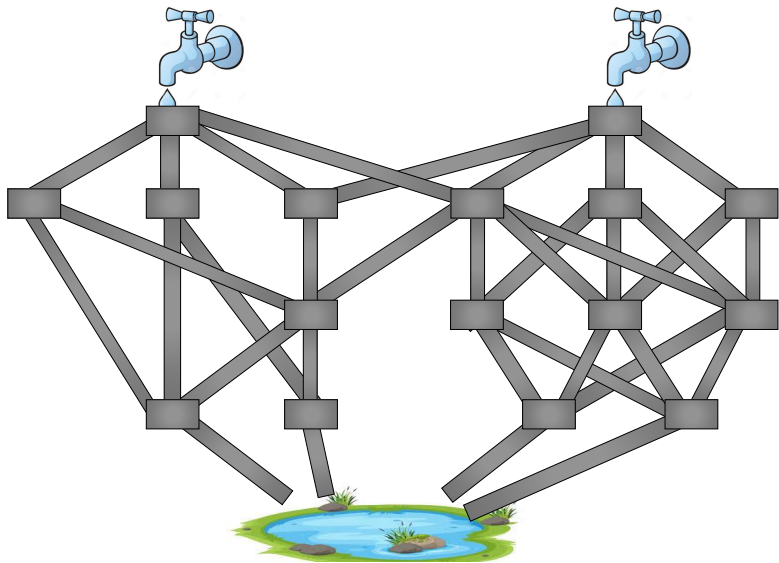
Critical Firms



Critical Firms



The Economy as a system of pipes



Applications

Flexibility of the approach

- Can prioritise goods—set output requirements for (certain) goods
- Or equally, set an overall output / GDP target.
- Can ask which groups of firms are jointly critical
- Run counterfactuals

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In principle, provides a framework for thinking about

- Where to target resources aimed at saving businesses
- Which firms / industries to relax restrictions for
- Which firms to bailout

Practical Challenges and Solutions

Supply network has only the approximate structure required

- Make the minimal adjustment to give it the right structure
- Computationally hard problem (NP Complete)
- But there are good algorithms for approximate solutions

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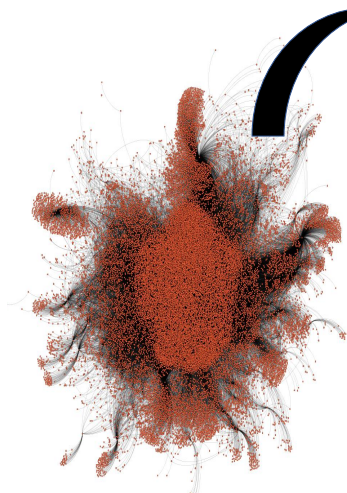
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Need to calculate maximum flows many times

- With and without firm (group of firms) of interest
- Linear programming problem—good algorithms exist

Proof of Concept—Uganda Pre-COVID



Economic Theory +
Machine Learning +
Computer Science

