A Sufficient Statistics Approach for Endogenous Production Networks: Theory and Evidence from Ukraine's War

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The question

- Suppose a big, permanent shock
- Suppose we only care about **aggregate, regional welfare**
- Let the production network be endogenous, i.e. extensive margin can change

How much of the **change in regional welfare** depends on the **change of the production network**?

The Paper

Sufficient statistics approach: conditional on macro restrictions, microfundations doesn't matter for welfare.

KMM push it further: you can abstract from *how* the network endogenously arises (search, fixed costs, etc).

Data requirement is relatively low: expenditure share and **number of linkages** within-region expenditure (and some parameters)

Quick ACR recap

Change in welfare W (real wage) depends only on change of **domestic share** λ and ϵ **trade elasticity**:

$$\hat{W}_i = \hat{\lambda}_i^{1/\epsilon}$$

Under which **macro assumptions**?

1. hp1: Balanced trade
2. hp2: Aggregate profits are a constant share of revenues
3. hp3: CES import demand

KMM network welfare

$$\hat{W}_i = \underbrace{\hat{\lambda}_i^{-\alpha/\epsilon}}_{ACR} \qquad \underbrace{\hat{M}_{ii}^{\alpha\,\eta}}_{\text{network change}}$$

The second element summarizes *all* on network impact in a **very parsimonious** way:

- 1 variable: M_{ii}, the number of within region suppliers
- 1 parameter: η, how much domestic suppliers are elastic with respect to changes in import prices , relative to costs.

The key assumptions to make the theory work

Network heterogeneity is *assumed* to have limited effects on both:

1. firm-level price distribution

$$p^I_{ui}(\omega) = P^I_{ui} g_i(\omega)$$

2. number of suppliers:

$$m_{ui}(\omega) = M_{ui} g^M_i(\omega)$$

In other words, suppliers impact downstream through exogenous variables/parameters.

KMM show that several papers satisfy these conditions.
It would be great to discuss when it doesn't.

When it doesn't (my understanding)

1. **plants** or sequential production in multiple regions (Antras and De Gortari, 2020)
2. input **substitutability** (Baqaee, Fahri, 2019)
3. **set** (Head, Mayer, 2019) or **path** (Minetti, Romanini, Ziv, 2023) choice of suppliers
4. **congestion/scale** effects (Ganapati, Wong, Ziv, 2020)

Notes:

- it's not clear to me how **markups** can be constant with measure suppliers endogenously changing (Arkolakis, Costinot, Donaldson, Rodriguez-Clare, 2019)
- if the model can generate zero flows/link as you see in the data

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Application: 2014 Crimea and the Donbas War

I skip the reduced-form results, straight into the sufficent statistics:

$$\hat{W}_i = \hat{\lambda_i}^{-\alpha/\epsilon} \quad \hat{M_{ii}}^{\alpha\,\eta}$$

Trade and network, f-2-f data on train "imports" to recover:

1. within-region expenditure shares λ_{ii}:
2. number of suppliers in a region M_{ii}

Calibrate three parameters:

1. labor share $\alpha = 0.2$, from Orbis/Amadeus
2. input substitution $\epsilon = 4$, taken from US data, either convince that it's ok, or show some robustness, or estimate it
3. supplier link elasticity η: estimated

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Endogenous Exposures

For both estimation of η and the overall welfare DiD exercise, even if the shock is exogenous, the **exposures are *endogenous***

Suggestion: "demean" the exposures with counterfactual shocks (Borusyak and Hull, 2021)

It could be the reason why the forward Domar weights coefficient is not significant, since OLS puts all the indirectess in the highe variation of the exposure variables.

Summary

1. Nice paper! aimed at incorporating endogenous network into welfare in a general and parsimonious way

2. Useful: one can get welfare results with significant lower modelling effort and a bit less data requirement

3. Ambitious calibration using firm-to-firm data from Ukraine

4. Some extra robustness might be needed

5. It might be useful to relate the estimated network effect to encompassed papers, showing the trade-off btw more micro story vs easier estimation