Discussion of "Multinational Firms and International Business Cycle Transmission" by Cravino and Levchenko

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Overview (1)

- Paper examines the role of multinational firms (MNCs) in the transmission of shocks across countries, both empirically and theoretically.

- Empirical evidence with firm-level data on parents and affiliates:
  - At the firm level: strong positive correlation of sales growth between parents and affiliates.
  - At the source-destination level: both source- and destination-specific shocks are important drivers of MNC sales growth.

- Multi-country model with technology transfer through MNCs:
  - Each country produces a final good that aggregates the output of local firms and MNC affiliates;
  - Each affiliate inherits a fraction of its productivity from the parent;
  - The transmission of shocks through MNCs depends on:
    - the fraction of technology inherited from parent (estimated);
    - the share of MNC sales in the destination (calibrated).

Overview (2)

- Model implications:

    (1) Impulse responses of output in each destination for productivity shocks to: (a) source country or (b) parents of large MNCs.
    - Show no notable effects on output in most destinations, but considerable effects for some country pairs and the largest MNCs.

    (2) How much correlation is generated by uncorrelated technology shocks in source countries only?
    - Less than in the data, but sizeable correlation for some country pairs.

    (3) Observe changes in the model-predicted dispersion of growth rates across destination countries under counterfactual scenarios with the MNC shares re-calibrated to (a) "no MNCs" and (b) "full integration".
    - Dispersion increases by 10%, decreases by 35%, respectively.

Empirics

1) Firm-level comovement:

$$\gamma_{in,t}\left(f\right) = \phi\gamma_{ii,t}\left(f\right) + \bar{a}_{inss',t} + \epsilon_{in,t}\left(f\right). \qquad (1)$$

- Use source-sector-destination-sector-year FE;
- ϕ = 0.228*** for all sectors, 0.299*** for manuf., 0.213*** for services.

2) Source-destination aggregate comovement:

$$\gamma_{in,t} = s_{i,t} + d_{n,t} + a_{in,t}. \qquad (2)$$

- Use source-year FE and, alternatively, destination-year FE;
- Coefficient estimates for $s_{i,t}$ = 0.10***, for $d_{i,t}$ = 0.17***

Model (1)

- Aggregate output of firms f from countries i in country n:

$$Q_{n,t} = \left[\sum_i A_{in,t}^{\frac{1}{\rho}} Q_{in,t}^{\frac{\rho-1}{\rho}} \right]^{\frac{\rho}{\rho-1}} \qquad Q_{in,t} = \left[\sum_{f \in \Omega_i} Q_{in,t}(f)^{\frac{\rho-1}{\rho}} \right]^{\frac{\rho}{\rho-1}}$$

$$Q_{in,t}(f) = Z_{in,t}(f) L_{in,t}(f) = Z_{i,t}^{\phi}(f) Z_{n,t}^{1-\phi}(f) L_{in,t}(f)$$

- The micro-founded mechanism of comovement hinges on affiliates' technology $Z_{in,t}$:
  - Fraction ϕ comes from the parent, ($1-\phi$) is affiliate-specific.

- Changes in the technology of parents ($z_{i,t}$) affect sales growth ($\Upsilon_{n,t}$);
  - Depending on ϕ (fraction of technology from parent), $\omega_{in,t}$ (share of sales in n provided by MNCs from source i), and $\psi/(\rho-1)$:

$$\Upsilon_{n,t} = \left(\frac{\psi}{\rho-1} \right) \sum_i \omega_{in,t} [a_{in,t} + \phi(\rho-1) z_{i,t}] + \psi(1-\phi) z_{n,t};$$

Model (2)

- What is ϕ?
  - There are two ways to pin down ϕ from the data:

    1) Use the estimates from firm-level data:

    $$\gamma_{in,t}(f) = \tilde{a}_{in,t} + \phi\gamma_{ii,t}(f) + \epsilon_{in,t}(f), \tag{22}$$

    2) Use the estimates for source and destination-specific shocks, together with structural equations and calibrated ψ and ρ:

    Table 5: Estimated ϕ based on source-destination data

Year	$\frac{\psi}{\rho-1} = 1$	$\frac{\psi}{\rho-1} = 2$	$\frac{\psi}{\rho-1} = \frac{2}{3}$
Mean	0.401	0.503	0.317
Median	0.392	0.505	0.301

  - Importantly, the estimates from (1) are less than with (2), because (1) obscures the within-firm transmission of aggregate shocks through the use of source-sector-destination-sector-year FE; (2) does not.

Comment 1: Data Coverage

- Rich dataset from ORBIS, covers 8 million firms from 34 countries over 2004-12; connects parents and affiliates across countries.

- Country coverage is skewed:
  - Dataset covers very few countries outside of Europe (the US, Mexico, Japan, Korea, and Australia only).
  - For the US and Australia, there are only few firms, the sample covers only a small fraction of aggregate sales.

- A more comprehensive sample would probably strengthen the results:
  - Technology transfer may be especially relevant for MNCs operating in economies at various levels of development, that are highly integrated.
  - The European economies covered fulfill these characteristics.
  - Availability of more economies dependent on the United States (i.e., Canada, Latin America) or on Japan-Korea (East Asia) would have probably strengthened the results.

Comment 2: Connecting Model with Data

- There is probably more to result #2 than suggested in the paper:
  - How much comovement in aggregate output would be generated by the presence of multinationals in a world where the only shocks are shocks to parent country productivity?

Table 7: Predicted and actual correlations

$\rho_{n,n'}$	Mean	St.Dev.	Min	Max	$d\rho_{n,n'}/d\omega$
Data	0.18	0.35	-0.68	0.87	2.27
Uncorrelated shocks	0.01	0.02	0.00	0.25	0.54
Correlated shocks	0.18	0.03	0.15	0.4	0.50

- The average correlation in the model reflects the bilateral MNC shares in the ORBIS sample.
  - For most country pairs, MNC shares are close to null, so it's not surprising that the correlation is also null.
- In a model that emphasizes the granular sources of comovement, it's not the average correlation across country pairs that matters, but how comovement varies with MNC shares.

Comment 2: Connecting Model with Data

Table A1: Bilateral Multinational Shares

Source → / Dest ↓	AUT	AUS	BEL	BUL	CZE	DEU	EST	ESP	FIN	FRA	GBR	GRE	HRV	HUN	IRL	ITA	JPN	KOR	LTU	LVA	MEX	NLD	NOR	POL	PRT	ROM	SRB	SWE	SGP	SVN	SVK	TUR	UKR	USA	ROW
AUT	58.9	0.0	0.2	0.0	0.0	13.1	0.0	0.2	0.4	1.4	4.6	0.0	0.0	0.1	0.2	1.4	3.8	0.5	0.0	0.0	0.1	1.4	0.2	0.1	0.1	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	3.5	9.3
AUS	0.0	74.0	0.1	0.0	0.0	0.7	0.0	0.2	0.1	1.1	5.4	0.0	0.0	0.0	0.1	0.0	2.7	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.0	0.0	0.0	0.0	5.7	8.6
BEL	0.2	0.1	48.4	0.0	0.0	4.6	0.0	0.2	0.2	14.1	1.8	0.2	0.0	0.0	0.2	1.4	5.8	0.2	0.0	0.0	0.0	3.1	0.2	0.0	0.0	0.0	0.0	1.4	0.1	0.0	0.0	0.0	0.0	10.9	6.9
BUL	2.3	0.0	0.4	73.2	1.4	4.0	0.0	0.1	0.0	0.6	0.9	1.5	0.2	0.1	0.0	0.4	0.1	0.0	0.0	0.0	0.0	0.9	0.5	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.3	0.1	1.6	10.9
CZE	3.4	0.0	0.4	0.0	52.1	14.8	0.0	1.3	0.2	2.9	3.3	0.0	0.0	0.1	0.2	1.9	1.9	0.7	0.0	0.0	0.0	2.3	0.0	0.4	0.0	0.0	0.0	0.8	0.0	0.0	0.6	0.0	0.0	3.8	8.4
DEU	0.7	0.1	0.5	0.0	0.0	75.1	0.0	0.2	0.3	1.9	3.5	0.0	0.0	0.0	0.1	0.8	2.3	0.5	0.0	0.0	0.1	2.0	0.3	0.1	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	5.9	4.2
EST	0.3	0.0	0.1	0.0	0.0	1.9	69.9	0.0	7.2	1.5	2.2	0.0	0.0	0.0	0.2	0.1	0.5	0.0	0.5	0.4	0.0	0.6	1.0	1.0	0.0	0.0	0.0	6.9	0.2	0.0	0.0	0.0	0.2	1.3	3.9
ESP	0.2	0.0	0.2	0.0	0.0	3.7	0.0	73.6	0.1	5.2	1.9	0.0	0.0	0.2	2.2	0.9	0.2	0.0	0.0	0.1	1.6	0.1	0.0	0.7	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	3.9	4.8
FIN	0.2	0.0	0.0	0.0	0.0	1.8	0.2	0.0	81.3	0.9	1.0	0.0	0.0	0.0	0.2	0.2	0.9	0.3	0.0	0.0	0.0	0.8	0.4	0.0	0.0	0.0	0.0	4.2	0.0	0.0	0.0	0.0	0.0	2.3	5.3
FRA	0.1	0.1	1.0	0.0	0.0	2.9	0.0	0.4	0.2	77.1	2.6	0.0	0.0	0.0	0.2	1.1	1.1	0.2	0.0	0.0	0.0	2.7	0.1	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	5.7	3.9
GBR	0.1	0.6	0.3	0.0	0.0	4.2	0.0	1.1	0.2	3.8	60.0	0.0	0.0	1.0	0.6	2.0	0.3	0.0	0.0	0.2	1.5	0.2	0.0	0.0	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0	14.2	9.2
GRE	0.1	0.0	0.9	0.0	0.0	2.1	0.0	0.2	0.1	1.1	2.6	81.6	0.0	0.0	0.4	0.7	0.3	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	2.4	6.1
HRV	4.6	0.0	0.1	0.0	0.2	4.4	0.0	0.1	0.0	1.6	0.3	0.0	78.3	0.4	0.1	2.3	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.1	0.0	0.0	0.2	0.2	0.0	1.8	0.0	0.0	0.0	0.9	3.8
HUN	1.4	0.0	0.1	0.0	0.0	6.8	0.0	0.1	1.7	2.6	1.5	0.0	0.0	74.4	0.0	0.9	1.1	0.9	0.0	0.0	0.1	1.2	0.3	0.0	0.0	0.0	0.0	0.6	0.9	0.0	0.0	0.0	0.0	3.5	2.0
IRL	0.0	0.2	0.6	0.0	0.0	4.0	0.0	3.4	0.2	4.9	18.2	0.0	0.0	0.1	16.5	1.8	2.7	0.6	0.0	0.0	0.1	1.3	0.3	0.0	0.0	0.0	0.0	0.6	0.2	0.0	0.0	0.0	0.0	35.7	8.7
ITA	0.2	0.0	0.2	0.0	0.0	2.6	0.0	0.3	0.2	3.7	1.6	0.0	0.0	0.1	0.1	80.0	0.7	0.1	0.0	0.0	0.0	1.5	0.1	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	3.5	4.7
JPN	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	98.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.5
KOR	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.2	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.8	95.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.6
LTU	0.2	0.0	0.1	0.0	0.0	1.7	1.6	0.0	1.7	1.3	0.4	0.0	0.0	0.0	0.2	0.3	0.0	0.0	74.4	0.3	0.1	1.1	1.6	0.7	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	2.7	9.2
LVA	0.1	0.0	0.1	0.0	0.0	1.0	0.7	0.0	2.3	0.4	0.6	0.0	0.0	0.0	0.0	0.1	0.1	0.2	1.6	81.1	0.1	0.3	1.8	1.0	0.0	0.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0	0.4	4.5
MEX	0.7	0.0	0.0	0.0	0.0	1.3	0.0	2.3	0.0	0.3	1.0	0.0	0.0	0.0	0.1	0.0	0.6	0.7	0.0	0.0	74.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	15.2	2.3
NLD	0.2	0.1	0.4	0.0	0.0	2.5	0.0	0.3	0.3	1.9	9.7	0.0	0.0	0.2	6.6	2.9	2.0	0.0	0.0	0.0	0.0	41.1	0.4	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	20.2	10.7
NOR	0.1	0.0	0.1	0.0	0.0	1.2	0.0	0.1	0.5	2.3	1.6	0.0	0.0	0.0	0.0	0.7	0.6	0.2	0.0	0.0	0.0	0.6	76.8	0.0	0.0	0.0	0.0	5.2	0.0	0.0	0.0	0.0	0.0	6.6	3.5
POL	0.8	0.0	0.4	0.0	0.1	6.9	0.0	0.6	0.5	4.9	2.4	0.0	0.0	0.1	0.2	2.0	1.2	0.7	0.0	0.0	0.1	1.9	0.3	64.6	0.8	0.0	0.0	1.6	0.1	0.0	0.0	0.0	0.1	4.1	5.2
PRT	0.1	0.0	0.4	0.0	0.0	2.6	0.0	3.7	0.0	3.1	1.5	0.0	0.0	0.0	0.1	0.5	0.2	0.1	0.0	0.0	0.0	0.6	0.0	0.0	82.5	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	1.7	2.7
ROM	3.7	0.0	0.2	0.0	0.2	3.1	0.0	0.2	0.2	2.7	1.5	0.0	0.4	0.0	0.5	1.4	0.7	0.0	0.0	0.0	0.0	0.7	0.0	0.2	0.0	76.3	0.0	0.2	0.0	0.0	0.0	0.1	0.0	1.2	6.1
SRB	1.8	0.0	1.5	0.2	0.1	2.3	0.0	0.1	0.0	1.5	0.5	1.6	1.5	0.3	0.1	1.0	0.1	0.0	0.0	0.0	0.0	0.9	0.4	0.1	0.0	0.1	70.1	0.2	0.0	1.9	0.1	0.0	0.0	1.5	12.1
SWE	0.2	0.0	0.1	0.0	0.0	4.2	0.0	0.1	3.2	1.5	2.2	0.0	0.0	0.0	0.1	0.3	1.6	0.1	0.0	0.0	0.0	1.3	1.8	0.0	0.0	0.0	0.0	73.0	0.1	0.0	0.0	0.0	0.0	3.6	6.5
SGP	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	1.1	14.8	0.0	0.0	0.0	0.7	0.1	10.7	3.2	0.0	0.0	0.0	1.8	0.1	0.0	0.0	0.0	0.0	0.2	43.1	0.0	0.0	0.0	0.0	13.6	10.3
SVN	3.8	0.1	0.1	0.0	0.1	3.0	0.0	0.1	0.1	3.1	1.9	0.0	0.8	0.2	0.0	0.9	0.4	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.1	0.0	79.3	0.0	0.0	0.0	2.2	2.6
SVK	4.0	0.0	0.6	0.0	1.7	16.2	0.0	0.2	0.1	4.5	2.0	0.0	0.0	4.0	0.2	3.2	0.7	0.0	0.0	0.1	3.4	0.5	0.3	0.0	0.0	0.0	0.0	0.4	0.0	0.0	42.9	0.0	0.0	4.3	5.5
TUR	1.2	0.0	0.1	0.0	0.0	1.5	0.0	0.1	0.1	1.0	2.2	0.0	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	1.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	88.4	0.0	0.5	2.5
UKR	0.3	0.0	0.1	0.0	0.0	0.8	0.0	0.0	0.0	0.5	1.2	0.0	0.0	0.1	0.0	0.1	0.2	0.1	0.0	0.0	0.0	1.2	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	79.4	1.8	13.7
USA	0.0	0.1	0.0	0.0	0.0	1.3	0.0	0.3	0.0	0.2	1.0	0.0	0.0	0.0	0.0	0.1	0.6	0.2	0.0	0.0	0.1	0.8	0.3	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	91.1	3.9

Notes: This table reports the shares of revenue (in percent) of firms owned by the country in the column in total revenues of all firms in the row country, in percent.

Comment 2: Connecting Model with Data

- Compare the *slope* between MNC shares and the correlation of sales growth in the model vs. data, rather than the *average correlations*.

  – Scatterplot with MNC shares on horizontal, comovement on the vertical

  – Larger MNC shares result in more technology transfer & comovement

  – Exercise similar to Burstein, Kurz, and Tesar (2008, JME), but emphasizing a different mechanism:
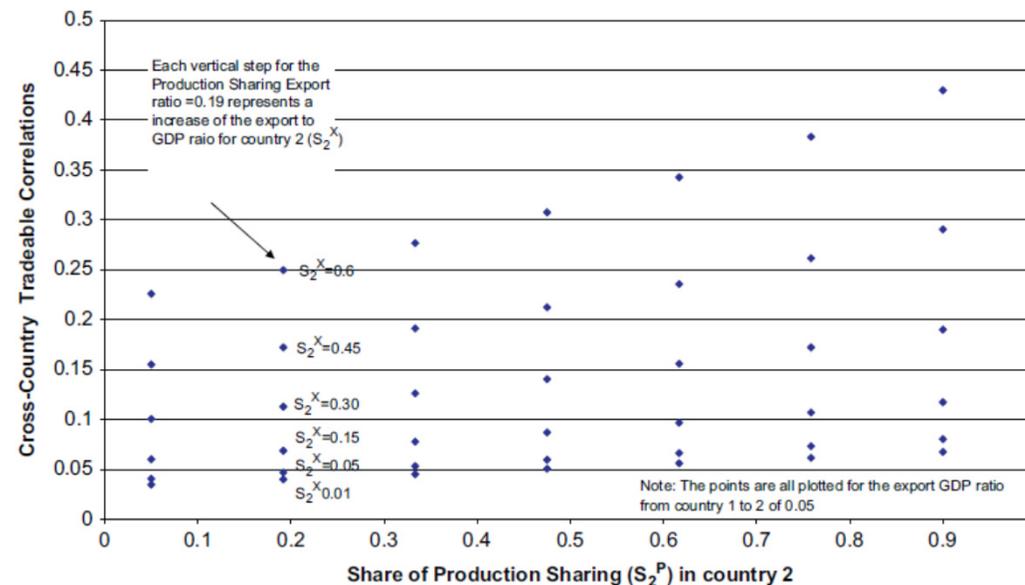
Comment 3: Why Do Economies Co-move?

- In the data:
  - Country pairs that trade more are more correlated (Frankel and Rose, 1998)
  - Comovement increases with the production-sharing intensity of bilateral trade (BKT 2008)
  - Bilateral trade between countries enhances comovement especially between those sectors with I-O linkages (diGiovanni and Levchenko, 2010)
  - Recently, the focus has shifted away from trade, like in this paper.

- In models:
  - Comovement sometimes driven by correlated TFP shocks, spillovers (BKK 92).
  - With trade in country-specific goods, comovement is conditional on a low elasticity of substitution (BKK94, BKT 2008)
  - In dynamic models with heterogeneous firms, the extensive margin of FDI affects comovement: procyclical offshoring through vertical FDI enhances comovement (Zlate, 2014).
  - In Craviono and Levchenko (CL2014), comovement depends on MNC activity, but not necessarily on trade; MNCs bring technology transfer, common demand shocks, etc.

Comment 4: How Is Technology Transferred?

- Parent and affiliate sales commove without trade necessarily taking place. How?
  - Technology transfer plausible, but we need evidence on how it happens.
- Is technology transfer from parents to affiliates homogenous across country pairs, sectors?
  - Does it vary with the source-destination income gap, sector, purpose of the affiliate, share of ownership, institutional quality in the host, etc.?
  - Robustness checks in CL2014 distinguish by manufacturing, services.
  - Alviarez (2014): MNC production is disproportionately allocated to industries where local producers exhibit comparative disadvantage.
  - Allowing for ρ to vary across country pairs and sectors would open a new dimension of heterogeneity in the transmission of shocks through technology, which is a different research agenda.
- Is technology always transferred from the parent to affiliate?
  - Does it also happen in reverse?

Comment 5: Is Technology Transfer Isomorphic to Demand Shocks?

- Yes in this model, but do you want to go that way?

- This is just a matter of interpretation.

- With technology shocks, parents transfer technology to affiliates in all destinations, which generates comovement; this is a plausible, microfounded explanation.

- With demand shocks, comovement would happen if preferences shift simultaneously for a MNC's product(s) across destinations. Is it plausible?

- The world is heterogeneous in income, tastes, etc.

Conclusion

- Novel empirical results on firm-level comovement.

- Very elegant model of comovement, in which the transfer of technology at the firm level results in aggregate comovement.

- The extent of technology transfer is estimated from the data, the MNC presence is calibrated.

- Plausible results, aggregate comovement varies greatly with MNC presence across country pairs.

- We need more evidence on what drives comovement at the firm level.

- Very nice paper and research agenda.

- Thank you!