The effect of trade openness on macro volatility Caselli, Koren, Lisicky, and Tenreyro (2015)

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Motivation

- The trade literature has looked at the effect of lower trade costs on volatility (both macro and micro) in a variety of ways.
- Differing conclusions on whether trade liberalization increases or decreases volatility:
  - *Increases*: sectoral specialization making an economy more vulnerable to global sectoral shocks.
  - *Decreases*: diversification in demand/supply to other countries making an economy less vulnerable to country-wide shocks.
- Build a model and take it to the data to investigate these two seemingly counteracting effects.
- Consider heterogeneity in these effects across countries.

Introduction

- Investigate this simple question using an EK model with intermediate goods and sector-wide and country-wide shocks:
  - Analytically solve simplified versions of the model for intuition on effect of domestic and foreign shocks to GDP volatility.
  - Calibrate using trade, output, trade costs data at country-sector-time level and solve the model numerically.
  - Solve model under counterfactual scenarios to find the effect of different shocks and trade liberalization
- GDP volatility depends on weighted productivity shocks of all countries by size in simplified model.
- Dampening due to diversification more important than amplification due to sectoral specialization in most countries.

Related Literature

- **EK model**: Eaton and Kortum (2002); Alvarez and Lucas (2006)
- **Eearly stylized theory**: Newbery and Stiglitz (1984)
- **Empirical studies**: Easterly, Islam, and Stiglitz (2001); Kose, Prasad, and Terrones (2003); di Giovanni and Levchenko (2009); Haddad, Lim, and Suborowski (2010); Bejan (2006)
- **More micro approaches**: Buch, Dopke, and Strotmann (2006); Burgess and Donaldson (2012); Allen and Atkin (2015)
- **Analysis of specific channels**: Wacziarg and Wallack (2004); Backus, Kehoe, and Kydland (1992); Koren and Tenreyro (2007)

Model

- N countries, J sectors, infinite time horizon (no intertemporal trading or capital), continuum of intermediate goods ω^j.
- By sector, firms produce composite good as a CES aggregation of intermediate goods– each with technology:

$$x_{nt}(\omega^j) = A^j_{nt} z_n(\omega^j) l_{nt}(\omega^j)^{\beta^j} M_{nt}(\omega^j)^{1-\beta^j}$$

- Time-invariant idiosyncratic shock $z_n(\omega^j) \sim$ Fréchet(T^j_n, θ).
- Country endowed with labor $L_{nt} = \sum_{j=1}^{J} L^j_{nt}$, $L^j_{nt} = \int_0^1 l_{nt}(\omega^j) d\omega^j$, and must allocate to sectors ex-ante.
- Final good either consumed or produces intermediate good: $Q_{nt} = C_{nt} + \sum_{j=1}^{J} \int_0^1 M_{nt}(\omega^j) d\omega^j$
- If 1 unit of good ω^j leaves n to m at time t, κ^j_{mnt} reaches.

Model: Comparing to EK

Solving the model gives the (somewhat) familiar resuts:

- $P^j_{nt} \sim$ Fréchet(Φ^j_{nt}, θ), $\Phi^j_{nt} \propto \sum_{m=1}^{N} T^j_m \left(\frac{w^{j\beta^j}_{mt} P^{1-\beta^j}_{mt}}{A^j_{mt} \kappa^j_{nmt}} \right)^{-\theta}$
- Trade share $\pi^j_{nmt} = \frac{T^j_m \left(\frac{w^{j\beta^j}_{mt} P^{1-\beta^j}_{mt}}{A^j_{mt} \kappa^j_{nmt}} \right)^{-\theta}}{\sum_{k=1}^{N} T^j_k \left(\frac{w^{j\beta^j}_{kt} P^{1-\beta^j}_{kt}}{A^j_{kt} \kappa^j_{nkt}} \right)^{-\theta}}$

Compare to vanilla EK model:

- $P_n \sim$ Fréchet(Φ_n, θ), $\Phi_n = \sum_{m=1}^{N} T_m (c_m d_{nm})^{-\theta}$
- $\pi_{nm} = \frac{T_m (c_m d_{nm})^{-\theta}}{\sum_{k=1}^{N} T_k (c_k d_{nk})^{-\theta}}$

Intuition: Autarky vs. Costless Trade

Model is then solved analytically and log-linearized for the two extreme cases of autarky and costless trade in a 1-sector model (back to EK), and output-shocks relationship is determined.

Defining the productivity shock variable $Z_{nt} = T_n(L_{nt}A_{nt}^{1/\beta})^{\beta\theta}$, get that:

$$\hat{Y}_{nt}^{CE} = \frac{1}{\beta\theta}\hat{Z}_{nt}$$

$$\hat{Y}_{nt}^{OE} = \frac{1}{\beta\theta}\sum_{m=1}^{N}\gamma_{mt}\hat{Z}_{mt}, \text{ where } \sum_{m=1}^{N}\gamma_{mt} = 1$$

Weights γ depend on the size of the trading partner, but clearly volatility with trade depends less on domestic shocks but now also depends on foreign shocks.

Data and Calibration

- Full model is solved numerically after a lengthy calibration exercise.
- Economy-wide parameters obtained from literature (comparative advantage parameter θ from EK, elasticity from Broda and Weinstein (2006))
- Obtain values of trading costs κ, productivity processes Z, value added β^j and aggregation parameters.
- Sample of 24 "core" countries and aggregated "rest of world", and 24 sectors over time period 1972-2007.
- Data on gross output, value added, expenditure shares, and prices by year-sector-country from a variety of sources (WB, EU, UN, PWT, IMF).

Counterfactual Analysis

Back out the productivity shocks, decompose as: $\hat{Z}^j_{nt} = \lambda^j_t + \mu_{nt} + \epsilon^j_{nt}$, with:

1. Global sector factor $\hat{\lambda}^j_t = N^{-1} \sum_{n=1}^{N} \hat{Z}^j_{nt}$
2. Country-specific factor $\hat{\mu}_{nt} = J^{-1} \sum_{j=1}^{J} (\hat{Z}^j_{nt} - \hat{\lambda}^j_t)$
3. Idiosyncratic factor $\hat{\epsilon}^j_{nt} = \hat{Z}^j_{nt} - \hat{\lambda}^j_t - \hat{\mu}_{nt}$

Different factors of the shocks can be turned off– in this case, global sectoral shocks are switched off to determine the response to only country-specific factors via diversification.

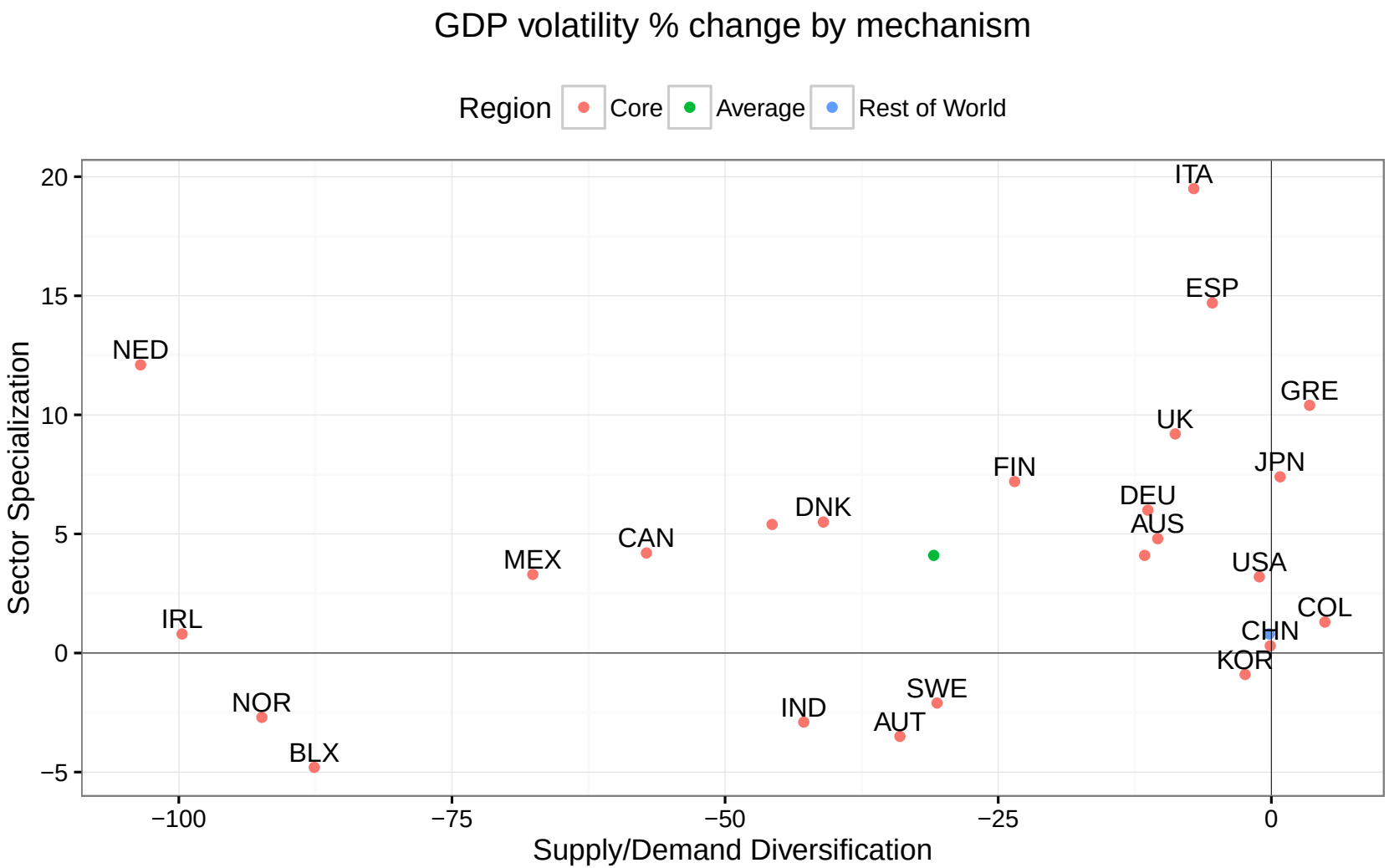
Results

Table 1: Baseline and counterfactual change in volatility (measured as variance) under free trade. Baseline calibration with $\theta = 4$.

	Average volatility				Changes in average volatility due to measured changes in trade barriers		
	Benchmark volatility (1)	Volatility absent sectoral shocks (2)	Volatility at 1972s trade barriers (3)	Volatility absent sectoral shocks, at 1972s trade barriers (4)	Volatility change due to change in trade barriers (5)	Volatility change due to specialization (6)	Volatility change due to diversification (7)
Australia	0.00085	0.00081	0.00090	0.00090	-5.6%	4.8%	-10.4%
Austria	0.00023	0.00020	0.00037	0.00033	-37.5%	-3.5%	-34.0%
Belgium and Luxembourg	0.00035	0.00019	0.00465	0.00426	-92.4%	-4.8%	-87.5%
Canada	0.00019	0.00014	0.00040	0.00037	-53.0%	4.2%	-57.2%
China	0.00631	0.00581	0.00630	0.00582	0.2%	0.3%	-0.1%
Colombia	0.00113	0.00089	0.00106	0.00084	6.2%	1.3%	4.9%
Denmark	0.00031	0.00013	0.00049	0.00032	-35.5%	5.5%	-41.0%
Finland	0.00038	0.00034	0.00046	0.00045	-16.3%	7.2%	-23.5%
France	0.00022	0.00012	0.00023	0.00014	-7.5%	4.1%	-11.6%
Germany	0.00028	0.00014	0.00029	0.00018	-5.3%	6.0%	-11.3%
Greece	0.00032	0.00023	0.00028	0.00022	13.9%	10.4%	3.5%
India	0.00087	0.00082	0.00159	0.00150	-45.7%	-2.9%	-42.7%
Ireland	0.00078	0.00055	0.06890	0.06919	-98.9%	0.8%	-99.6%
Italy	0.00017	0.00009	0.00015	0.00010	12.4%	19.5%	-7.1%
Japan	0.00027	0.00011	0.00025	0.00011	8.2%	7.4%	0.8%
Mexico	0.00066	0.00076	0.00186	0.00202	-64.3%	3.3%	-67.6%
Netherlands	0.00021	0.00012	0.00239	0.00260	-91.4%	12.1%	-103.5%
Norway	0.00055	0.00046	0.01116	0.01078	-95.1%	-2.7%	-92.4%
Portugal	0.00115	0.00082	0.00193	0.00170	-40.3%	5.4%	-45.6%
ROW	0.00164	0.00173	0.00163	0.00173	0.6%	0.8%	-0.2%
South Korea	0.00094	0.00069	0.00097	0.00072	-3.3%	-0.9%	-2.4%
Spain	0.00018	0.00015	0.00017	0.00016	9.3%	14.7%	-5.4%
Sweden	0.00020	0.00020	0.00030	0.00029	-32.7%	-2.1%	-30.6%
United Kingdom	0.00020	0.00016	0.00020	0.00018	0.4%	9.2%	-8.8%
United States	0.00028	0.00017	0.00027	0.00018	2.1%	3.2%	-1.1%
Average	0.00075	0.00063	0.00429	0.00420	-26.8%	4.1%	-31.0%

Note: Column (1) shows the average volatility in the baseline model using the calibrated kappas and shocks from 1972-2007. Column (2) is the volatility in (1) after removing common sectoral shocks. Column (3) shows the average volatility using the calibrated shocks from 1972-2007 under the assumption that trading costs in manufacturing and agriculture remain at their 1970 levels. Column (4) is similar to (3), after removing common sectoral shocks. Column (5) shows the percent change in average volatility as economies lowered their trading costs (move from (3) to (1)). Column (6) shows the contribution of specialization to the change in volatility in (5). Column (7) shows the contribution of diversification to the change in volatility in (5).

Results


GDP volatility % change by mechanism
Region
Core
Average
Rest of World
Sector Specialization
Supply/Demand Diversification
20
15
10
5
0
−5
−100
−75
−50
−25
0
ITA
ESP
NED
GRE
UK
FIN
JPN
DNK
DEU
AUS
CAN
MEX
USA
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IRL
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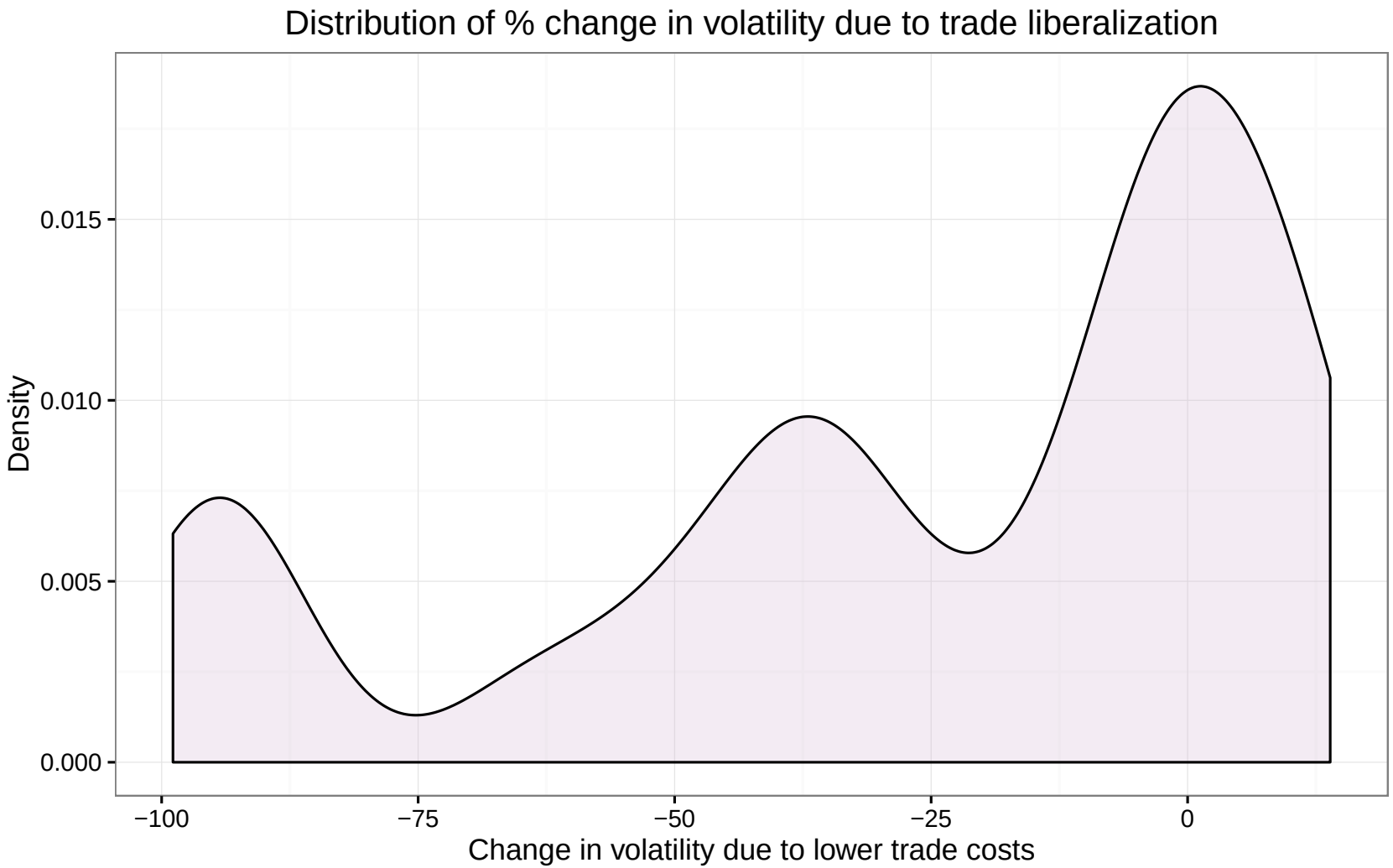
Results

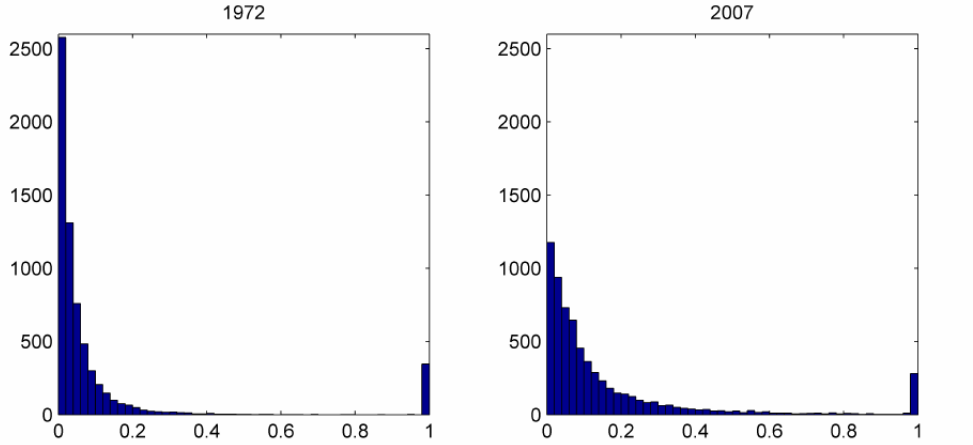

Distribution of % change in volatility due to trade liberalization
Density
0.015
0.010
0.005
0.000
−100
−75
−50
−25
0
Change in volatility due to lower trade costs

Comments

- Counterfactual framework used here is a powerful method to isolate mechanisms in play.
- Calibration procedure is very data-intensive, with many different sources needed– may compound measurement error.
- Would be interesting to see developing countries included in the analysis.
- Results are completely contingent on the model with no external robustness checks.
- Very concise takeaway, with few results.

Comment: Ambiguity of trade cost patterns

Figure 3: Histogram of bilateral κ in Manufacturing sectors. Years 1972 and 2007



- Conclusion that trade liberalization decreased volatility assumes that trade costs fell across the board.
- Motivates this assumption by showing that the distribution of trade costs fell. There could be heterogeneity in pattern.
- If there is much heterogeneity in the changes in trade costs over the sample period, could provide a counterfactual with parallel changes in trade costs.

Conclusion/Key takeaways

- Trade liberalization can affect income volatility by encouraging sectoral specialization and diversification of supply/demand.
- Large heterogeneity in the impact of the supply/demand diversification channel on volatility, less so on the sectoral specialization channel.
- On average, stabilizing effect of diversification 7 times larger than amplifying effect of specialization.
- 16 of 24 countries in sample had their volatility decreased by trade liberalization.