Paper discussion: "Trade Openness and Income Inequality: New Empirical Evidence"

Federico Giorgi - 3197626 - federico.giorgi@studbocconi.it
Filippo Grandoni - 3187864 - filippo.grandoni@studbocconi.it
Ludovico Panariello - 3192212 - ludovico.panariello@studbocconi.it
Lorenzo Ravera - 3200788 - lorenzo.ravera@studbocconi.it

July 1, 2024

Abstract

This paper has the ambitious aim of studying, deeply understanding and highlighting the crucial feature deriving by the paper ***Trade Openness and Income Inequality: New Empirical Evidence*** *- by Florian Dorn, Clemens Fuest, Niklas Potrafke. The entire work of analysis, deep study and enhancement of knowledge was supported by the great availability of Professors by Florian Dorn, Clemens Fuest, Niklas Potrafke, who through various interviews have helped us to understand their point of view as authors, and deeply reviewing the great prompts given by the papers. For this reason we want to express them our sincere appreciation.*

Contents

Theoretical question and theoretical model

The paper by Florian Dorn, Clemens Fuest and Niklas Potrafke examines the relationship between trade openness and income inequality, and explores how it changes across different types of countries: developing, developed, and transition countries.
Their analysis is based on the **Heckscher-Ohlin (HO) model** (Ohlin, 1933) and the **Stolper-Samuelson theorem** (Stolper and Samuelson, 1941). The HO model suggests that trade openness affects income inequality based on a country's factors of production and their dependence on labor or capital. Countries specialize in goods that use their abundant factors and export them. The Stolper-Samuelson theorem predicts that trade raises returns for abundant factors used in export production and lowers returns for scarce factors. In developed nations with abundant capital and skilled labor, trade can increase income inequality by moving wages concentration towards the top. Conversely, in developing countries where unskilled labor is abundant, trade can decrease income inequality by boosting these wages. However, several studies have pointed out limitations of the standard HO model implications; moreover also the empirical evidence is mixed and hardly reports causal effects.

Estimation methodology, variables and country sub-samples

The study used unbalanced panel data from 139 countries in the period 1970-2014, following the literature the data are averaged over five years in nine periods between 1970 and 2014.

To measure income **inequality**, it was used the Gini household income inequality indices of Solt's (2016) Standardized World Income Inequality Database (SWIID, v5.1). SWIID provides standardized Gini income inequality measures for market and net outcomes, allowing comparisons of income inequality before and after taxes and over time. To measure **trade openness**, it was used the sum of imports and exports as a share of GDP.

Moreover they included different control variables: **real GDP per capita**, to control for any distributional effect due to different income levels; the **age dependency ratio** and the **logarithm of total population**, in fact, demographic changes influence both international trade and the income distribution, and the **KOF globalization sub-indices** for political and social globalization and an index for FDIs; in fact, trade openness is correlated with migration and political globalization.

The instrumental variable (IV) is **predicted openness**; and is constructed by using a gravity model including exogenous large-scale natural disasters in other countries, since they influence trade openness and the per capita income level of countries. Note that they controlled for the effect of large-scale natural disasters on the income distribution within countries, in order to check that the estimated relationship between trade and inequality is not driven by the correlation between disasters registered in the home country and income inequality.

Full and benchmark samples: they both used the full sample of 139 countries, and a sample for high and upper middle income countries as a benchmark sample, following the World Bank criterion. 57 countries are classified as lower income countries; however because of the concerns about the quality of the income inequality data they were excluded from the the benchmark sample.
Development levels: they used sub-samples for the most advanced economies and emerging markets & developing economies (EMD), according to the classification of the International Monetary Fund. 34 countries are classified as advanced economies and are included in the benchmark sample; 105 countries make up the sub-sample of EMD economies and are taken from both income groups.
Transition economies: transition economies have experienced a large shift in trade openness, which was not, however, cushioned by the welfare state. The transition toward market economies might therefore be an omitted driver of trade openness and inequality in transition countries. A sample of the new European Union member states from Central and Eastern Europe and China contributes to a large extent to changes in the global income distribution since the fall of the Berlin Wall.

Descriptive statistics

Trade openness and income inequality across countries

As we can see in Figure 1, between 2010 and 2014, income inequality before taxes (Gini market) is hardly correlated with trade openness (0.01), while income inequality after taxes and transfers (Gini net) is negatively correlated with trade openness (-0.17). In this period, Gini net is on average 9.8 index points lower than the Gini market. Moreover, net income inequality in open countries is lower than in less open countries because of larger welfare states.

Trends across samples and countries

As we can see in Figure 2, trade openness and income inequality both increased rapidly between the 1980s and the 1990s, after the fall of the Berlin Wall, and in the 2000s. Gini market and Gini net both decreased from the early 2000s in EMD economies; meanwhile, in advanced economies, Gini net remained stable while Gini market has increased; that indicates a rise of redistribution. Before taxation and transfers, income

inequality is at a similar level in advanced and EMD economies; while after taxation and transfers, inequality is much lower in advanced economies than in EMD economies.
There is a positive correlation between the changes in trade openness and the market and net income inequality in countries of the benchmark sample between the periods 1990-1994 and 2005-2009. There are, however, two groups of countries that are the key drivers of the linear relationship: on one hand Hong Kong, Luxembourg and Singapore are outliers regarding trade openness; on the other the transition countries in Eastern Europe and China experienced a huge opening process and a huge rise in income inequality during that time. Excluding the outliers, the correlation is almost zero; while after excluding outliers and transition countries, the correlation is negative instead.

Empirical Strategy

OLS Panel FE Model

To estimate the baseline panel model using OLS, they applied the following relationship:

$$Y_{i,\tau} = \beta \times TRADE_{i,\tau} + \Theta' \times \chi_{i,\tau} + \nu_i + \nu_\tau + \epsilon_{i,\tau}$$

- $Y_{i,\tau}$ is the income inequality of country i in period τ.
- $TRADE_{i,\tau}$ is the trade openness of country i in period τ.
- $\chi_{i,\tau}$ is a vector of control variables.
- ν_i and ν_τ are the country and period fixed effects, respectively.
- $\epsilon_{i,\tau}$ is the error term.

This method exploits within-country variation over time, eliminating observable and unobservable country-specific time-invariant effects and includes fixed time effects to control for period-specific shocks that influence multiple countries simultaneously. The standard errors are robust to heteroscedasticity and are clustered at the country level.

2SLS Panel IV Model & Endogeneity Problem

The trade openness variable may suffer from endogeneity due to omitted variable bias and reverse causality. Possible omitted variables include factors like competition from low-cost countries prompting high-income countries to specialize in high-tech goods. Reverse causality can arise from changes in income inequality affecting trade policies.

Gravity Equation as an Instrumental Variable (IV): to address the endogeneity of trade openness, they used a gravity model as an IV, incorporating exogenous natural disasters in foreign countries as predictors. These disasters serve as exogenous shocks affecting trade openness due to geographic and temporal variations.

Instrument Construction: the predicted trade openness $\hat{\omega}_t^{i,j}$ is constructed through a two-step process:

$$\omega_t^{i,j} = \exp(\delta \times D^i + \gamma \times Z_t^{i,j} + \lambda \times (\Phi_t^{i,j} \times D^i) + v^i + v^j + v_t + \epsilon_t^{i,j})$$

where the variables are defined as follows:

- $Z_{i,j}^t = [\ln(POP_i \cdot POP_j); \ln(DIST_{i,j}^t); BOR_{i,j}]$ includes exogenous controls for population, geographic distance, and border adjacency.
- D_j^t represents large-scale natural disasters in country j.
- $\phi_{i,j}^t = [\ln(FINDIST); \ln(AREA); \ln(POP); BOR_{i,j}]$ includes variables interacting with D_j^t such as financial remoteness, area, and population.

Fixed effects are captured by v^i, v^j, and v_t, and $\epsilon_{i,j}^t$ is the idiosyncratic error.

In the second step of constructing the IV, they aggregated predicted bilateral openness values $\omega_{i,j}^t$ across all bilateral country pairs and years to form the multilateral openness $\Omega_{i,t}$:

$$\Omega_{i,t} = \sum_{i \neq j} \omega_{i,j}^t$$

Using this aggregated measure, they derived the instrument for $TRADE_{i,t}$ based on data from 1966 to 2008, employing one-period lags of predicted openness for robustness.

Results Analysis

Baseline results

The average effect of trade openness on Gini income inequality is examined in the full and benchmark sample, but the results initially do not suggest a statistically significant relationship between trade openness and income inequality. Indeed the baseline specifications, in line with predictions of the Stolper-Samuelson theorem, which predicts that trade openness increases inequality in developed countries and decreases inequality in developing countries, do not confirm that trade openness influences equality within countries when they used large country samples.

Subsample results

The analysis focuses on the impact of trade openness on income distribution across different income groups (deciles), using 2SLS regression with relative net income shares as dependent variables. The findings indicate no significant overall relationship between trade openness and income inequality for the entire sample. However, a more distinct relationship emerges in a

specific subset (the benchmark sample), revealing that trade openness negatively affects the income shares of lower income deciles (1 to 7) and positively affects those of higher income deciles, although the changes are small.
Significantly, for the upper middle class in the 9th decile, an increase in trade openness by ten percentage points corresponds to a 0.12 percentage point increase in their income share, a finding statistically significant at the 5% level. According to the Stolper-Samuelson theorem, the results vary by economic development level: in developing economies, the poorest benefit from trade openness at the expense of higher income deciles, whereas in advanced economies, the upper middle class gains disproportionately at the expense of lower income deciles. The analysis confirms the relevance of the instrument used, as indicated by the Cragg-Donald Wald F-statistic surpassing critical values in both subsamples.

Outliers and transition countries

The unconditional relationship between the change in trade openness and income inequality seems to be driven by outliers in trade openness and by Central and Eastern European transition countries (East EU) and China. The effect of trade openness on income inequality is therefore examined when outliers and transition countries are excluded from the analysis:

- Excluding Singapore as an outlier, the effect of trade openness on income inequality becomes statistically insignificant across advanced and benchmark economies, revealing varied but non-significant impacts on different income groups.
- Excluding China and East EU transition countries from the benchmark sample results in smaller coefficient estimates for trade openness, which are not statistically significant. Without these countries, the effect of trade openness on income shares becomes negligible or negative when using Gini indices as dependent variables. However, after excluding transition countries from the benchmark sample, there was no overall inequality-increasing effect of trade openness in a large sample of advanced and emerging economies, consistent with the predictions of the HO model (Stolper-Samuelson theorem).

Limits and further analysis

The paper presents some limits:

1. **Data Quality and Availability**: The concern about the quality of income inequality data, particularly in less developed countries, is crucial. As a fact, the authors are aware of the concerns over the reliability of SWIID's imputed estimates in data-poor regions. Moreover, it does not show which parts of a country's income distribution gain or lose and cause changes in the Gini index, therefore it was also employed the data on relative net income shares of the Global Consumption and Income Project (GCIP) by Lahoti et al. (2016) as a measure of post tax and transfer income inequality.
2. **Usage of Export-Import Only as an Indicator of Trade Openness**: Despite being on of the most relevant indicator to measure the openness of an economy in the literature, the indicator could be expanded by incorporating alternative indicators such as trade in services and digital trade flows, which are increasingly relevant in today's global economy.
3. **IV Instrument Concern**: The chosen instrument, natural disasters, poses significant challenges suggesting that the IV estimates may be biased.
    - **Violation of exclusion: Direct Impact on Income Inequality**: For an instrument to be valid, it must satisfy the exclusion restriction, meaning it should affect the dependent variable (income inequality) only through the endogenous regressor (trade openness) and not through any other channels. Natural disasters can directly influence income inequality. The reconstruction efforts following a disaster often lead to increased economic activity that benefits certain segments of the population disproportionately, potentially exacerbating income inequality. Additionally, the ability of a country to implement disaster mitigation measures is correlated with its GDP, introducing further bias. Given that natural disasters directly affect economic structures and income distribution, the exclusion condition is violated.
    - **Violation of Exogeneity: Geographic Correlation**: The incidence of natural disasters is highly correlated with geographic location. Countries in certain regions (e.g., the Pacific Ring of Fire, hurricane-prone areas) are more susceptible to natural disasters. This geographic concentration limits the variability of the instrument across the sample, reducing its effectiveness and making it difficult to generalize the findings.

    To address these issues, we propose using a combination of instruments that are less likely to be directly correlated with income inequality and provide a broader and more stable source of exogenous variation in trade openness. These include global technological innovations in trade, such as the adoption of e-commerce platforms (e.g., Amazon, eBay), which facilitate international trade (i.e. reduction of transaction costs) without significantly impacting income inequality. The diffusion of these technologies can be tracked over time and across countries, providing a robust source of exogenous variation. Additionally, geopolitical stability indicators, which include embargos and trade agreements, and historical trade routes can serve as valid instruments, influencing trade patterns while being less likely

to affect current income distribution directly. They both provide a long-term and stable source of variation due to data collected by WTO, IMF or WBI. Combining these instruments enhances the robustness and credibility of the IV estimates, mitigating the weaknesses associated with any single instrument.

Model Specification

$$Y_{i,t} = \beta \cdot \text{TRADE}_{i,t} + \Theta' \cdot X_{i,t} + \nu_i + \nu_t + \epsilon_{i,t} \quad (1)$$

First-Stage Regression

$$\begin{aligned} \text{TRADE}_{i,t} = {} & \pi_1 \cdot \text{TECH}_{i,t} + \pi_2 \cdot \text{GEO}_{i,t} \\ & + \pi_3 \cdot \text{HIST}_{i,t} + \Theta' \cdot X_{i,t} \\ & + \nu_i + \nu_t + \epsilon_{i,t} \end{aligned} \quad (2)$$

where:

- $\text{TECH}_{i,t}$: Adoption of technological innovations in trade.
- $\text{GEO}_{i,t}$: Geopolitical stability indicators.
- $\text{HIST}_{i,t}$: Historical trade routes or agreements.

Second-Stage Regression
Use the predicted values of trade openness from the first-stage regression to estimate its impact on income inequality.

Testing Instrument Validity

- **Hansen J-Test**: Conduct to verify the overidentification of instruments, ensuring they are uncorrelated with the error term.
- **Stock-Yogo Test**: Perform to check for weak instruments, ensuring strong correlation with the endogenous variable.

Robustness Checks: Exclude regions where the instrument might be overly concentrated and check if the results hold. Include control variables that capture the direct effects of natural disasters and political stability on income inequality.

4. **Generalization of Results**: The paper rightly acknowledges that the impacts of trade openness on income inequality vary significantly across different national contexts, highlighting the importance of a nuanced approach in future research. To delve deeper into the complexities of how trade affects inequality, it is essential to examine the interplay between trade policies and various domestic factors such as governance quality and labor market dynamics. Future studies could enhance our understanding by incorporating interaction terms in regression analyses, which would allow researchers to quantify how specific domestic conditions modify the effects of trade openness. Additionally, adopting a multi-level modeling approach could be beneficial. This method would facilitate the examination of data at multiple levels—for instance, individual, regional, and national—thereby providing insights into the hierarchical nature of how trade impacts are disseminated across different layers of society.
5. **Refining Econometric Models**: The paper employs sophisticated econometric techniques to address the complexities of trade openness and income inequality. Further refinement could include dynamic panel data models to account for temporal variations and lagged effects of trade policies. Additionally, structural equation modeling (SEM) could be used to explore indirect causal pathways, potentially revealing how trade influences inequality through intermediary variables such as education and technology adoption. These advanced methodologies would enhance the robustness of the findings and provide deeper insights into the mechanisms at play.
6. **Micro-Level Analysis**: The paper's macro-level approach highlights broad trends but may mask heterogeneous effects at the micro level. Detailed case studies or microdata analysis could illuminate how individual households or specific communities are affected by trade policies. This could involve using household survey data to analyze income changes over time within specific segments of the population. Such an analysis might reveal differential impacts not just by economic status but also by other demographic characteristics such as education level, gender, and occupation. Understanding these nuances could inform targeted interventions to mitigate adverse effects on vulnerable groups.
7. **Policy Evaluation**: The paper hints at the varied effects of trade openness across different economic contexts but stops short of a thorough evaluation of specific trade and domestic policy combinations. Future research could benefit from a comparative analysis of policy frameworks across countries that successfully manage the inequality effects of trade openness. This might involve case studies or cross-country comparisons to draw lessons on effective combinations of trade policy and domestic interventions, such as social safety nets or educational reforms, aimed at distributing the gains from trade more equitably.

Moreover, further analysis could be necessary with respect to **temporal dynamics**: The lack of examination of long-term effects is a significant gap. Longitudinal studies or the use of time series analysis could shed light on the enduring impacts of trade on inequality, providing insights into the dynamics that short-term studies might miss.

References

[1] Dorn, D. and Hanson, G. H. *The China syndrome: Local labor market effects of import competition in the US*, American Economic Review, 103(6), 2121–2168, 2013.

[2] Berg, A., Ostry, J. D., and Zettelmeyer, J. *What makes growth sustained?*, Journal of Development Economics, 98(2), 149–166, 2012.

[3] Borjas, G. J., Freeman, R. B., Katz, L. F., DiNardo, J., and Abowd, J. M. *How much do immigration and trade affect labor market outcomes?*, Brookings Papers on Economic Activity, 1(1), 1–90, 1997.

[4] Feenstra, R. C., and Hanson, G. H. *The impact of outsourcing and high-technology capital on wages: Estimates for the United States, 1979–1990*, Quarterly Journal of Economics, 114(3), 907–940, 1999.

[5] Goldberg, P. K., and Pavcnik, N. *Distributional effects of globalization in developing countries*, Journal of Economic Literature, 45(1), 39–82, 2007.

[6] Jaumotte, F., Lall, S., and Papageorgiou, C. *Rising income inequality: Technology, or trade and financial globalization?*, IMF Economic Review, 61(2), 271–309, 2013.

[7] Milanovic, B. *Explaining the increase in inequality during transition*, Economics of Transition, 7(2), 299–341, 1999.

[8] Ravallion, M., and Chen, S. *China's (uneven) progress against poverty*, Journal of Development Economics, 82, 1–42, 2007.

[9] Siddique, A. B. *Impact of trade on inequality: New evidence of what, when, and where*, CESifo Economic Studies, forthcoming, 2021.

[10] Wood, A. *How trade hurt unskilled workers*, Journal of Economic Perspectives, 9(3), 57–80, 1995.

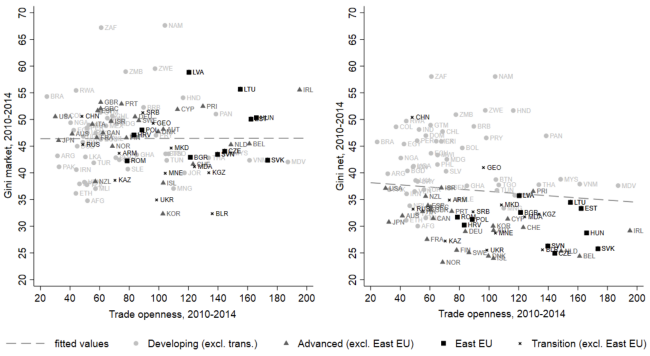

Figure 1: *Trade openness and Gini income inequality, 2010-2014*

Source: SWIID 5.1, World Bank (2017), own calculations. **Notes:** Figure 1 relates to the full country sample within the period 2010-2014. The figure excludes Luxembourg and Singapore as outliers. Transition (excl. East EU) relate to former members of the Soviet Union (FSU, non-EU), Western Balkan (non-EU) states, and China. Unconditional correlations: $\beta_{\text{market}} = 0.005; \beta_{\text{net}} = -0.171^{*}$ ($^{*}p < 0.1$).

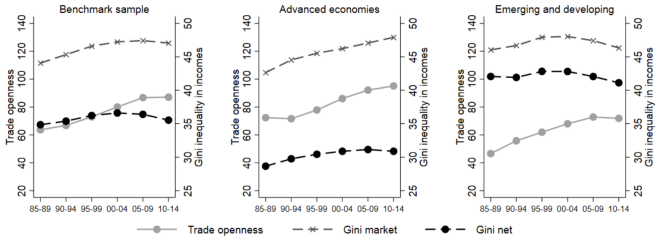

Figure 2: *Global trends in trade openness and Gini income inequality*

Source: SWIID 5.1, World Bank (2017), own calculations. **Notes:** Trends between the periods 1985-1989 and 2010-2014. Unweighted mean of balanced samples. In the full sample, 63 of 140 countries have observations in all six periods, in the benchmark sample 47 of 82 countries, 24 of 34 countries within the sample of advanced economies, and 39 of 106 countries in the sample of emerging and developing economies (EMD).