Long-Run Dynamics Between Trade Liberalization and Income Inequality in the European Union:

A Special Case of Cointegration

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Introduction

- Europe was the battlefield of the two World Wars.
- After 1945, the main goal was **economic growth**.
- A key tool used: international trade (motivated by research).
- European countries have steadily increased their openness to trade.
- Income inequality has also steadily increased over time.
- Does openness to trade have an impact on income inequality?
- Theoretical frameworks:
    - The Hecksher-Ohlin model
    - The Stolper-Samuelson model

Empirical findings

- Two main branches of the literature: research on developing and developed countries.
- The branch on developed countries is more established.
- The results are the same irrespective of the branch:
  - positive relationship
  - negative relationship

Developed economies

positive relationship

- Bergh and Nilsson, 2010
- Barusman and Barusman, 2017

negative relationship

- Milanovic and Squire, 2005
- Asteriou et al., 2013
- Jaumotte et al., 2013
- Neagu et al., 2016

Developing economies

positive relationship

- Milanovic and Squire, 2005
- Meschi and Vivarelli, 2009
- Bogliaccini, 2013
- Mamoon, 2017
- Pavcnik, 2017

negative relationship

- Reuveny and Li, 2003
- Dollar and Kraay, 2004
- Székely and Sámano, 2012
- Lim and McNelis, 2014

- Major focus on **short-run dynamics**.
- To our knowledge, the only paper studying the **long-run dynamics** is Cassette et al. (2012)
- They find evidence for both a short-run and a long-run effect.
- *We show that their model may have been misspecified.*

Data

- 15 EU countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the United Kingdom.
- Data from 1985 to 2015 (31 years)
- Variables:
  - Market income inequality
  - Disposable income inequality
  - Trade openness $\frac{X+M}{GDP}$

Methodology

- We study the long-run dynamics with **cointegration analysis**.
- Traditionally:

  (i) Unit root test

  (ii) Cointegration test
- **Major pitfall: cross-section dependence**
- Our methodology:

  (i) Cross-section dependence test

  (ii) Second-generation unit root test

  (iii) Second-generation cointegration test

Cross-section dependence tests

- Breush and Pagan (1980) LM test

$$LM = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}^2 \sim \chi^2_{N(N-1)/2}$$

- Pesaran (2004a) LM test

$$CD_{LM} = \sqrt{\frac{1}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (T\hat{\rho}_{ij}^2 - 1) \overset{asy}{\sim} N(0,1)$$

- Pesaran (2004b) CSD test

$$CD = \sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho_{ij}} \overset{asy}{\sim} N(0,1)$$

- Pesaran et al. (2008) CSD test

$$LM_{adj} = \sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho_{ij}} \frac{(T-k)\hat{\rho}_{ij}^2 - \mu_{Tij}}{\sqrt{\nu_{Tij}^2}} \overset{asy}{\sim} N(0,1)$$

CSD test results

Variable	Statistic	P-value
CD		
Lgdis	-2.771	0.003
Lgmar	-3.048	0.001
Ltr	-2.615	0.004
CDLM		
Lgdis	3.889	0.000
Lgmar	2.659	0.004
Ltr	11.197	0.000
LM		
Lgdis	161.353	0.000
Lgmar	143.535	0.007
Ltr	267.256	0.000
LMadj		
Lgdis	1.941	0.026
Lgmar	4.374	0.000
Ltr	3.888	0.000

Unit root test

- The model:

$$\Delta y_t = \alpha_i y_{i,t-1} + \delta_i' d_t + \sum_{j=1}^{p_i} \beta_{ij} \Delta y_{i,t-j} + c_i \bar{y}_{t-1} + \sum_{j=0}^{p_i} \gamma_{ij} \Delta \bar{y}_{i,t-j} + e_{i,t}$$

- Individual test statistics:

$$CADF_i = t_i(\alpha_i) = \frac{\hat{\alpha}_i}{se(\hat{\alpha}_i)}$$

- CIPS test statistic:

$$CIPS = \frac{\sum_{i=1}^{N} CADF_i}{N}$$

Unit root test results

Variable	Level	Difference
Lgmar	-1.645	-3.991***
Ltr	-1.761	-3.942***
Lgdis	-2.345	-3.957***

- Our series are I(1).

Cointegration tests

- Panel cointegration tests with cross-section dependence:
  - Error-correction based cointegration test (Westerlund, 2007)
  - Panel LM bootstrap test (Westerlund and Edgerton, 2007)

Westerlund (2007)

1. Group mean statistics (assumes heterogeneity)

- The model

$$\Delta y_{i,t} = \delta_i^{'} d_t + a_i y_{i,t-1} + b_i^{'} x_{i,t-1} + \sum_{j=1}^{p_i} \alpha_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{p_i} \beta_{ij} \Delta x_{i,t-j} + e_{ij}$$

- The statistics

$$G_\tau = \frac{1}{N} \sum_{i=1}^{N} \frac{\hat{\alpha}_i}{se(\hat{\alpha}_i)}$$

$$G_\alpha = \frac{1}{N} \sum_{i=1}^{N} \frac{T\hat{\alpha}_i}{\hat{\alpha}_i(1)}$$

Westerlund (2007) (2)

1. Panel statistics (assumes homogeneity)

- The model

$$\Delta y_{it} = a_i^{'} d_t + \beta_i x_{i,t-1} + \sum_{j=1}^{p_i} \alpha_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{p_i} \gamma_{ij} \Delta x_{i,t-j} + u_{it}$$

$$y_{it} = a_i^{'} d_t + \beta_i x_{i,t-1} + \sum_{j=1}^{p_i} \alpha_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{p_i} \gamma_{ij} \Delta x_{i,t-j} + v_{it}$$

$$\hat{u}_{it} = \alpha \hat{v}_{i,t-1} + w_{it}$$

- The statistics

$$P_\tau = \frac{\hat{\alpha}}{se(\hat{\alpha})}$$

$$P_\alpha = T\hat{\alpha}$$

Westerlund and Edgerton, 2007

- The model:

$$y_{it} = \delta_i^{'} d_t + b_i^{'} x_{it} + \varepsilon_{it}$$

The disturbance ε_{it} has the following decomposition:

$$\varepsilon_{it} = u_{it} + v_{it}$$

$v_{it} = \sum_{j=1}^{t} \eta_{ij}$ where $\eta_{ij} \sim \mathcal{N}(0, \sigma_i^2)$.

- The statistic:

$$LM_N^+ = \frac{1}{NT^2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{\omega}_i^{-2} S_{it}^2$$

S_{it} is the partial sum process of $\hat{\varepsilon}_{it}$ and $\hat{\omega}_i^2$ is the estimated long-run variance of u_{it} conditional on Δx_{it}.

Panel cointegration test results

Westerlund, 2007

Statistic	Estimate	Asymptotic	Bootstrap
Market income inequality			
Gt	1.793	0.963	0.949
Ga	1.005	0.843	0.914
Pt	1.003	0.842	0.846
Pa	-0.961	0.168	0.631
Disposable income inequality			
Gt	-1.524	0.064	0.431
Ga	-1.859	0.032	0.309
Pt	-1.785	0.037	0.413
Pa	-2.131	0.017	0.428

Westerlund and Edgerton, 2007

Model	Statistic	Asymptotic	Bootstrap
Market	16.400	0.000	0
Disposable	12.815	0.001	0

Conclusion

- The literature mainly focuses on the short-run dynamics between trade openness and income inequality.
- We use cointegration analysis to study the long-run dynamics.
- We show the existence of *cross-section dependence* in the panels.
- We reproduce the results of Cassette et al. (2012) who found evidence for the existence of a long-run relationship.
- We show that when *cross-section dependence* is accounted for, no long-run relationship is found.