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On the Impact of CETA: Trade and Investment

Mario Larch (with James E. Anderson and Yoto V. Yotov)
University of Bayreuth

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On the Impact of CETA: Trade and Investment

James E. Anderson
Boston College and NBER

Mario Larch
University of Bayreuth

Yoto V. Yotov
Drexel University

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Motivation and Contributions

Motivation, I

"The Comprehensive Economic and Trade Agreement will generate economic growth and jobs on both sides of the Atlantic and reflects both sides' commitment to free, fair and progressive trade, for the benefit of nearly 550 million EU and Canadian citizens."

(European Commission, press release from October 30, 2016)

Motivation, II

- “The Comprehensive Economic and Trade Agreement (CETA) was adopted by the Council and signed at the EU-Canada Summit on 30 October 2016.
- Once applied, it will offer EU firms more and better business opportunities in Canada and support jobs in Europe.
- It will
  - remove customs duties,
  - end restrictions on access to public contracts,
  - open-up the services market,
  - offer better conditions for investors and
  - help prevent illegal copying of EU innovations and traditional products.”

(European Commission)

Motivation and Contribution

- CETA, TPP and TTIP are about FDI and IPR in addition to trade and trade barriers.
- Policy maker optimism that growth effects multiply static gains contrasts with academic economists doubts.
- We provide evidence for dynamic gains from structural econometric model estimated on bilateral trade, FDI and capital accumulation data for 89 countries, 1990-2011.
- Simulation of trade liberalization between CA and EU.

Strategy

Eventual goal is counterfactuals; requires (structural) model.

Credibility indicated: estimated structural model with good fit. Also, plausible theory.

- Exploit good fit and structural interpretation of gravity.
- Dynamics built on capital accumulation model of Anderson, Larch, Yotov (2015).
- FDI stocks fitted to gravity structure (Head and Ries, 2008).
- Novelty: treat FDI as non-rival knowledge capital transfer (McGrattan and Prescott, 2009); greatly simplifies dynamics.

Tactics

- Theory $\Rightarrow$ small scale structural econometric model.
- Quantify effects of BITs and RTAs on FDI and trade in gravity system.
- Version of model estimated using approximated, analytical transition functions.
- Simulation of transition between steady states of model using estimated parameters and calibration.

Preview of Results: Trade

- Large effects of RTAs on bilateral trade;
- Even larger effects of BITs on bilateral trade;
- Standard large effects of distance;
- Weak to nil effects of common language, former colony;
- Trade effect of BITs: FDI as tech. transfer raises trade.

Preview of Results: FDI

- Big effects of distance on FDI (bigger than on trade);
- Small effect of BITs on FDI (and RTAs) in OLS;
- No effect of BITs on FDI with controls for endogeneity;
- Weak evidence for BIT effect on FDI due to mis-measured FDI;
- FDI stocks also problematic dependent variable because little variation;
- We experiment with FDI flows as dependent variable.

Outline

- Theoretical Foundation
- From Theory to Empirics
- Counterfactual Experiments
- Conclusions and Future Directions

Theoretical Foundation

Basic Model

One good CES Armington preferences.

GDP from Cobb-Douglas fn. of Labor L, physical capital K and technology capital that combines technology from partners.

Transition dynamics: physical and technology capital accumulate with log-linear adj. cost (Lucas-Prescott, 1971).

Each country buys and sells physical and technology capital subject to period-by-period current account balance.

Production

Production $Y_{j,t}$ in country j at time t relies on local productivity ($A_{j,t}$) and country-specific (internationally immobile) resources including inelastically supplied labor ($L_{j,t}$), a stock of physical capital ($K_{j,t}$), and a stock of technology capital ($\mathcal{M}_{j,t}$):

$$Y_{j,t} = p_{j,t} A_{j,t} \left(L_{j,t}^{1-\alpha} K_{j,t}^{\alpha} \right)^{1-\phi} \left(\prod_{i=1}^{N} \left(\omega_{ij,t}^{\xi} \mathcal{M}_{i,t} \right)^{\eta_i} \right)^{\phi} ; \quad \alpha, \phi \in (0,1),$$

where $p_{j,t}$ denotes the factory-gate price of good j at time t.

$\omega_{ij,t} \in [0,1]$ denotes the openness measure for foreign technology. $\omega = 1$ is frictionless openness, $\omega = 0$ is prohibitive friction.

Technology Capital

The bilateral FDI stock from country i in country j at time t is given by:

$$FDI_{ij,t} \equiv \omega_{ij,t}^{\xi} \mathcal{M}_{i,t}.$$

Here, $\mathcal{M}_{i,t}$ is defined as aggregate technology capital stock in country i at time t. Note non-rival nature, $\mathcal{M}_{i,t}$ used in all j.

Dynamics

Transition dynamics modeled as Cobb-Douglas accumulation (Lucas-Prescott):

$$K_{j,t+1} = \Omega_{j,t}^{\delta_K} K_{j,t}^{1-\delta_K}, \delta_K \in (0,1);$$

$$\mathcal{M}_{j,t+1} = \chi_{j,t}^{\delta_M} \mathcal{M}_{j,t}^{1-\delta_M}, \delta_M \in (0,1).$$

The δ parameters combine depreciation with adjustment cost.

Note that steady state implies full replacement of physical and technology capital each period.

No closed-form solution out of steady-state.

Solving the Model

The model is solved with two-stage budgeting:

1. First, for given aggregate variables, we solve for bilateral allocations ('Lower Level').
2. Then, we solve for the aggregate variables ('Upper Level').

Theoretical Foundation: 'Lower Level' (Static), I

Total nominal spending: $X_{ij,t} = p_{ij,t}\left(c_{ij,t} + I^{K}_{ij,t} + I^{M}_{ij,t}\right)$.
Optimization of

$$C_{j,t} = \left(\sum_i \gamma_i^{\frac{1-\sigma}{\sigma}} c_{ij,t}^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}, \ \forall t$$

$$\Omega_{j,t} = \left(\sum_i \gamma_i^{\frac{1-\sigma}{\sigma}} \left(I^{K}_{ij,t}\right)^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}, \ \forall t$$

$$\chi_{j,t} = \left(\sum_i \gamma_i^{\frac{1-\sigma}{\sigma}} \left(I^{M}_{ij,t}\right)^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}, \ \forall t$$

subject to $E_{j,t} = P_{j,t}C_{j,t} + P_{j,t}\Omega_{j,t} + P_{j,t}\chi_{j,t}$ and taking $C_{j,t}$, $\Omega_{j,t}$ and $\chi_{j,t}$ for all j as given and imposing market clearance, $Y_{i,t} = \sum_j X_{ij,t}$, we can derive the following equation system:

Theoretical Foundation: 'Lower Level' (Static), II

$$
\begin{aligned}
X_{ij,t} &= \frac{Y_{i,t}E_{j,t}}{Y_t}\left(\frac{t_{ij,t}}{\Pi_{i,t}P_{j,t}}\right)^{1-\sigma}, \\
P_{j,t}^{1-\sigma} &= \sum_i \left(\frac{t_{ij,t}}{\Pi_{i,t}}\right)^{1-\sigma} \frac{Y_{i,t}}{Y_t}, \\
\Pi_{i,t}^{1-\sigma} &= \sum_j \left(\frac{t_{ij,t}}{P_{j,t}}\right)^{1-\sigma} \frac{E_{j,t}}{Y_t}, \\
p_{j,t} &= \frac{(Y_{j,t}/Y_t)^{\frac{1}{1-\sigma}}}{\gamma_j \Pi_{j,t}}.
\end{aligned}
$$

Theoretical Foundation: 'Upper Level' (Dynamic)

$$
\begin{aligned}
\max_{\{C_{j,t},\Omega_{j,t},\chi_{j,t}\}} & \quad \sum_{t=0}^{\infty} \beta^t \ln(C_{j,t}) \\
K_{j,t+1} &= \Omega_{j,t}^{\delta_K} K_{j,t}^{1-\delta_K}, \ \forall t \\
\mathcal{M}_{j,t+1} &= \chi_{j,t}^{\delta_M} \mathcal{M}_{j,t}^{1-\delta_M}, \ \forall t \\
Y_{j,t} &= p_{j,t} A_{j,t} \left(L_{j,t}^{1-\alpha} K_{j,t}^{\alpha} \right)^{1-\phi} \left(\prod_{i=1}^{N} \left(\omega_{ij,t}^{\xi} \mathcal{M}_{i,t} \right)^{\eta_i} \right)^{\phi}, \ \forall t \\
E_{j,t} &= P_{j,t} C_{j,t} + P_{j,t} \Omega_{j,t} + P_{j,t} \chi_{j,t}, \ \forall t \\
E_{j,t} &= Y_{j,t} + \phi \eta_j \sum_{i \neq j} Y_{i,t} - \phi \left(1 - \eta_j \right) Y_{j,t}, \ \forall t \\
K_{j,0}, \mathcal{M}_{j,0} & \quad \text{given.}
\end{aligned}
$$

Structural System

Structural Gravity: $$X_{ij,t} = \frac{Y_{i,t}E_{j,t}}{Y,t}\left(\frac{t_{ij,t}}{\Pi_{i,t}P_{j,t}}\right)^{1-\sigma},$$

Inward Resistance: $$P_{j,t}^{1-\sigma} = \sum_{i=1}^{N}\left(\frac{t_{ij,t}}{\Pi_{i,t}}\right)^{1-\sigma}\frac{Y_{i,t}}{Y_t},$$

Outward Resistance: $$\Pi_{i,t}^{1-\sigma} = \sum_{j=1}^{N}\left(\frac{t_{ij,t}}{P_{j,t}}\right)^{1-\sigma}\frac{E_{j,t}}{Y_t},$$

Market Clearance: $$p_{j,t} = \frac{\left(Y_{j,t}/Y_t\right)^{\frac{1}{1-\sigma}}}{\beta_j\Pi_{j,t}},$$

Income: $$Y_{j,t} = p_{j,t}A_{j,t}\left(L_{j,t}^{1-\alpha}K_{j,t}^{\alpha}\right)^{1-\phi}\left(\prod_{i=1}^{N}\left(FDI_{ij,t}^{stock}\right)^{\eta_i}\right)^{\phi},$$

Expenditure: $$E_{j,t} = (1-\phi)Y_{j,t} + \phi\eta_j Y_t,$$

Physical Capital: $$\beta(1-\phi)\alpha(1-\phi+\phi\eta_j)\frac{Y_{j,t+1}}{K_{j,t+1}} - \frac{C_{j,t+1}P_{j,t+1}}{\delta_K C_{j,t}}\frac{K_{j,t+1}^{\frac{1}{\delta_K}-1}}{K_{j,t}^{\frac{1-\delta_K}{\delta_K}}} = \frac{\beta(\delta_K-1)P_{j,t+1}}{\delta_K}\left(\frac{K_{j,t+2}}{K_{j,t+1}}\right)^{\frac{1}{\delta_K}},$$

Technology Capital: $$\beta\phi\eta_j\left((1-\phi)\frac{Y_{j,t+1}}{\mathcal{M}_{j,t+1}} + \phi\eta_j\frac{\sum_{i=1}^{N}Y_{j,t+1}}{\mathcal{M}_{j,t+1}}\right) - \frac{C_{j,t+1}P_{j,t+1}}{\delta_M C_{j,t}}\frac{\mathcal{M}_{j,t+1}^{\frac{1}{\delta_M}-1}}{\mathcal{M}_{j,t}^{\frac{1-\delta_M}{\delta_M}}}$$

$$= \frac{\beta(\delta_M-1)P_{j,t+1}}{\delta_M}\left(\frac{\mathcal{M}_{j,t+2}}{\mathcal{M}_{j,t+1}}\right)^{\frac{1}{\delta_M}} \quad \text{with} \quad FDI_{ij,t}^{stock} = \omega_{ij,t}^{\xi}\mathcal{M}_{i,t}.$$

Structural System: Steady State

Structural Gravity: $$X_{ij} = \frac{Y_i E_j}{Y} \left(\frac{t_{ij}}{\Pi_i P_j} \right)^{1-\sigma},$$

Inward Resistance: $$P_j^{1-\sigma} = \sum_{i=1}^{N} \left(\frac{t_{ij}}{\Pi_i} \right)^{1-\sigma} \frac{Y_i}{Y},$$

Outward Resistance: $$\Pi_i^{1-\sigma} = \sum_{j=1}^{N} \left(\frac{t_{ij}}{P_j} \right)^{1-\sigma} \frac{E_j}{Y},$$

Market Clearance: $$p_j = \frac{\left(Y_j/Y\right)^{\frac{1}{1-\sigma}}}{\beta_j \Pi_j},$$

Income: $$Y_j = p_j A_j \left(L_j^{1-\alpha} K_j^{\alpha} \right)^{1-\phi} \left(\prod_{i=1}^{N} \left(FDI_{ij}^{stock} \right)^{\eta_i} \right)^{\phi},$$

Expenditure: $$E_j = (1-\phi) Y_j + \phi \eta_j Y,$$

SS Physical Capital: $$K_j = \frac{\alpha \beta \delta_K (1-\phi)(1-\phi+\phi\eta_j)}{1-\beta+\beta\delta_K} \frac{Y_j}{P_j},$$

SS Technology Capital: $$FDI_{ij}^{stock} = \frac{\beta \phi \eta_i \delta_M}{1-\beta+\beta\delta_M} \omega_{ij}^{\xi} \frac{E_i}{P_i}.$$

Ad-hoc Transition Functions

- $K_{j,t+1} = \Omega_{j,t}^{\delta_K} K_{j,t}^{1-\delta_K}$ and $\mathcal{M}_{j,t+1} = \chi_{j,t}^{\delta_M} \mathcal{M}_{j,t}^{1-\delta_M}$ imply in steady state $K_j = \Omega_j$ and $\mathcal{M}_j = \chi_j$.
- In steady state we derived the following expressions:

$$K_j = \frac{\alpha\beta\delta_K(1-\phi)(1-\phi+\phi\eta_j)}{1-\beta+\beta\delta_K} \frac{Y_j}{P_j},$$

$$FDI_{ij}^{stock} = \frac{\beta\phi\eta_i\delta_M}{1-\beta+\beta\delta_M} \omega_{ij}^{\xi} \frac{E_i}{P_i}.$$

- Hence, we assume the following ad-hoc transition functions:

$$K_{j,t+1} = \left[\frac{\alpha\beta\delta_K(1-\phi)(1-\phi+\phi\eta_j)}{(1-\beta+\beta\delta_K)} \frac{Y_{j,t}}{P_{j,t}}\right]^{\delta_K} K_{j,t}^{1-\delta_K},$$

$$FDI_{ij,t+1}^{stock} = \omega_{ij,t+1}^{\xi} \left[\frac{\beta\phi\eta_i\delta_M}{1-\beta+\beta\delta_M} \frac{E_{i,t}}{P_{i,t}}\right]^{\delta_M} \left(\frac{FDI_{ij,t}^{stock}}{\omega_{ij,t}^{\xi}}\right)^{1-\delta_M}.$$

- Ad-hoc transition functions are perfectly consistent with the steady-state and results can be compared with the ones from the solution of the transition based on the first order conditions.
- Approximation error is small.

Structural System: Ad-hoc Transition Functions

Structural Gravity: $$X_{ij,t} = \frac{Y_{i,t}E_{j,t}}{Y_t}\left(\frac{t_{ij,t}}{\Pi_{i,t}P_{j,t}}\right)^{1-\sigma},$$

Inward Resistance: $$P_{j,t}^{1-\sigma} = \sum_{i=1}^{N}\left(\frac{t_{ij,t}}{\Pi_{i,t}}\right)^{1-\sigma}\frac{Y_{i,t}}{Y_t},$$

Outward Resistance: $$\Pi_{i,t}^{1-\sigma} = \sum_{j=1}^{N}\left(\frac{t_{ij,t}}{P_{j,t}}\right)^{1-\sigma}\frac{E_{j,t}}{Y_t},$$

Market Clearance: $$p_{j,t} = \frac{\left(Y_{j,t}/Y\right)^{\frac{1}{1-\sigma}}}{\beta_j\Pi_{j,t}},$$

Income: $$Y_{j,t} = p_{j,t}A_{j,t}\left(L_{j,t}^{1-\alpha}K_{j,t}^{\alpha}\right)^{1-\phi}\left(\prod_{i=1}^{N}\left(FDI_{ij,t}^{stock}\right)^{\eta_i}\right)^{\phi},$$

Expenditure: $$E_{j,t} = (1-\phi)Y_{j,t} + \phi\eta_j Y_t,$$

Physical Capital: $$K_{j,t+1} = \left[\frac{\alpha\beta\delta_K(1-\phi)(1-\phi+\phi\eta_j)}{(1-\beta+\beta\delta_K)}\frac{Y_{j,t}}{P_{j,t}}\right]^{\delta_K}K_{j,t}^{1-\delta_K},$$

Technology Capital: $$FDI_{ij,t+1}^{stock} = \omega_{ij,t+1}^{\xi}\left[\frac{\beta\phi\eta_i\delta_M}{1-\beta+\beta\delta_M}\frac{E_{i,t}}{P_{i,t}}\right]^{\delta_M}\left(\frac{FDI_{ij,t}^{stock}}{\omega_{ij,t}^{\xi}}\right)^{1-\delta_M}.$$

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Technology Capital: $$FDI_{ij,t+1}^{stock} = \omega_{ij,t+1}^{\xi}\left[\frac{\beta\phi\eta_i\delta_M}{1-\beta+\beta\delta_M}\frac{E_{i,t}}{P_{i,t}}\right]^{\delta_M}\left(\frac{FDI_{ij,t}^{stock}}{\omega_{ij,t}^{\xi}}\right)^{1-\delta_M}.$$

Structural System: Ad-hoc Transition Functions

Structural Gravity: $X_{ij,t} = \frac{Y_{i,t}E_{j,t}}{Y_t}\left(\frac{t_{ij,t}}{\Pi_{i,t}P_{j,t}}\right)^{1-\sigma}$,

Inward Resistance: $P_{j,t}^{1-\sigma} = \sum_{i=1}^{N}\left(\frac{t_{ij,t}}{\Pi_{i,t}}\right)^{1-\sigma}\frac{Y_{i,t}}{Y_t}$,

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Structural System: Ad-hoc Transition Functions

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Structural System: Ad-hoc Transition Functions

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Structural System: Ad-hoc Transition Functions

Structural Gravity: $X_{ij,t} = \frac{Y_{i,t}E_{j,t}}{Y_t}\left(\frac{t_{ij,t}}{\Pi_{i,t}P_{j,t}}\right)^{1-\sigma},$

Inward Resistance: $P_{j,t}^{1-\sigma} = \sum_{i=1}^{N}\left(\frac{t_{ij,t}}{\Pi_{i,t}}\right)^{1-\sigma}\frac{Y_{i,t}}{Y_t},$

Outward Resistance: $\Pi_{i,t}^{1-\sigma} = \sum_{j=1}^{N}\left(\frac{t_{ij,t}}{P_{j,t}}\right)^{1-\sigma}\frac{E_{j,t}}{Y_t},$

Market Clearance: $p_{j,t} = \frac{\left(Y_{j,t}/Y\right)^{\frac{1}{1-\sigma}}}{\beta_j\Pi_{j,t}},$

Income: $Y_{j,t} = p_{j,t}A_{j,t}\left(L_{j,t}^{1-\alpha}K_{j,t}^{\alpha}\right)^{1-\phi}\left(\prod_{i=1}^{N}\left(FDI_{ij,t}^{stock}\right)^{\eta_i}\right)^{\phi},$

Expenditure: $E_{j,t} = (1-\phi)Y_{j,t} + \phi\eta_j Y_t,$

Physical Capital: $K_{j,t+1} = \left[\frac{\alpha\beta\delta_K(1-\phi)(1-\phi+\phi\eta_j)}{(1-\beta+\beta\delta_K)}\frac{Y_{j,t}}{P_{j,t}}\right]^{\delta_K}K_{j,t}^{1-\delta_K},$

Technology Capital: $FDI_{ij,t+1}^{stock} = \omega_{ij,t+1}^{\xi}\left[\frac{\beta\phi\eta_i\delta_M}{1-\beta+\beta\delta_M}\frac{E_{i,t}}{P_{i,t}}\right]^{\delta_M}\left(\frac{FDI_{ij,t}^{stock}}{\omega_{ij,t}^{\xi}}\right)^{1-\delta_M}.$

Structural System: Ad-hoc Transition Functions

Structural Gravity: $$X_{ij,t} = \frac{Y_{i,t}E_{j,t}}{Y_t}\left(\frac{t_{ij,t}}{\Pi_{i,t}P_{j,t}}\right)^{1-\sigma},$$

Inward Resistance: $$P_{j,t}^{1-\sigma} = \sum_{i=1}^{N}\left(\frac{t_{ij,t}}{\Pi_{i,t}}\right)^{1-\sigma}\frac{Y_{i,t}}{Y_t},$$

Outward Resistance: $$\Pi_{i,t}^{1-\sigma} = \sum_{j=1}^{N}\left(\frac{t_{ij,t}}{P_{j,t}}\right)^{1-\sigma}\frac{E_{j,t}}{Y_t},$$

Market Clearance: $$p_{j,t} = \frac{\left(Y_{j,t}/Y\right)^{\frac{1}{1-\sigma}}}{\beta_j \Pi_{j,t}},$$

Income: $$Y_{j,t} = p_{j,t}A_{j,t}\left(L_{j,t}^{1-\alpha}K_{j,t}^{\alpha}\right)^{1-\phi}\left(\prod_{i=1}^{N}\left(FDI_{ij,t}^{stock}\right)^{\eta_i}\right)^{\phi},$$

Expenditure: $$E_{j,t} = (1-\phi)Y_{j,t} + \phi\eta_j Y_t,$$

Physical Capital: $$K_{j,t+1} = \left[\frac{\alpha\beta\delta_K(1-\phi)(1-\phi+\phi\eta_j)}{(1-\beta+\beta\delta_K)}\frac{Y_{j,t}}{P_{j,t}}\right]^{\delta_K} K_{j,t}^{1-\delta_K},$$

Technology Capital: $$FDI_{ij,t+1}^{stock} = \omega_{ij,t+1}^{\xi}\left[\frac{\beta\phi\eta_i\delta_M}{1-\beta+\beta\delta_M}\frac{E_{i,t}}{P_{i,t}}\right]^{\delta_M}\left(\frac{FDI_{ij,t}^{stock}}{\omega_{ij,t}^{\xi}}\right)^{1-\delta_M}.$$

Structural System: Ad-hoc Transition Functions

Structural Gravity: $$X_{ij,t} = \frac{Y_{i,t}E_{j,t}}{Y_t}\left(\frac{t_{ij,t}}{\Pi_{i,t}P_{j,t}}\right)^{1-\sigma},$$

Inward Resistance: $$P_{j,t}^{1-\sigma} = \sum_{i=1}^{N}\left(\frac{t_{ij,t}}{\Pi_{i,t}}\right)^{1-\sigma}\frac{Y_{i,t}}{Y_t},$$

Outward Resistance: $$\Pi_{i,t}^{1-\sigma} = \sum_{j=1}^{N}\left(\frac{t_{ij,t}}{P_{j,t}}\right)^{1-\sigma}\frac{E_{j,t}}{Y_t},$$

Market Clearance: $$p_{j,t} = \frac{\left(Y_{j,t}/Y\right)^{\frac{1}{1-\sigma}}}{\beta_j\Pi_{j,t}},$$

Income: $$Y_{j,t} = p_{j,t}A_{j,t}\left(L_{j,t}^{1-\alpha}K_{j,t}^{\alpha}\right)^{1-\phi}\left(\prod_{i=1}^{N}\left(FDI_{ij,t}^{stock}\right)^{\eta_i}\right)^{\phi},$$

Expenditure: $$E_{j,t} = (1-\phi)Y_{j,t} + \phi\eta_j Y_t,$$

Physical Capital: $$K_{j,t+1} = \left[\frac{\alpha\beta\delta_K(1-\phi)(1-\phi+\phi\eta_j)}{(1-\beta+\beta\delta_K)}\frac{Y_{j,t}}{P_{j,t}}\right]^{\delta_K}K_{j,t}^{1-\delta_K},$$

Technology Capital: $$FDI_{ij,t+1}^{stock} = \omega_{ij,t+1}^{\xi}\left[\frac{\beta\phi\eta_i\delta_M}{1-\beta+\beta\delta_M}\frac{E_{i,t}}{P_{i,t}}\right]^{\delta_M}\left(\frac{FDI_{ij,t}^{stock}}{\omega_{ij,t}^{\xi}}\right)^{1-\delta_M}.$$

Structural System: Ad-hoc Transition Functions

Structural Gravity: $$X_{ij,t} = \frac{Y_{i,t}E_{j,t}}{Y_t}\left(\frac{t_{ij,t}}{\Pi_{i,t}P_{j,t}}\right)^{1-\sigma},$$

Inward Resistance: $$P_{j,t}^{1-\sigma} = \sum_{i=1}^{N}\left(\frac{t_{ij,t}}{\Pi_{i,t}}\right)^{1-\sigma}\frac{Y_{i,t}}{Y_t},$$

Outward Resistance: $$\Pi_{i,t}^{1-\sigma} = \sum_{j=1}^{N}\left(\frac{t_{ij,t}}{P_{j,t}}\right)^{1-\sigma}\frac{E_{j,t}}{Y_t},$$

Market Clearance: $$p_{j,t} = \frac{\left(Y_{j,t}/Y\right)^{\frac{1}{1-\sigma}}}{\beta_j\Pi_{j,t}},$$

Income: $$Y_{j,t} = p_{j,t}A_{j,t}\left(L_{j,t}^{1-\alpha}K_{j,t}^{\alpha}\right)^{1-\phi}\left(\prod_{i=1}^{N}\left(FDI_{ij,t}^{stock}\right)^{\eta_i}\right)^{\phi},$$

Expenditure: $$E_{j,t} = (1-\phi)Y_{j,t} + \phi\eta_j Y_t,$$

Physical Capital: $$K_{j,t+1} = \left[\frac{\alpha\beta\delta_K(1-\phi)(1-\phi+\phi\eta_j)}{(1-\beta+\beta\delta_K)}\frac{Y_{j,t}}{P_{j,t}}\right]^{\delta_K}K_{j,t}^{1-\delta_K},$$

Technology Capital: $$FDI_{ij,t+1}^{stock} = \omega_{ij,t+1}^{\xi}\left[\frac{\beta\phi\eta_i\delta_M}{1-\beta+\beta\delta_M}\frac{E_{i,t}}{P_{i,t}}\right]^{\delta_M}\left(\frac{FDI_{ij,t}^{stock}}{\omega_{ij,t}^{\xi}}\right)^{1-\delta_M}.$$

An FDI Gravity System

$$FDI_{ij}^{stock,value} = F \frac{E_i}{P_i} \frac{Y_j}{\mathcal{M}_i} \eta_i^2 \omega_{ij}^{\xi},$$

$$P_i = \left[\sum_{j=1}^{N} \left(\frac{t_{ji}}{\Pi_j} \right)^{1-\sigma} \frac{Y_j}{Y} \right]^{\frac{1}{1-\sigma}},$$

$$\Pi_j = \left[\sum_{i=1}^{N} \left(\frac{t_{ji}}{P_i} \right)^{1-\sigma} \frac{E_i}{Y} \right]^{\frac{1}{1-\sigma}}.$$

From Theory to Empirics

Data

Data

Balanced panel for 89 countries, 1990-2011. Start date dictated by FDI data availability; end date by physical capital stock availability.

Coverage: more than 96% of world GDP, more than 94% of FDI.

Data:

- Bilateral trade and FDI (stocks and flows, 1990-2011);
- Bilateral distance, common language, contiguity, colonial ties;
- Bilateral time varying policy, RTAs, BITs, currency unions;
- National GDP, employment, physical capital, natural disasters.

Trade Equation

Estimating Trade Gravity

PPML regression of multiplicative gravity:

$$X_{ij,t} = \exp\left[\pi_1 RTA_{ij,t} + \pi_2 POLICY_{ij,t} + \mu_{i,t} + \nu_{j,t} + \mu_{ij}\right] + \epsilon_{ij,t}.$$

$\mu_{i,t}$ = time-varying source-country fixed effects, $\nu_{j,t}$ = time varying destination country fixed effects and μ_{ij} = country-pair time-invariant fixed effects.

Potential correlation between (endogenous) $RTA_{ij,t}$ and other $POLICY_{ij,t}$ variables such as BITs and error term $\epsilon_{ij,t}$, controlled for by μ_{ij} (Baier and Bergstrand, following Wooldridge).

Trade Gravity Estimation Results

	RTAs	RTAs_BITs	CANADA	SPECIFIC
RTA	0.324	0.249		
	(0.105)**	(0.088)**		
BIT		0.399		
		(0.042)**		
CURRU		0.074	0.073	0.073
		(0.044)+	(0.044)+	(0.044)+
RTA_NO_CAN			0.196	0.182
			(0.071)**	(0.074)*
BIT_NO_CAN			0.404	0.405
			(0.042)**	(0.043)**
RTA_CAN			0.711	
			(0.089)**	
BIT_CAN			0.392	0.390
			(0.148)**	(0.149)**
CAN_ISR				0.749
				(0.062)**
CAN_CHL				0.613
				(0.062)**
CAN_MEX				1.393
				(0.079)**
CAN_USA				0.633
				(0.089)**
N	59543	59543	59543	59543

Trade & Policy: Implications

- Canada's RTAs have successfully promoted Canada's bilateral trade in each direction, i.e., both exports and imports.
- All estimates of Canada's RTAs are large, positive and statistically significant at any conventional level.
- Canada's RTAs is significantly larger as compared to the average RTA estimate for the rest of the world.
- Significant asymmetries between the effects of Canada's RTAs.
- Agreements with Israel, Chile, and Mexico (especially with Mexico) lead to a disproportional increase in imports as compared to exports.
- NAFTA lead to relatively more Canadian exports to the U.S.
- Canada's BITs have also stimulated Canada's bilateral trade.
- Effects of Canada's BITs on trade are similar to average BIT effect on trade for rest of world.

FDI Equation

Estimating FDI Gravity

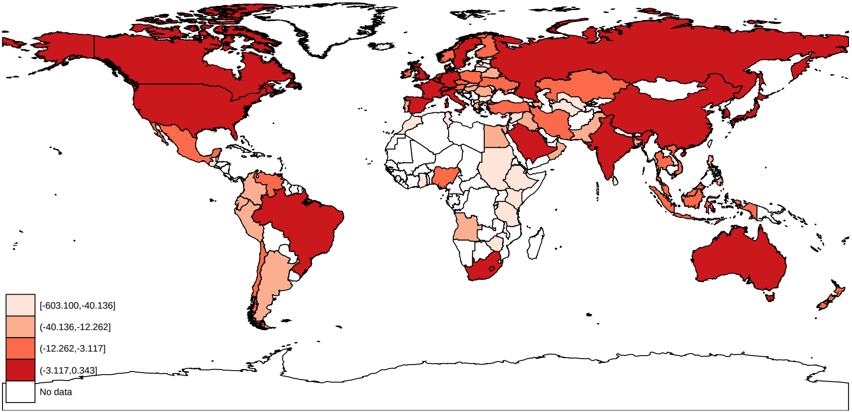
$$
\begin{aligned}
FDI_{ij,t}^{stock,value} = \; & \pi_1 BIT_{ij,t} + \pi_2 EIA_{ij,t} + \pi_3 FTA_{ij,t} + \pi_4 CUSTU_{ij,t} \\
& + \pi_5 PRTL_{ij,t} + \pi_6 CURRU_{ij,t} + \sum_{m=7}^{10} \pi_m \ln DIST_{ij,m-6} \\
& + \pi_{11} BRDR_{ij} + \pi_{12} LANG_{ij} + \pi_{13} CLNY_{ij} \\
& + \tilde{\nu}_{i,t} + \tilde{\nu}_{j,t} + \tilde{\varepsilon}_{ij,t}, \qquad (1)
\end{aligned}
$$

Estimated with OLS and PPML.

FDI Gravity Estimation Results

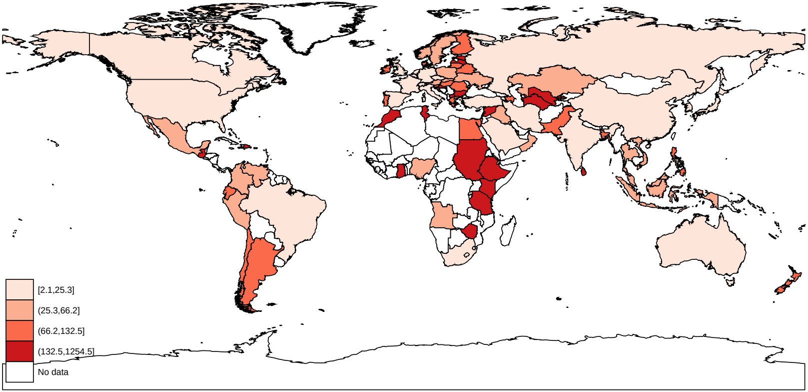
	(1) GRAVITY	(2) POLICY	(3) SPECIFIC	(4) NEW_DATA	(5) PAIR_FEs	(6) PPML
DIST_1	-1.724	-1.703	-1.695	-1.760		-0.388
	(0.152)**	(0.153)**	(0.152)**	(0.158)**		(0.129)**
DIST_2	-1.703	-1.675	-1.654	-1.714		-0.422
	(0.138)**	(0.140)**	(0.139)**	(0.144)**		(0.109)**
DIST_3	-1.726	-1.698	-1.675	-1.746		-0.443
	(0.127)**	(0.129)**	(0.128)**	(0.133)**		(0.106)**
DIST_4	-1.748	-1.720	-1.696	-1.763		-0.466
	(0.125)**	(0.127)**	(0.127)**	(0.131)**		(0.096)**
BRDR	0.380	0.411	0.393	0.407		0.345
	(0.229)+	(0.228)+	(0.227)+	(0.241)+		(0.159)*
LANG	1.123	1.120	1.082	1.030		0.360
	(0.227)**	(0.225)**	(0.225)**	(0.237)**		(0.153)*
CLNY	1.625	1.607	1.661	1.719		0.481
	(0.277)**	(0.276)**	(0.275)**	(0.283)**		(0.160)**
BIT		0.209	0.231	0.228	-0.185	-0.398
		(0.113)+	(0.112)*	(0.111)*	(0.132)	(0.149)**
RTA		0.168				
		(0.123)				
CURRU		0.258	0.115	0.071	0.234	-0.075
		(0.222)	(0.218)	(0.220)	(0.243)	(0.193)
FTA			0.085	0.170	0.181	0.569
			(0.150)	(0.153)	(0.205)	(0.156)**
EIA			-0.055	-0.114	-0.165	0.172
			(0.187)	(0.185)	(0.182)	(0.152)
PRTL			0.618	0.733	-0.021	0.655
			(0.269)*	(0.276)**	(0.505)	(0.293)*
CUSTU			0.546	0.555	0.347	0.114
			(0.214)*	(0.217)*	(0.311)	(0.208)
N	18927	18927	18927	15204	18927	36103
R^2	0.699	0.699	0.700	0.692	0.827	

FDI Competitiv. Index: $\widehat{\text{FDI-O}} = Y_{NLD} \exp\left(\widehat{\tilde{\nu}}_{i,t}\right) / Y_i$



Ranking 9-th in outward resistance, Canada is close to top-five performers: UK, Japan, USA, France, and Germany.

FDI Attractiveness Index: $\widehat{\text{FDI-H}} = Y_{NLD} \exp\left(\widehat{\tilde{\nu}}_{j,t}\right) / E_j$



Canada ranks 21 in inward resistance, outperforming 68 countries. Top-five performers: United States, China, Japan, Russia, and Germany.

FDI Estimation Results: Implications, I

- No significant effects of Canada's BITs and RTAs on Canada's FDI.
- Canada is ranked 9th according to the FDI origin competitiveness indexes, close to the top-five performers which include Great Britain, Japan, United States, France and Germany.
- Canada's ranking in terms of FDI competitiveness and success is relatively stable over time: Canada's rank improved by 4 places 1999-2011.
- Canada is in top third of the countries (rank 21) on FDI attractiveness. Leaders are USA, China, and Japan.
- Canada's FDI host attractiveness rank fell from 9 to 21 over 1999-2011.

FDI Estimation Results: Implications, II

- Many European countries ranked highly according to the FDI origin competitiveness indexes: Great Britain (rank 1), France (rank 4), Germany (rank 5), Netherlands (rank 7), Italy (rank 10), Belgium (rank 12), Spain (rank 14), ..., Austria (rank 29).
- Ranking in terms of outward FDI competitiveness and success is relatively stable over time: Great Britain (+5), France (+3), Germany (0), Netherlands (-3), Italy (-1), Belgium (-2), Spain (0), ..., Austria (-2).
- Many European countries do also well in terms of FDI host attractiveness: Germany (rank 5), Belgium (rank 7), Italy (rank 11), France (rank 12), Great Britain (rank 14),..., Austria (rank 42).
- Ranks of FDI attractiveness improved over time: Germany (-2), Belgium (-2), Italy (-3), France (-6), Great Britain (-7),..., Austria (-14).

Income Equation

Income, Trade Openness, and FDI

Endogenous 'factory gate' price solved for market clearance from each country, yielding a nominal GDP equation:

$$\begin{aligned}\ln Y_{j,t} &= \kappa_1 \ln L_{j,t} + \kappa_2 \ln K_{j,t} + \kappa_3 \ln FDI_{j,t}^{stock,in} \\ &\quad + \kappa_4 \ln\left(\frac{1}{\Pi_{j,t}^{1-\sigma}}\right) + \nu_t + \vartheta_j + \varepsilon_{j,t}.\end{aligned}$$

This base specification allows recovery of an estimate for the trade elasticity σ. Various robustness checks suggest good performance.

Endogeneity of $\Pi_{j,t}$ controlled by removing the 'own effect' term for j's internal trade (Anderson, Larch and Yotov, 2015). Instrument constructed from the bilateral trade cost estimates and multilateral resistance equations (using labor).

Trade Openness, FDI, and Income, 1990-2011

	Base	Base-Cnstr	TFP	IV-All	IV-All-Cnstr
ln $L_{j,t}$	0.282	0.363	0.251	0.239	0.303
	(0.040)**	(0.036)**	(0.041)**	(0.050)**	(0.031)**
ln $K_{j,t}$	0.452	0.476	0.521	0.456	0.453
	(0.032)**	(0.043)**	(0.042)**	(0.038)**	(0.020)**
$\ln(\widehat{\Pi_{j,t}^{\sigma-1}})$	-0.122	-0.150	-0.104	-0.261	-0.239
	(0.024)**	(0.017)**	(0.018)**	(0.049)**	(0.023)**
ln $FDI_{j,t}$	0.011	0.011	0.011	0.008	0.006
	(0.004)**	(0.004)**	(0.004)**	(0.004)*	(0.003)+
$TFP_{j,t}$			0.323	0.206	0.275
			(0.086)**	(0.060)**	(0.022)**
N	1623	1623	1504	1080	1223
UnderId				71.644	
χ^2 p-val				(0.000)	
Weak Id				12.138	
χ^2 p-val				(0.000)	
Over Id				4.652	
χ^2 p-val				(0.460)	

- Establish causal relationships between income, trade openness, and FDI.
- Obtain estimates of structural parameters: $\hat{\sigma} = 4$, $\hat{\alpha} = 0.5$, $\hat{\phi} = 0.01$.

Counterfactual Analysis

Simulated Effects of CETA

Using our structural model and based on parameters from estimated trade, FDI and income equations; supplemented with parameters from literature for agents' discount rate, depreciation rates.

Simulate three comparative statics of three aspects of CETA:

- Start with CETA effects on trade costs as an RTA,
- Add CETA effects on trade costs as a BIT,
- Add CETA effects on FDI frictions as a BIT.

In each case, decompose the effects of CETA into partial, conditional GE, static GE, and dynamic GE.

Trade Effects of CETA as an RTA on Trade Costs

(1) Country	(2) Direct Eff.	(3) Cond. GE	(4) Full GE Static	(5) Full GE Dynamic	(6) Full GE Dynamic FDI
AUS	0.0000	-0.0434	-0.0378	-0.0209	-0.0229
AUT	0.5367	0.3158	0.3615	0.4908	0.4991
CAN	8.2725	6.0485	6.7072	8.3302	7.4967
CHN	0.0000	-0.0617	-0.0536	-0.0291	-0.0317
DEU	0.6241	0.4289	0.4678	0.5804	0.5975
FRA	0.7003	0.4926	0.5339	0.6533	0.6719
GBR	1.6787	1.2490	1.3479	1.6200	1.6642
GRC	0.3669	0.2325	0.2542	0.3267	0.3201
IRL	0.8597	0.5177	0.5910	0.7946	0.8092
JPN	0.0000	-0.0508	-0.0443	-0.0247	-0.0270
MEX	0.0000	-0.1006	-0.0947	-0.0607	-0.0686
TUR	0.0000	-0.0701	-0.0621	-0.0342	-0.0365
USA	0.0000	-0.4338	-0.3643	-0.1819	-0.1975
World	0.4813	0.2566	0.3031	0.4283	0.4303
CETA	103.6020	98.1506	99.3822	102.4111	102.3218
ROW	0.0000	-0.2003	-0.1593	-0.0477	-0.0536

Physical Capital and FDI Effects of CETA as an RTA on Trade Costs of the "Full GE Dynamic" Scenarios

(1) Country	(2) Physical Capital without FDI	(3) Physical Capital with FDI	(4) Outward FDI quantity	(5) Outward FDI earn.	(6) Inward FDI pay.
AUS	-0.0022	-0.0028	-0.0026	0.0655	-0.0028
AUT	0.2363	0.2395	0.2371	0.1138	0.2395
CAN	3.9858	4.1126	4.0948	1.4518	4.1126
CHN	-0.0040	-0.0033	-0.0032	0.0732	-0.0033
DEU	0.1971	0.2014	0.2012	0.0972	0.2014
FRA	0.2082	0.2119	0.2115	0.1008	0.2119
GBR	0.5646	0.5754	0.5737	0.1978	0.5754
GRC	0.0680	0.0682	0.0682	0.0698	0.0682
IRL	0.3856	0.3917	0.3865	0.1575	0.3917
JPN	-0.0041	-0.0040	-0.0039	0.0698	-0.0040
MEX	-0.0303	-0.0279	-0.0271	0.0815	-0.0279
TUR	-0.0074	-0.0089	-0.0084	0.0489	-0.0089
USA	-0.0264	-0.0319	-0.0318	0.0906	-0.0319
World	0.0831	0.0809	0.1151	0.0884	0.0809
CETA	0.3648	0.3659	0.2307	0.1476	0.3659
ROW	-0.0081	-0.0106	-0.0077	0.0585	-0.0106

Trade Effects of CETA as an RTA and BIT on Trade Costs and FDI Frictions

(1) Country	(2) Direct Eff.	(3) Cond. GE	(4) Full GE Static	(5) Full GE Dynamic	(6) Full GE Dynamic FDI
AUS	0.0000	-0.0822	-0.0721	-0.0400	-0.0398
AUT	1.0429	0.5966	0.6863	0.9439	0.9677
CAN	16.0751	11.4931	12.8344	16.1821	14.6516
CHN	0.0000	-0.1165	-0.1018	-0.0557	-0.0571
DEU	1.2127	0.8105	0.8882	1.1162	1.1551
FRA	1.3608	0.9302	1.0132	1.2565	1.2987
GBR	3.2620	2.3541	2.5549	3.1157	3.2071
GRC	0.7129	0.4506	0.4925	0.6271	0.6239
IRL	1.6706	0.9766	1.1208	1.5283	1.5637
JPN	0.0000	-0.0962	-0.0845	-0.0471	-0.0480
MEX	0.0000	-0.1913	-0.1808	-0.1156	-0.1253
TUR	0.0000	-0.1303	-0.1162	-0.0657	-0.0651
USA	0.0000	-0.8248	-0.6951	-0.3464	-0.3629
World	0.9352	0.4865	0.5783	0.8288	0.8415
CETA	201.3183	185.9714	189.3940	197.9635	197.9171
ROW	0.0000	-0.3792	-0.3030	-0.0912	-0.0946

CETA as an RTA and BIT on Trade Costs and FDI Frictions of the “Full GE Dynamic” Scenarios

(1) Country	(2) Physical Capital without FDI	(3) Physical Capital with FDI	(4) Outward FDI quantity	(5) Outward FDI earn.	(6) Inward FDI quantity	(7) Inward FDI pay.
AUS	-0.0042	-0.0027	-0.0023	0.1301	0.1770	-0.0027
AUT	0.4549	0.4690	0.6927	0.2283	0.4046	0.4690
CAN	7.7625	8.1135	15.1614	2.7818	6.7426	8.1135
CHN	-0.0075	-0.0051	-0.0050	0.1456	0.1770	-0.0051
DEU	0.3794	0.3933	0.6208	0.1960	0.4043	0.3933
FRA	0.4006	0.4142	0.6414	0.2035	0.4044	0.4142
GBR	1.0866	1.1141	1.3405	0.3917	0.4044	1.1141
GRC	0.1316	0.1402	0.3675	0.1431	0.4043	0.1402
IRL	0.7418	0.7617	0.9803	0.3125	0.4043	0.7617
JPN	-0.0078	-0.0059	-0.0057	0.1381	0.1770	-0.0059
MEX	-0.0577	-0.0478	-0.0462	0.1579	0.1770	-0.0478
TUR	-0.0139	-0.0130	-0.0120	0.1009	0.1770	-0.0130
USA	-0.0503	-0.0582	-0.0581	0.1751	0.1770	-0.0582
World	0.1600	0.1616	0.3799	0.1770	0.3186	0.1616
CETA	0.7044	0.7198	0.7490	0.2925	0.4542	0.7198
ROW	-0.0162	-0.0176	-0.0120	0.1187	0.1770	-0.0176

On the CETA Effects: Summary

CETA effects on Canada from the 'Full Dynamic FDI GE' scenario, where CETA acts on trade as an RTA and as a BIT, and on FDI as a BIT:

- Canada's exports will increase by 14.7% due to CETA.
- Canada's imports will increase 15.2%.
- Inward FDI in Canada will increase by 6.7%.
- Outward Canadian FDI will increase by 15.2%.
- Capital accumulation in Canada will increase by 8.1%.
- CETA will lead to 8.0% increase in Canada's real GDP.

On the CETA Effects: Summary

The E.U. will benefit from CETA too, but, overall, the effects on Canada will be larger. The rest of the world will not be affected as much:

- Export changes range from 3.2% for Great Britain to -0.20% for Norway (0.97% for Austria) due to CETA.
- Outward FDI changes range from 1.3% for Great Britain to -0.04% for Norway (0.70% for Austria).
- Capital accumulation changes range from 1.1% for Great Britain to -0.04% for Norway (0.47% for Austria).
- Real GDP changes range from 1.1% for Great Britain to -0.04% for Norway (0.46% for Austria).

Conclusions and Future Directions

Conclusion and Future Directions

Conclusions:

- Additional dynamic gains from physical and technology capital;
- CETA will potentially promote exports, imports as well as inward and outward FDI for Canada.

Future Directions:

- Allow for current account imbalances, i.e., allow for borrowing and lending on international financial markets;
- Introduce sectors and dynamic sectoral links;
- Introduce provincial dimension;
- Analyze impact of FDI on poor countries.

Thank you very much for your attention!
I am looking forward to your questions and the discussion.