Departamento de Economía
Facultad de Ciencias Sociales
Universidad de la República

Why do countries engage in the preferential trade agreement network?

Flavia Rovira (CINVE) y Marcel Vaillant (dECON, FCS, UDELAR)

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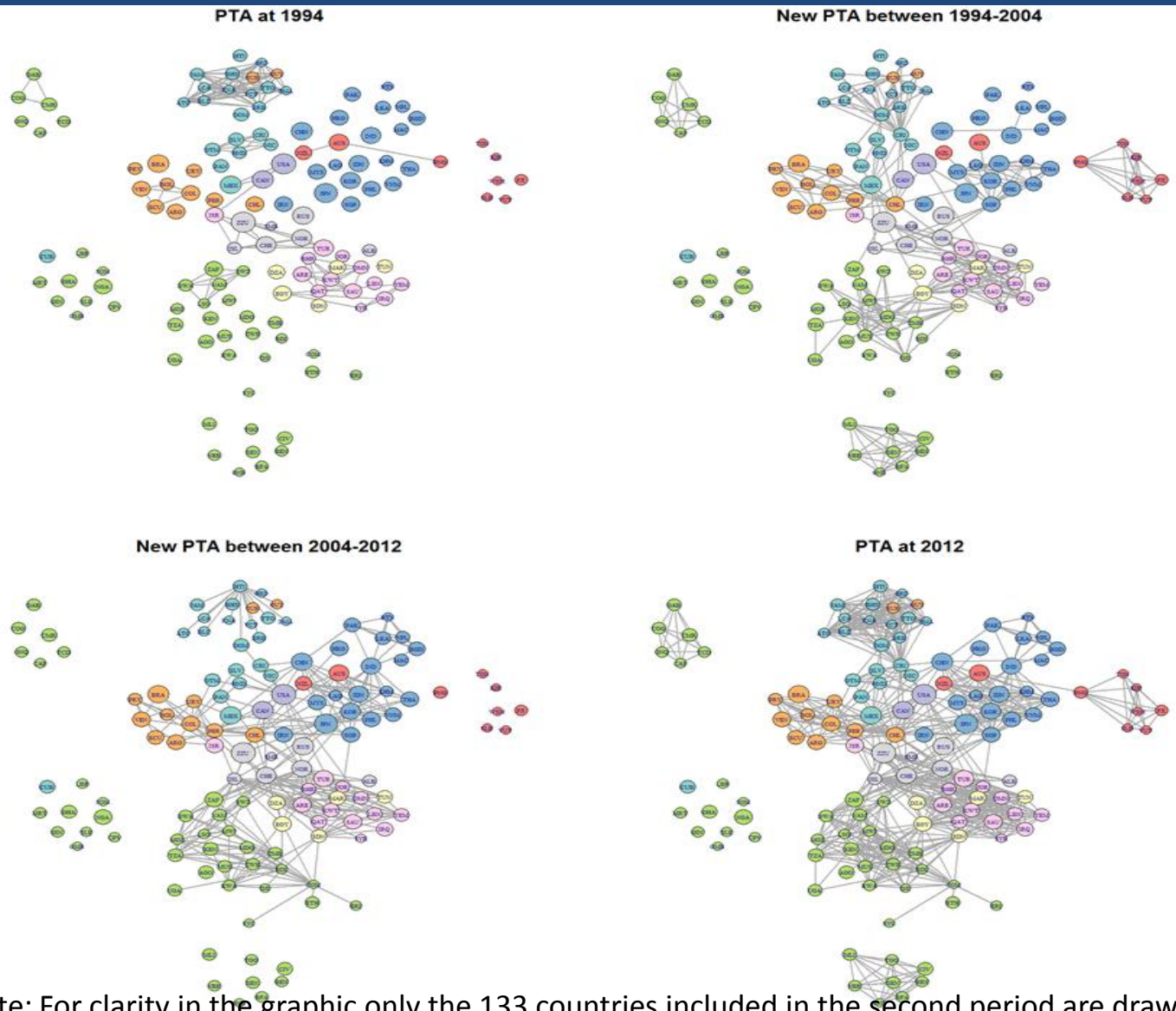
Presentation outline

- Introduction
- Theory and methodology
- Data and results
- Conclusion

Motivation

- Reciprocal trade liberalization (bilateral and plurilateral) predominant in established rules of trade
  - PTA=FTA+CU+CM+EU
- Evolution of PTA over the last decades shows permanent increase in the extensive (number of PTA) and intensive margin (deepness of PTA).

Motivation



Note: For clarity in the graphic only the 133 countries included in the second period are drawn.

Motivation

Network Statistics	1994	2004 (EU 1994)	2004 (EU 2004)	2012
# of nodes	140	140	133	133
# of isolates	83	26	27	12
# of links	155	538	446	751
links in region	129	371	328	485
Links out region	26	167	118	266
ratio links In/Out	*5,0*	*2,2*	*2,8*	*1,8*
# of triangles	314	1601	1173	2557

Source: Data Base of PTA by Baier and Bergstrand (2017).

Objectives

- Analyze the dynamics of PTA formation taking into account the network effects.
- Theoretical framework based in an extension of Badlwin (1995) to rationalize the determinants of PTA
- Expand previous findings using variables of trade specialization

Bibliographic background

- Studied in different ways PTA determinants:
  - First approach: Choice model (Cross and Panel variation)
    - Baier and Bergstrand (2004) Monopolistic model with trade cost a la ´Krugman´.
    - Baier, Bergstrand and Mariutto (2014)
  - Second approach: include explicitly the network structure phenomena and its evolution (Stochastic actor-oriented models)
    - Manger, Pickup, and Snijders (2012). Longitudinal network analysis for period 1962-1993 and 1994-2004)
    - Manger and Pickup (2016)

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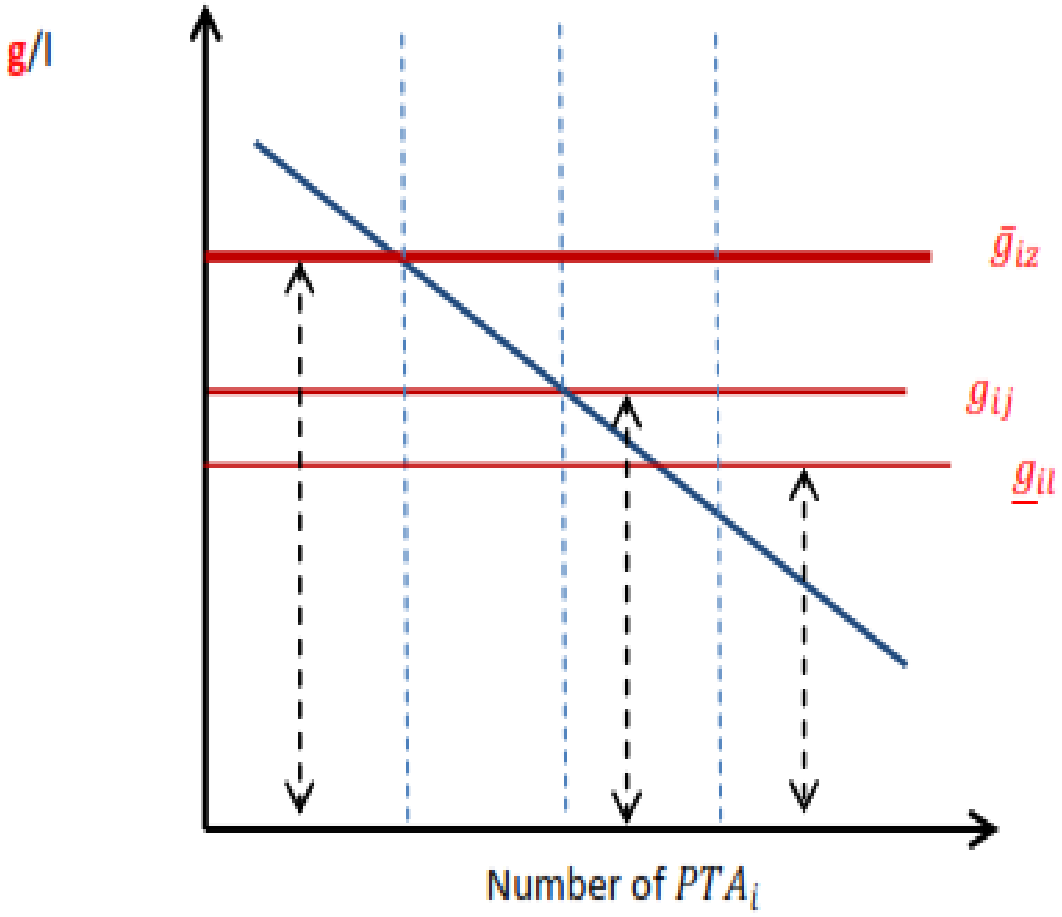
Domino effect

- Baldwin (1995) political economy approach. Creation of PTA is a reciprocal exchange of market access.
  - Loss- If a country gives access to its own market it has a negative effect on the value function of the Government (import substitution sector lobby, trade diversion). Resistance decreases as the amount of own PTA increases
  - Gain- PTA gains are ought to greater market access (quantity, prices). If the potential partner already has a PTA with other countries the agreement will have the potential benefit of reducing discrimination.

Marginal gains (g) and Losses (l) of country i by number of PTA_i



Empirical model: SAOM

- Dependent variable is a sequence of temporal networks (X_t) . In time t:
  - $x_{tij} = 1$ if there is a PTA between country *i* and *j* and zero otherwise $x_{tij} = 0$.
- Time is continuous but network observed in different moments.

$$X_{t_m} = [x_{t_m ij}] \text{ with } t_m = t_1, t_2 \ldots t_M$$

  - an unobservable continuous-time Markov process causes shift towards $X_{t_2} \ldots X_{t_M}$
  - At each time t, only one country has the possibility to make a change in the network (create a link)

Empirical model: SAOM

- In a time t, in a State of the network $x = X_t$ each player *i*
  - has a rate of change $\lambda_{i=}\lambda_i(x, \delta)$, where δ is a statistical parameter
    - we assume is the same for all countries
  - Waiting time until the next opportunity for change by any actor has the exponential distribution

$$P(next\ opportunity\ of\ change\ is\ before\ t + \Delta t|t) = 1 - \exp(\lambda\Delta t)$$

  - with: $\lambda = \lambda_+(x, \delta) = \sum_i \lambda_i(x, \delta)$.
  - probability that the next opportunity to change is for the actor i is:

$$\frac{\lambda_i(x, \delta)}{\lambda_+(x, \delta)}$$

Empirical model: SAOM

- Actor *i* when it has the chance to choose
  - observes the network status x and evaluates the gain that gives him to move to a new state x'
  - Satisfaction function

$$f_i(x, x'; \beta) = \sum_k \beta_k \, s_{ki}(x, x') + \epsilon_i$$

  - Where $k = 1, \ldots, K$ is the index of effects; ϵ_i-have a standard Gumbel distribution.
  - Evaluation function enters the probability calculations of both countries: the one that is initiating a tie and the other that must to confirm the tie.

Empirical model: SAOM

- one-sided initiative with reciprocal confirmation
  - *i* to *j* $\bar{p}_{ij}\left(x, x^{\pm ij}; \beta\right) = \frac{\exp\left(\sum_k \beta_k s_{ki}\left(x, x^{\pm ij}\right)\right)}{\sum_h \exp\left(\sum_k \beta_k s_{ki}\left(x, x^{\pm ih}\right)\right)}$
  - *j confirmation*

$$p_j\left(x, x^{+ij}; \beta\right) = \frac{\exp\left(\sum_k \beta_k s_{kj}\left(x, x^{+ij}\right)\right)}{\exp\left(\sum_k \beta_k s_{kj}(x, x)\right) + \exp\left(\sum_k \beta_k s_{kj}\left(x, x^{+ij}\right)\right)}$$

  - *Tie created or eliminated*

$$p_{ij}\left(x, x^{\pm ij}; \beta\right) = \left(\frac{\exp\left(\sum_k \beta_k s_{ki}\left(x, x^{\pm ij}\right)\right)}{\sum_h \exp\left(\sum_k \beta_k s_{ki}\left(x, x^{\pm ih}\right)\right)}\right)\left(\frac{\exp\left(\sum_k \beta_k s_{kj}\left(x, x^{+ij}\right)\right)}{\exp\left(\sum_k \beta_k s_{kj}(x, x)\right) + \exp\left(\sum_k \beta_k s_{kj}\left(x, x^{+ij}\right)\right)}\right)^{(1-x_{ij})}$$

Presentation outline

- Introduction
- PTA network description
- Theory and methodology
- Estimation and results

Estimation and results

- Simulation Investigation for Empirical Network Analysis (SIENA; Ripley, Snijders, and Preciado López, 2011). Longitudinal network analysis package (in R)
  - Parameters to estimate: $\theta = (\beta, \lambda)$
  - Period 1994-2004; 2004-2012.
  - Bergstrand (2017) database on PTA, selecting only the agreements classified as Free Trade Agreements, Customs Union, Common Market or Economic Union (https://www3.nd.edu/~jbergstr/)

Variable definitions

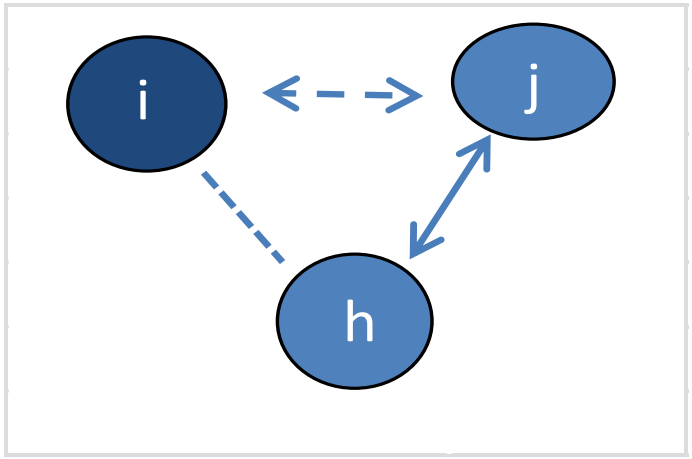
- Network effects
  - Distance two-non share agreements
  - Transitive ties (triangles)- share agreements
  - Isolation
- Covariables
  - (I) Trade cost and market size: distance; trade; market size; trade openness; multilateral resistance.
  - (II) Level of development: H-H;H-M; H-L;M-L;L-L.
  - (III) Political – democracy; interaction ego-alter
  - (IV) Trade patterns- rivalry

Variable definitions

Rivalry:

$$R^{ih} = \left[\frac{\sum_s \sum_p x_{ph} x_{pi} m_{ps}}{\sum_s \sum_p x_{pi} m_{ps}}\right]$$

Closure of covariate with rivalry



Double arrow complete line: existing PTA; Double arrow dots new PTA being evaluated; dotted line is trade rivalry between country *i* and *h*.

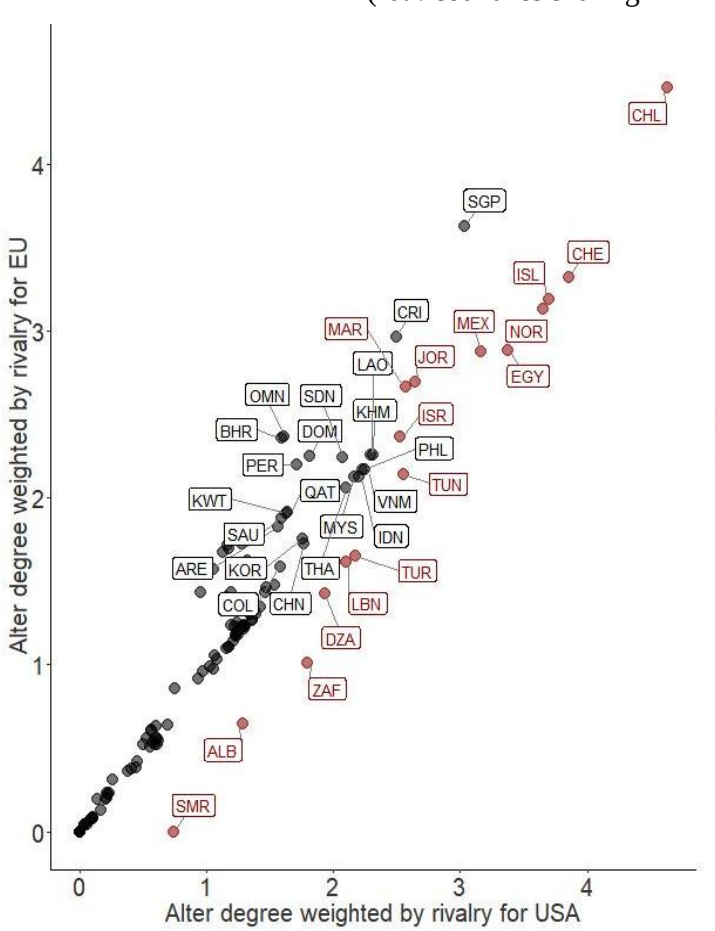
Example: USA and EU high *mutual* rivalry

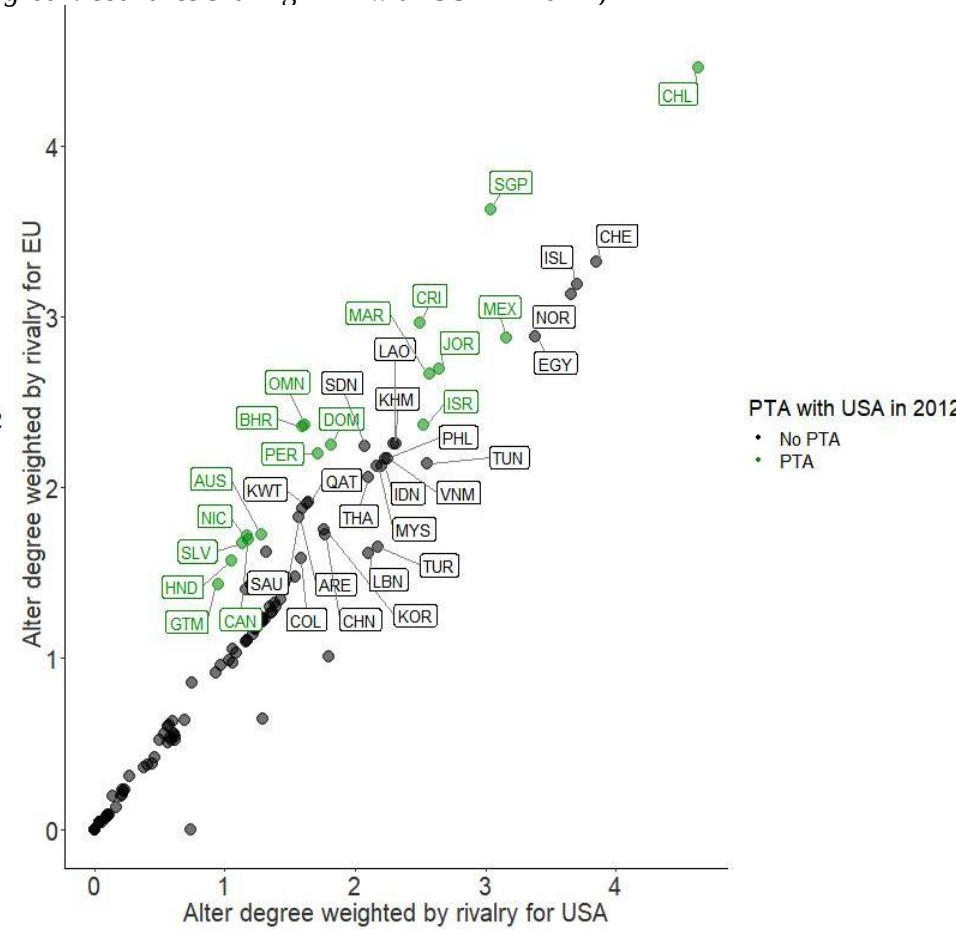
- In fact their rivalry is in the top 3% highest of joint rivalry distribution. Regarding the marginal distribution of rivalry by country, they are also in the top position of rivalry of each other.
- Both countries being trade rivals we postulate that is an incentive for the move they made in Latin American countries.
  - As USA gets preference in this markets it increases the incentives of EU to also sign PTA in order to reduce discrimination in those markets. The historical sequences of PTAs are a clear example: Mexico signed in 1994 a FTA with USA and in 2000 with EU, Chile did it in 2003 and 2005 respectively, Central American countries in 2006 and 2013, Colombia in 2012 and 2013, Peru in 2009 and 2013, and Panama in 2012 and 2013.

Example: USA and EU high *mutual* rivalry

Rivalry of USA and EU in other countries in 2004

(*red*: countries sharing PTA with EU in 2012; *green*: countries sharing PTA with USA in 2012)





Source: Own calculation using Data Base of PTA by Baier and Bergstrand (2017) and BACI.

Note: Only countries with high a value of the degree weighted by rivalry bigger than 1.4 for both countries or with PTA are labeled in each graph

Table 1

Dependent variable: preferential trade agreements dynamics in period 1994-2004

	Model I		Model II		Model III	
	B	s.d	B	s.d	B	s.d
Network structural effects						
Transitive ties	1,37***	(0,28)	1,27***	(0,29)	1,32***	(0,43)
Indirect ties	-0,39***	(0,04)	-0,39***	(0,04)	-0,77***	(0,18)
Isolate	9,58***	(0,81)	10,48***	(0,84)	16,06***	(2,19)
Natural trade cost and market size effects						
Distance	-1,16***	(0,10)	-1,3***	(0,10)	-1,66***	(0,29)
Trade	0,18***	(0,03)	0,17***	(0,03)	0,2***	(0,04)
GDPinv	1,29***	(0,20)	1,44***	(0,23)	1,81***	(0,46)
Trade*GDPinv	-0,11***	(0,02)	-0,09***	(0,02)	-0,18***	(0,05)
Mult. Resistance			0,39***	(0,11)	0,65***	(0,17)
Sim GDPinv			3,55***	(0,75)	4,44***	(1,40)
Hierarchy effects						
L&L	-1,86***	(0,43)	-1,57***	(0,44)	-3,07***	(0,91)
L&H	-1,92***	(0,48)	-1,85***	(0,49)	-3,32***	(1,03)
L&M	-1,19***	(0,27)	-1,05***	(0,28)	-1,96***	(0,60)
H&M	-0,43*	(0,25)	-0,16	(0,25)	0,02	(0,37)
H&H	-1,01**	(0,40)	-0,57	(0,40)	-0,92	(0,69)
Political economy						
Democracy	-0,64***	(0,10)	-0,68***	(0,09)	-1,53***	(0,31)
Democracy ego*alter	-0,0009	(0,00)	-0,0004	0,00	-0,0066	0,00
Specialization						
WXX* Rivalry					3,07***	(0,86)
Overall maximum convergence ratio	0.17		0,18		0,16	

Table 2. Estimation results.
Dependent variable: preferential trade agreements dynamics in period 2004-2012

	Model I		Model II		Model III	
	B	s.d	B	s.d	B	s.d
Network structural effects						
Transitive ties	2,06***	(0,43)	2,04***	(0,46)	1,9***	(0,66)
Indirect ties	-0,39***	(0,04)	-0,39***	(0,04)	-0,64***	(0,08)
Trade Cost effects						
Distance	-0,57***	(0,10)	-0,48***	(0,13)	-0,48***	(0,15)
Trade	0,11***	(0,03)	0,11***	(0,03)	0,1***	(0,04)
GDPinv	-1,45***	(0,37)	-1,97***	(0,46)	-2,63***	(0,67)
Trade*GDPinv	-0,12***	(0,05)	-0,05	(0,05)	-0,02	(0,06)
Mult. Resistance			0,18	(0,23)	0,58**	(0,28)
Sim GDPinv			2,87***	(0,70)	3,15***	(1,03)
Same language			0,45***	(0,16)	0,68***	(0,21)
Same continent			0,19	(0,19)	0,42*	(0,25)
Hierarchy effects						
L&L	0,41	(0,40)	0,34	(0,44)	1,5***	(0,56)
L&H	0,3	(0,35)	0,47	(0,38)	1,41***	(0,47)
L&M	0,45	(0,28)	0,52*	(0,31)	1,34***	(0,37)
H&M	0,4*	(0,22)	0,69***	(0,24)	1,33***	(0,34)
H&H	0,89**	(0,44)	1,2***	(0,45)	1,76***	(0,56)
Political economy						
Democracy	-0,51***	(0,13)	-0,55***	(0,16)	-1,02***	(0,21)
Democracy ego*alter	0,0002	(0,002)	-0,0011	(0,002)	0.00	(0.00)
Specialization and interaction						
WXX* Rivality					1,67***	(0,30)
Overall maximum convergence ratio		0,11		0,13		0,16

The joint significant test of the new variables in model III gives us confidence on the relevance of including them into the model (see table A1).

Democracy

- Democracy consolidation and trade.
  - PTA promotes trade and trade influence in the democratization process. Trade-inequality-democratization. Non monotonic relationship.
- PTA and democracy
  - Mansfield, Milner and Rosendorf (2002) positive effect of democracy for a longer initial period (1951-1992) of PTA evolution
  - MPS (2012) democracy acts in two different ways: greater level of democracy diminishes PTA, but on the other hand when a democracy signs an agreement it will be more probably with another democracy
  - MP (2016) positive interaction effect. Two strong democracies but also two strong autocracies.
  - Our own evidence strong negative effect (1994-2004 and 2004-2012).

Conclusions

- Krugman Natural Bloc
  - Less trade cost greater incentives to PTA (RTA)
- Triangles and PTA
  - PTA armonization spaguettis and lasagnas
- Democracy and PTA puzzle
- Domino effect through trade rivaliry
  - Juggernaut effect export lobby interest and global free trade
- New: Application to choose patterns

Thank you