

FDI and the evolution of the comparative advantage of nations

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- In the process of economic development, the productive structure of countries progressively changes (Kuznets, 1966; Lewis 1954).
- The capacity to renew and develop new activities in an economy is key to sustain economic growth (Pasinetti, 1993; Glaeser, 2005; Hidalgo et al., 2019)→ Thus, the development of new industries ranks high in the scientific and political agenda
 - Ej: Smart Specialization Strategy in the UE (Balland et al., 2019)
- Hidalgo et al. (2007), Neffke et al. (2011), Essletzbichler (2015)... highlight the role of existing capabilities in an economy as a key driver for the development of new areas of specialization → *Principle of relatedness* (Hidalgo et al. 2018)
 - The probability that an economy develops a new specialization (diversifies) is a function of the number of activities related to the new specialization that already exist in that economy.
 - The transformation of the productive structure of an economy as a path-dependent process.

- The principle of relatedness emphasizes the relevance of local capabilities to diversify into new areas, but overlooks non-local ones. However:
 - Economies are not self-contained and isolated entities (Tripp et al., 2018).
 - Too much inward looking entails risk of lock-in and decline (Grabher, 1993; Bathelt et al., 2004; Martin and Sunley, 2006).
- Bahar et al. (2014) extended the study of Hidalgo et al. (2007) to consider the effect of geographical proximity → The areas of specialization of the neighbors of a country influence the evolution of the areas in which it specializes.
- The **aim of the paper** is to study the impact of FDI linkages on the evolution of the comparative advantages of nations.

- There is a significant body of literature on **International Economics** that has examined the impact of FDI on the productivity and growth of receiving economies (Borensztein et al., 1998; Alfaro et al., 2004)
 - However, it has overlooked FDI's role in driving the evolution of comparative advantages.
- There is a growing body of literature on (Evolutionary) **Economic Geography** that has analyzed the impact of external linkages (FDI, migration, collaboration, etc.) on the diversification possibilities of economies (Lo Turco and Maggioni, 2019; Balland and Boschma, 2020; Miguelez and Morrison, 2023; Qiao et al., 2024...)
 - However, they use rich micro-data for several regions within a single country.
- We analyze the impact of FDI linkages on the evolution of national areas of specialization using both product and macro-data for a sample of 138 countries from 2001 to 2021.

- Diversification mostly occurs through related rather than unrelated diversification (Boschma and Frenken, 2011; Pinheiro et al, 2022)
- The principle of relatedness seems to hold across types of activities, relatedness measures, and spatial scales.
- The forces pushing towards this local search relate to:
 - Limited capacity to absorb external knowledge
 - Accessing distant knowledge bases makes the learning process more uncertain, costly, and risky
 - Knowledge exchange (in particular complex and tacit knowledge) is done more efficiently in close geographical proximity.
- However, over-reliance on local actors and relationships is a source of redundancy and cognitive lock-in.
- External linkages crucial for acquiring new non-redundant knowledge and capabilities → *to bring fresh air* avoid risk of lock-in and decline.

- Several studies have assessed the importance of non-local linkages for the development of new areas of specialization in an economy (new path development):
 - Bahar et al. (2014) and Boschma et al. (2017) look at the effect of neighboring regions and find a positive and significant effect.
 - Miguelez and Morrison (2023) and Diodato et al (2022) found that migrants have a significant role as agents of technological change.
 - Balland and Boschma (2020) found a positive and significant effect of global collaboration in patents on regional technological diversification.
 - Lo Turco and Maggioni (2019) for Turkey, Hartog et al., (2017) for Sweden, Elekes et al. (2019) for Hungary, Zhu et al. (2017) and Qiao et al. (2024) for China or Ascani et al. (2020) for Italy, found that MNEs had a positive and significant impact on regional diversification (new entries).

- However, the presence of MNEs is not a guarantee of positive spillovers → Conditioning factors (Crespo and Fontoura, 2007; Rojec and Knell, 2018):
 - Domestic firms absorptive capacity
 - Cognitive distance between foreign and local enterprises
 - FDI entry modes
 - Geographical distance
 - Host country characteristics: skilled labor, infrastructure, institutional quality... (Alfaro et al., 2008; Alfaro, 2017)
- So, it is not only a matter of the number of external linkages, but also of what they may bring → **Complementarity**.
- Conditioning factors leave lagging economies in a *delicate* position:
 - Although their internal capabilities are weaker and so they have a stronger need for non-local ones...
 - They (tend to) have a weaker capacity to absorb them (Tripl et al. 2018)

- Data sources:
 - Trade data from Atlas of Complexity (raw from COMTRADE)
 - Bilateral **FDI stocks** from UNCTAD
 - Additional bilateral or national data (e.g. GDP, Population, distance...) from CEPII
- Three-year windows: average values
- Our sample: 138 countries, 1215 products in 7 periods of three years from 2001 to 2021.

- Defining the economic structure of a country:
 - Revealed Comparative Advantage (RCA_{rip}) of country r in product i at period $p \rightarrow$ 3-year windows: Average of annual RCA_{rit}
 - A country r is specialized on product i at period p when it has a $RCA_{rip} \geq 1$
 - The vector of $RCA_{rip} \geq 1$ and ≤ 1 define the economic structure of the country at each moment of time
 - The shifts on the RCA_{rip} from period $p - 1$ to period p define the change on the economic structure over time.

- **Static approach:** Bilateral similarity of countries' specialization profiles
- Gravity equation: similarity between a country pair depends positively on their respective masses (FDI, GDP...) and negatively on the distance that separates them (Bahar et al. 2014).

$$\begin{aligned} Sim_{r,s,p} = & \beta_0 + \beta_1 \ln(FDI_{r,s,p}) + \beta_2 Time_Variant_Controls_{r,s,p} \\ & + \beta_3 Time_Invariant_Controls_{r,s} + \phi_r + \omega_s + \delta_p + \epsilon_{r,s,p} \end{aligned}$$

- **Dynamic approach:** Shifts on RCAs of countries in products over time → Extensive margin: entry model.

$$\begin{aligned}P(\text{Entry}_{r,i,p} = 1) &= \beta_0 + \beta_1 \text{HH.FDI}_{r,p-1} + \beta_2 \text{Direct.CL.FDI}_{r,i,p-1} \\ &+ \beta_3 \text{Related.CL.FDI}_{r,i,p-1} + \beta_4 \text{RelDens}_{r,i,p-1} \\ &+ \gamma \text{controls}_{r,i,p-1} + \phi_r + \omega_i + \delta_p + \epsilon_{r,i,p}\end{aligned}$$

- Dependent variable:
 - Entry = 1, if $\text{RCA}_{rip-1} < 1$ and $\text{RCA}_{rip} \geq 1$
 - Entry = 0, otherwise.

- **Relatedness:**

$$\phi_{i,j,p} = \min(P(RCA_{i,p} | RCA_{j,p}), P(RCA_{j,p} | RCA_{i,p}))$$

- **Relatedness density:**

$$\text{RelDens}_{r,i,p} = \frac{\sum_{j \neq i} \phi_{i,j,p} RCA_{j,r,p}}{\sum_{j \neq i} \phi_{i,j,p}}$$

▶▶ Example 1

- **HH FDI:** Herfindahl-Hirschman of the shares of FDI stocks of country r from countries s .

$$HHI_{r,p} = \sum_{s=1}^N s_s^2$$

- **Direct complementarity:** measures, for each potential new product i , the extent to which the country r is linked through incoming FDI to other countries s , that are specialized in product i

$$DirectCL_{r,i,p} = \sum_{s=1}^N \frac{FDI_{r \leftarrow s,p}}{FDI_{r,p}} RCA_{s,i,p}^{0,1}$$

- **Related complementarity:** measures, for each potential new product i , the extent to which a country r is linked to other countries s , that are specialized in products j to which the new product i is related but are missing in country r .

$$RelatedCL_{r,i,p} = \sum_{s=1}^N \frac{FDI_{r \leftarrow s,p}}{FDI_{r,p}} \sum_{j \neq i} \phi_{i,j,p} \cdot CL_{r,s,j,p}$$

Where:

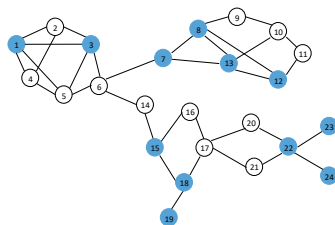
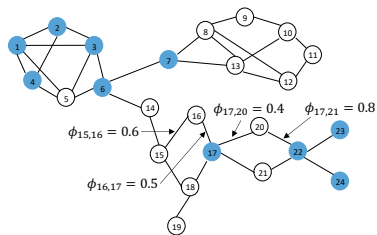
$CL_{r,s,j,p} = 1$, if $RCA_{j,s} \geq 1$ and $RCA_{j,r} < 1$

$CL_{r,s,j,p} = 0$, otherwise

Data and Methods: variables

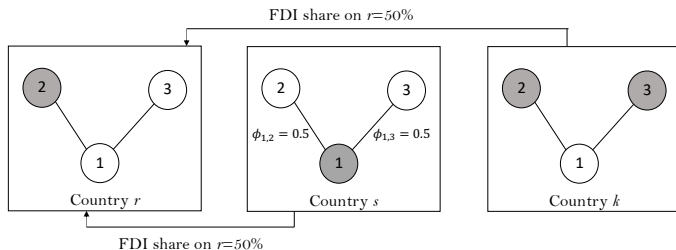
$$\text{RelDens}_{r,20,p} = \frac{1 \times 0.4 + 1 \times 0.8}{0.4 + 0.8} = 1$$

$$\text{RelDens}_{s,20,p} = \frac{0 \times 0.4 + 1 \times 0.8}{0.4 + 0.8} = 0.67$$



▶▶ Back to variables

Data and Methods: variables

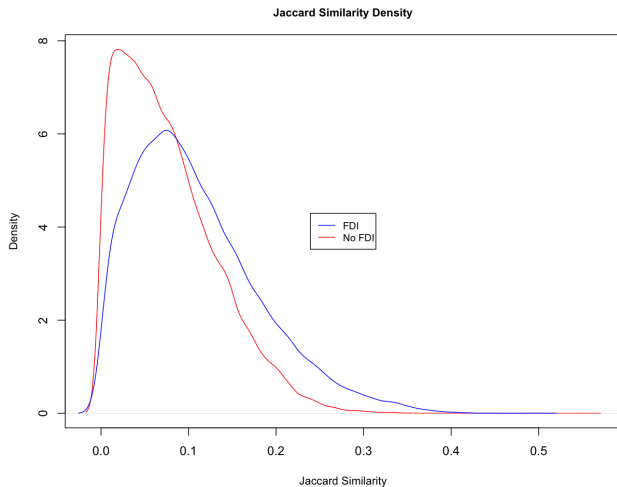


$$\text{Direct.CL}_{r,1,p} = 1 \times 0.5 + 0 \times 0.5 = 0.5$$

$$\text{Related.CL}_{r,1,p} = 0 \times 0.5 + 0.5 \times 0.5 = 0.25$$

▶▶ Back to Variables

Figure: Similarity density. $FDI = 0$ and $FDI > 0$.



Results

Static similarity

Dependent Variable: Jaccard $Sim_{r,s,p}$			
Model:	(1)	(2)	(3)
In.FDI	0.071*** (0.003)	0.033*** (0.003)	0.027*** (0.002)
In.Distance		-0.148*** (0.006)	-0.204*** (0.006)
Contiguity		0.148*** (0.008)	0.147*** (0.007)
Common Colony		0.093*** (0.004)	0.179*** (0.009)
Free Trade Agreement.WTO		0.116*** (0.019)	0.123*** (0.021)
Tax Haven		-0.206*** (0.009)	-0.158*** (0.003)
In.Trade			-0.030*** (0.002)
GDP difference			-0.023*** (0.003)
FE: Period + Country r + Country s	Yes	Yes	Yes
Num.Obs.	66.171	58.695	37.660
AIC	32 896.5	28 893.2	19 620.4
BIC	35 444.5	31 308.8	21 891.0

Standard-errors in parentheses are clustered by period.

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Results

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Standard-errors in parentheses are clustered by period.

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Results

Dynamics of similarity: baseline model

Dependent Variable: Entry					
Model:	(1)	(2)	(3)	(4)	(5)
log(Population.lag)	0.016217*** (0.001642)	0.016387*** (0.001648)	0.014795*** (0.001645)	0.014464*** (0.001669)	0.014473*** (0.001662)
log(GDPpc.lag)	0.008448*** (0.000742)	0.008303*** (0.000745)	0.008458*** (0.000742)	0.008543*** (0.000743)	0.008097*** (0.000744)
Open economy.FDI.lag	0.000811*** (0.000246)	0.000860*** (0.000247)	0.000604** (0.000246)	0.000584** (0.000248)	0.000638** (0.000248)
Open economy.Trade.lag	0.007257*** (0.001156)	0.007628*** (0.001160)	0.006530*** (0.001155)	0.006641*** (0.001156)	0.007274*** (0.001159)
RD.lag	0.004877*** (0.000076)	0.004885*** (0.000076)	0.004765*** (0.000076)	0.004897*** (0.000076)	0.004792*** (0.000077)
HH.FDI.lag		-0.004352*** (0.001334)			-0.012030*** (0.001596)
Direct.CL.lag			0.000132*** (0.000008)		0.000135*** (0.000010)
Related.CL.lag				0.000151*** (0.000021)	0.000065** (0.000029)
FE Period + Country + Product	Yes	Yes	Yes	Yes	Yes
Observations	979,704	979,704	979,704	979,704	979,704

Heteroskedasticity-robust standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Results

Dynamics of similarity: baseline model

Dependent Variable: Entry					
Model:	(1)	(2)	(3)	(4)	(5)
log(Population_lag)	0.016217*** (0.001642)	0.016387*** (0.001648)	0.014795*** (0.001645)	0.014464*** (0.001669)	0.014473*** (0.001662)
log(GDPpc_lag)	0.008448*** (0.000742)	0.008303*** (0.000745)	0.008458*** (0.000742)	0.008543*** (0.000743)	0.008097*** (0.000744)
Open economy.FDI_lag	0.000811*** (0.000246)	0.000860*** (0.000247)	0.000604** (0.000246)	0.000584** (0.000248)	0.000638** (0.000248)
Open economy.Trade_lag	0.007257*** (0.001156)	0.007628*** (0.001160)	0.006530*** (0.001155)	0.006641*** (0.001156)	0.007274*** (0.001159)
RD_lag	0.004877*** (0.000076)	0.004885*** (0.000076)	0.004765*** (0.000076)	0.004897*** (0.000076)	0.004792*** (0.000077)
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Observations	979,704	979,704	979,704	979,704	979,704

Heteroskedasticity-robust standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Results

Dynamics of similarity: interactions

Dependent Variable: Entry			
Model:	(1)	(2)	(3)
log(Population_Lag)	0.013959*** (0.001662)	0.017024*** (0.001650)	0.014061*** (0.001677)
log(GDPpc_Lag)	0.008080*** (0.000744)	0.007952*** (0.000744)	0.008152*** (0.000745)
Open economy.FDI_Lag	0.000499** (0.000249)	0.000757*** (0.000247)	0.000552** (0.000248)
Open economy.Trade_Lag	0.007213*** (0.001159)	0.007220*** (0.001159)	0.007450*** (0.001159)
RD_Lag	0.004671*** (0.000077)	0.004241*** (0.000081)	0.004823*** (0.000095)
HH.FDI_Lag	-0.011662*** (0.001598)	-0.010767*** (0.001354)	-0.015418*** (0.001555)
Direct.CL_Lag	0.000477*** (0.000030)	-0.000014 (0.000010)	
Related.CL_Lag	0.000098*** (0.000029)		0.000232*** (0.000031)
Direct.CL_Lag × Related.CL_Lag	-0.000010*** (0.000001)		
RD_Lag × Direct.CL_Lag		0.000014*** (0.000001)	
RD_Lag × Related.CL_Lag			0.000006** (0.000003)
FE: Period + Country + Product	Yes	Yes	Yes
Observations	979,704	979,704	979,704

Heteroskedasticity-robust standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Results

Dynamics of similarity: interactions

Dependent Variable: Entry			
Model:	(1)	(2)	(3)
log(Population_Lag)	0.013959*** (0.001662)	0.017024*** (0.001650)	0.014061*** (0.001677)
log(GDPpc_Lag)	0.008080*** (0.000744)	0.007952*** (0.000744)	0.008152*** (0.000745)
Open economy.FDI_Lag	0.000499** (0.000249)	0.000757*** (0.000247)	0.000552** (0.000248)
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HH.FDI_Lag	-0.011662*** (0.001598)	-0.010767*** (0.001354)	-0.015418*** (0.001555)
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Related.CL_Lag	0.000098*** (0.000029)		0.000232*** (0.000031)
Direct.CL_Lag × Related.CL_Lag	-0.000010*** (0.000001)		
RD_Lag × Direct.CL_Lag		0.000014*** (0.000001)	
RD_Lag × Related.CL_Lag			0.000006** (0.000003)
FE: Period + Country + Product	Yes	Yes	Yes
Observations	979,704	979,704	979,704

Heteroskedasticity-robust standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Results

Dynamics of similarity: interactions

Dependent Variable: Entry			
Model:	(1)	(2)	(3)
log(Population.Lag)	0.013959*** (0.001662)	0.017024*** (0.001650)	0.014061*** (0.001677)
log(GDPpc.Lag)	0.008080*** (0.000744)	0.007952*** (0.000744)	0.008152*** (0.000745)
Open economy.FDI.Lag	0.000499** (0.000249)	0.000757*** (0.000247)	0.000552** (0.000248)
Open economy.Trade.Lag	0.007213*** (0.001159)	0.007220*** (0.001159)	0.007450*** (0.001159)
RD.Lag	0.004671*** (0.000077)	0.004241*** (0.000081)	0.004823*** (0.000095)
HH.FDI.Lag	-0.011662*** (0.001598)	-0.010767*** (0.001354)	-0.015418*** (0.001555)
Direct.CL.Lag	0.000477*** (0.000030)	-0.000014 (0.000010)	
Related.CL.Lag	0.000098*** (0.000029)		0.000232*** (0.000031)
Direct.CL.Lag × Related.CL.Lag	-0.000010*** (0.000001)		
RD.Lag × Direct.CL.Lag		0.000014*** (0.000001)	
RD.Lag × Related.CL.Lag			0.000006** (0.000003)
FE: Period + Country + Product	Yes	Yes	Yes
Observations	979,704	979,704	979,704

Heteroskedasticity-robust standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Results

Dynamics of similarity: effects of complexity

Dependent Variable: Entry				
Model:	(1)	(2)	(3)	(4)
log(Population_lag)	0.014464*** (0.001661)	0.014525*** (0.001662)	0.014481*** (0.001662)	0.014450*** (0.001662)
log(GDPpc_lag)	0.008021*** (0.000744)	0.008143*** (0.000744)	0.008148*** (0.000744)	0.008147*** (0.000744)
Open economy.FDI_lag	0.000640*** (0.000248)	0.000634** (0.000248)	0.000630** (0.000248)	0.000627** (0.000248)
Open economy.Trade_lag	0.007147*** (0.001159)	0.007260*** (0.001159)	0.007274*** (0.001159)	0.007277*** (0.001159)
RD_lag	0.004626*** (0.000076)	0.004773*** (0.000077)	0.004782*** (0.000077)	0.004785*** (0.000077)
Product Complexity (PCI)	-4.664400*** (0.181874)	-3.082080*** (0.180240)	-2.969710*** (0.177717)	-2.856580*** (0.196900)
HH.FDI_lag	-0.011723*** (0.001595)	-0.012282*** (0.001617)	-0.012144*** (0.001597)	-0.012275*** (0.001601)
Direct.CL_lag	0.000117*** (0.000010)	0.000135*** (0.000010)	0.000139*** (0.000011)	0.000137*** (0.000010)
Related.CL_lag	0.000076*** (0.000029)	0.000065** (0.000029)	0.000070** (0.000029)	0.000080*** (0.000031)
RD_lag × PCI	0.121756*** (0.005322)			
HH.FDI_lag × PCI		0.265710 (0.208769)		
Direct.CL_lag × PCI			-0.002367 (0.002353)	
Related.CL_lag × PCI				-0.006915* (0.003833)
FE: Period + Country + Product	Yes	Yes	Yes	Yes
Observations	979,704	979,704	979,704	979,704

Heteroskedasticity-robust standard-errors in parentheses

Signif. Codes: ***, 0.01, **, 0.05, *, 0.1

Robustness checks

Level of development

Dependent Variable: Entry				
Model:	(1)	(2)	(3)	(4)
log(Population.Lag)	-0.000106 (0.001781)	0.013197*** (0.001802)	0.013670*** (0.001667)	0.011272*** (0.001708)
log(GDPpc.Lag)	0.012818*** (0.000751)	0.007523*** (0.000798)	0.006906*** (0.000756)	0.004730*** (0.000828)
Open economy.FDI.Lag	0.000445* (0.000248)	0.000657*** (0.000249)	0.000624** (0.000248)	0.000600** (0.000248)
Open economy.Trade.Lag	0.007041*** (0.001159)	0.007567*** (0.001164)	0.007603*** (0.001159)	0.008623*** (0.001167)
RD.Lag	0.006117*** (0.000108)	0.004787*** (0.000077)	0.004705*** (0.000077)	0.004778*** (0.000077)
HH.FDI.Lag	-0.005104*** (0.001617)	-0.014802*** (0.001694)	-0.012993*** (0.001595)	-0.014087*** (0.001599)
Direct.CL.Lag	0.000144*** (0.000010)	0.000135*** (0.000010)	0.000064*** (0.000011)	0.000133*** (0.000010)
Related.CL.Lag	0.000018 (0.000029)	0.000065** (0.000029)	0.000087*** (0.000029)	-0.000093*** (0.000033)
RD.Lag × log(GDPpc.Lag)	-0.000685*** (0.000038)			
HH.FDI.Lag × log(GDPpc.Lag)		0.001810*** (0.000647)		
Direct.CL.Lag × log(GDPpc.Lag)			0.000048*** (0.000005)	
Related.CL.Lag × log(GDPpc.Lag)				0.000143*** (0.000012)
FE: Period + Country + Product	Yes	Yes	Yes	Yes
Observations	979,704	979,704	979,704	979,704

Heteroskedasticity-robust standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Robustness checks

Geography

Dependent Variable: Entry						
Model:	(1)	(2)	(3)	(4)	(5)	(6)
log(Population_lag)	0.015744*** (0.001640)	0.015178*** (0.001640)	0.015857*** (0.001638)	0.015017*** (0.001646)	0.012493*** (0.001659)	0.014027*** (0.001659)
log(GDPpc_lag)	0.007778*** (0.000742)	0.007472*** (0.000743)	0.007876*** (0.000742)	0.007556*** (0.000744)	0.007178*** (0.000745)	0.007608*** (0.000744)
Open economy.FDI_lag	0.000819*** (0.000246)	0.000824*** (0.000246)	0.000818*** (0.000246)	0.000754*** (0.000247)	0.000568** (0.000248)	0.000638** (0.000248)
Open economy.Trade_lag	0.005879*** (0.001155)	0.005194*** (0.001160)	0.006088*** (0.001159)	0.006065*** (0.001159)	0.005299*** (0.001163)	0.006208*** (0.001162)
RD_lag	0.004314*** (0.000077)	0.004741*** (0.000077)	0.004312*** (0.000077)	0.004270*** (0.000077)	0.004806*** (0.000077)	0.004307*** (0.000077)
Direct.CL_geo_lag	0.000350*** (0.000011)		0.000362*** (0.000014)	0.000335*** (0.000012)		0.000349*** (0.000014)
Related.CL_geo_lag		0.001666*** (0.000089)	-0.000205* (0.000106)		0.001649*** (0.000089)	-0.000221** (0.000106)
HH.FDI_lag				-0.007733*** (0.001351)	-0.014357*** (0.001576)	-0.011620*** (0.001594)
Direct.CL_lag				0.000097*** (0.000009)		0.000077*** (0.000010)
Related.CL_lag					0.000281*** (0.000025)	0.000128*** (0.000029)
FE Period + Country + Product	Yes	Yes	Yes	Yes	Yes	Yes
<i>Fit statistics</i>						
Observations	979,704	979,704	979,704	979,704	979,704	979,704

Heteroskedasticity-robust standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

- Our results hold to several shifts in the specification:
 - Use of Logit model (instead of Linear Probability Model)
 - Stronger condition for entry: solid entry \rightarrow Country r becomes specialized in product i at period p , and keeps this specialization for more than one period.
 - Use of alternative measures of relatedness: Cosine similarity instead of Hidalgo et al. (2007) method.

- FDI as a source of new competitive advantages for nations.
 - Through the exchange of capabilities, it contributes to increase the similarity in the competitive advantage profile of economies.
 - Direct and related complementarity both contribute to acquiring new areas of specialization.
 - Although both have a positive effect, they may act as substitutes from each other.
 - They tend to benefit more to rich countries, but do not have a differential effect to specialize in complex products
- Limitations and further research:
 - Assumption of what flows through FDI: pros and cons.
 - Smooth the threshold for specialization change.
 - Focus on the sending countries.

Thank you for your attention and comments!

Figure: Main inward FDI hosts. 25% top stocks. 2001-2003

FDI Network 2001-2003 (Top 25% Stocks)

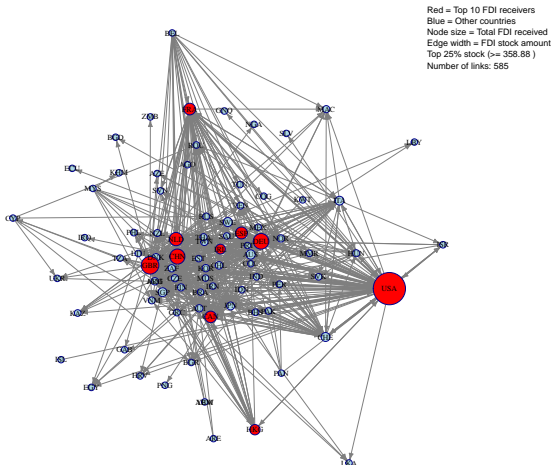


Figure: Main inward FDI hosts. 25% top stocks. 2019-2021

FDI Network 2019–2021 (Top 25% Flows)

