

TRADE LIBERALIZATION AND REGIONAL GROWTH
PRODUCTIVITY:
SOME LESSONS FROM MEXICO'S NORTHERN
BORDER'S MANUFACTURING AFTER 20 YEARS

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ESPE Seminar, Bogota, October 2015

Trade
Liberalization

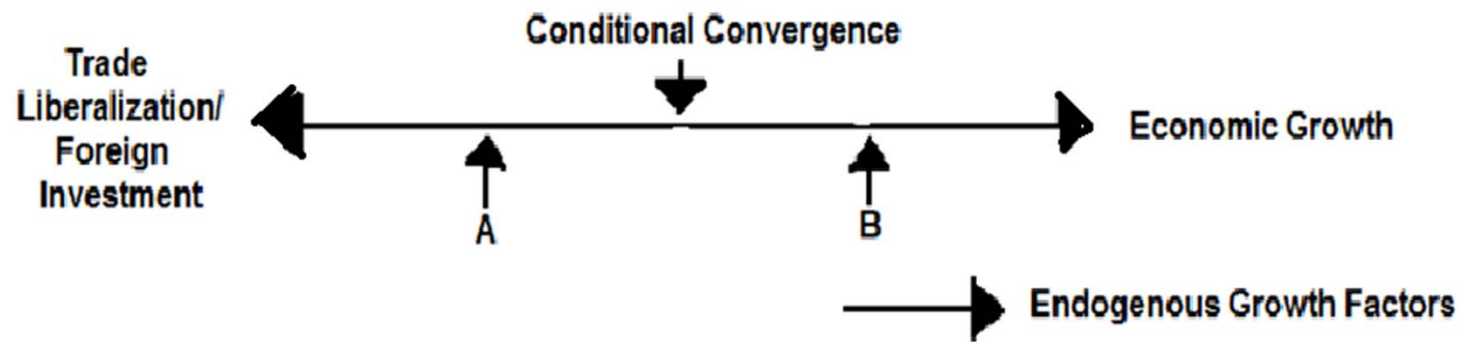


Economic Growth
(Labor Productivity)
Y/L

- By means of [foreign trade], the narrowness of the home market does not hinder the division of labor in any particular branch of art or manufacture from being carried to the highest perfection. By opening a more extensive market for whatever part of the produce of their labor may exceed the home consumption, it encourages them to improve its productive powers. (Smith, 1776, vol. 1, p. 413)

«CLASIC/SOLOW» ECONOMIC GROWTH PERSPECTIVE





20 years ago

Cross-country studies:

Sachs-Warner (1995) positive

Rodrick-Rodriguez & Rodrick, 2000, rather negative

Wacziarg and Welch (2003),

- when Wacziarg and Welch (2003) examine a subsample of 24 developing countries, they identified the following lessons:
- “First, there is a vast amount of heterogeneity across countries in the extent to which growth rose after trade reforms. While the average effect obtained in the large sample is positive, roughly half of the countries experienced zero or even negative changes in growth post-liberalization. Second, generalizations about the factors that may explain these differences are difficult to draw. The preexisting institutional environment of countries, the extent of political turmoil, the scope and depth of economic reforms, and the characteristics of concurrent macroeconomic policies all seem to have a role to play”
- Then WW recommended further analysis to identify those factors accounting for heterogeneity in the growth effects of trade reform.

- Kneller, Morgan y Kanchanahatakij who reviewed a sample of 37 “liberalising countries” in a cross-section analysis, and after exploring different measurement of trade liberalization as well a different conditional variables such as human capital, natural barriers and institutional quality, they found that heterogeneity in results cannot be explained, and with Pritchett (2001) y Bhagwati and Srinivasan (2002), they suggest that “case study evidence may offer greater returns than further cross-country analysis”.

Cross-country studies



Country

Mostly sectoral, a sample:

Paus, Reinhardt, Robinson (2003) on Latin America, Chand and Sen (2002) on India, Cavalcanti and Rossi (2003) on Brasil, and Iregui, Melo y Ramirez (2007) on Colombia.

New Geographical economics

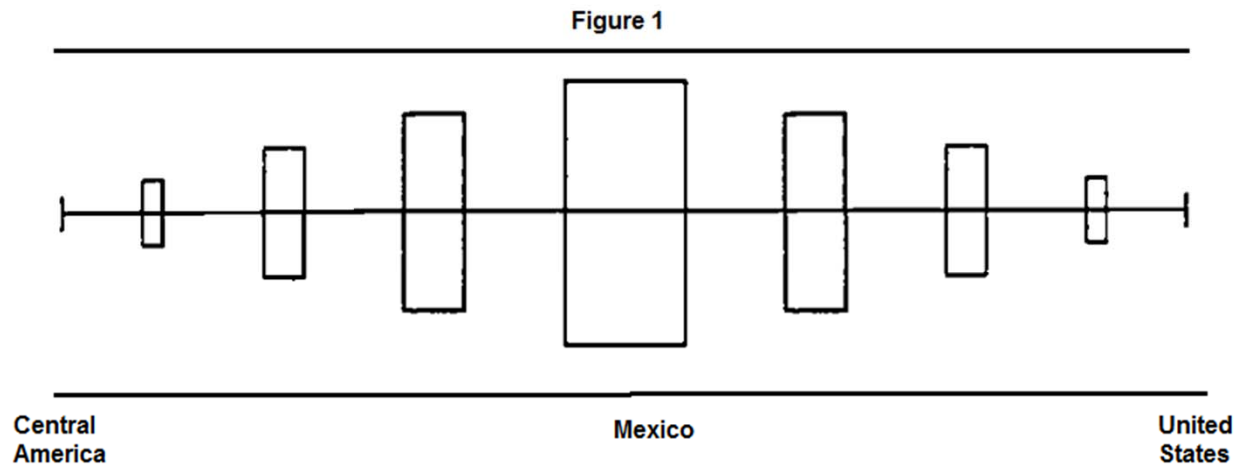
- Including transport cost-distance, agglomerations, increasing returns, cost of agglomeration
- Inmobility of selected growth factors.

- A couple of stylized facts:
- Export asseambly firms (maquiladoras) in Norther Mexico
- «Localized» endogenous growth factors in Central Mexico

- Lack of studies across regions:
- In Border economics? in Regional science?
- No, but something can be induced by previous study in NGE
- Quite amazing given the number of TLA

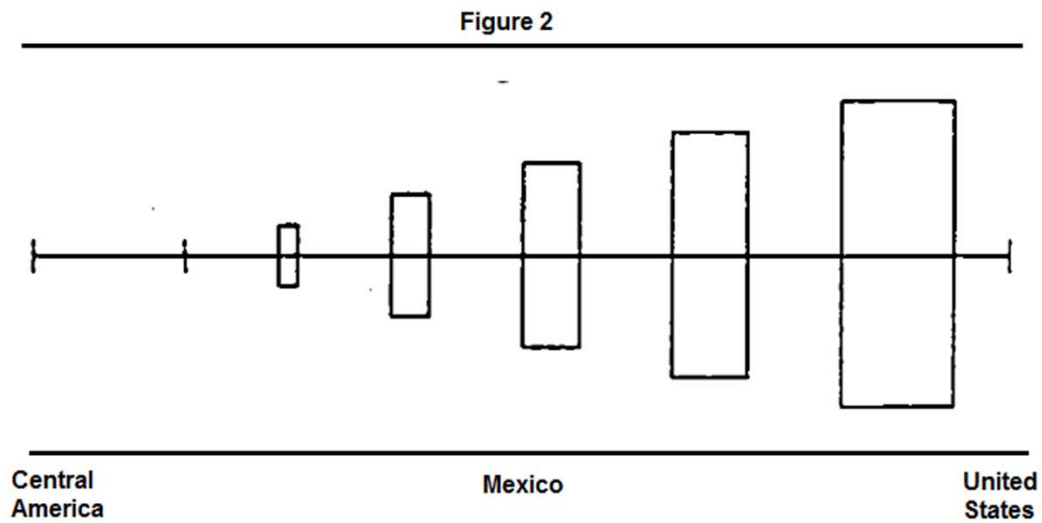
New Geographical Economics

Hanson (1994) Krugman & Livas (1993)



Source: Hanson (1994, p. 5)

Hanson (1994)



Source: Hanson (1994, p. 7)

**Manufacturing employment share in relation to national total.
Mexico: 1970 -2014**

Regions	1970	1988	1994	1998	2004	2008	2014
Mexico City	47.23	33.36	28.72	23.14	21.48	20.04	17.75
Northern States	18.59	27.66	29.84	33.56	35.26	33.94	35.48
Total	65.82	61.02	58.56	56.70	56.74	53.98	53.23

Source: INEGI database and own calculations.

**Manufacturing output share in relation to the national total.
Mexico: 1970 - 2014.**

Regions	1970	1988	1994	1998	2004	2008	2014
Mexico City	54.52	38.21	37.27	27.32	21.32	22.26	18.32
Northern States**	15.27	16.68	17.01	20.62	22.15	22.83	24.98
Total	69.79	54.89	54.28	47.94	43.47	45.09	43.30

Source: INEGI Database and own calculations

- How does trade liberalization affect productivity growth across regions?
- How much the outcome is affected by the immobility of localized growth factors (as suggested in previous research) or technological externalities due to reallocation of economic activity?
- Are these local factors affecting differentially productivity growth region along the time?

- Identifying the role of reduction of transportation costs (agglomerations) and «endogenous factors» such as education, knowledge spillovers...

**Manufacturing output per worker share in relation to the National Total.
Mexico: 1970-2014.**

Regions	1970	1988	1998	2004	2008	2014
Mexico City*	1.15	1.15	1.18	1.00	1.11	1.03
Northern States**	1.11	0.94	0.83	0.94	0.97	1.00
Total	1	1	1	1	1	1

Source: INEGI Database and own calculations

**Growth rate of labor productivity in relation to the national total.
Mexico 1970-2014**

Regions	1970-1988
Mexico City+	0.84
Northern border**	0.70

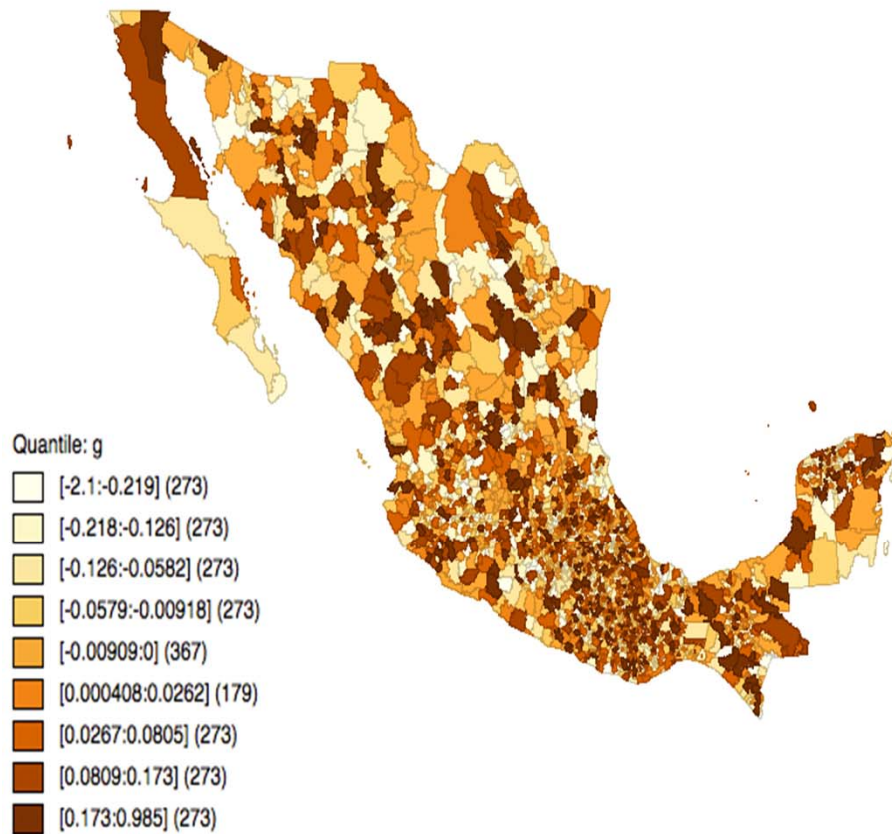
Source: INEGI database and own calculations.

**Growth rate of labor productivity in relation to the national total.
Mexico 1970-2014**

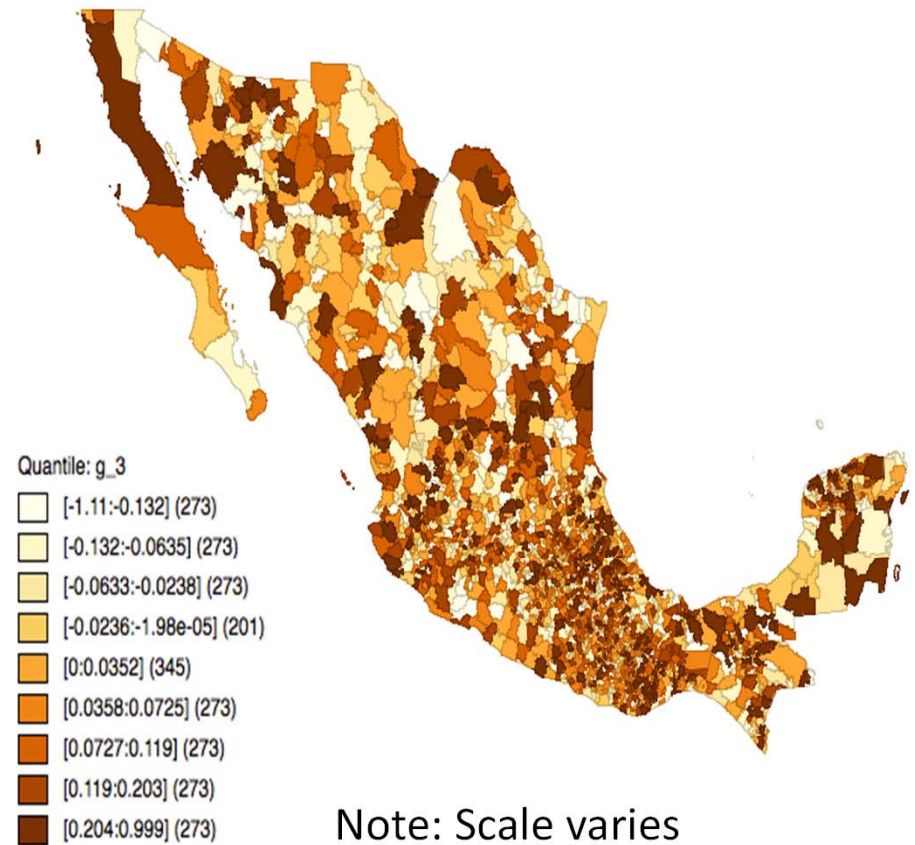
Regions	1970-1988	1988-1998	1998-2008	2008-2014
Mexico City+	0.84	1.03	0.95	0.95
Northern States**	0.70	1.07	1.07	1.61

Source: INEGI database and own calculations.

VACB per capita growth, 1988-1993.
Mexican counties



VACB per capita growth, 2008-2013.
Mexican counties



Note: Scale varies

Previous study

$$Y = \alpha + \beta X + \gamma Z + \eta t + \varepsilon_{i,t}$$

Table A1

Definition of the Explanatory Variables

Primary education: Share of total population older than 25 years of age with at least one year of primary education.

Secondary education: Share of total population older than 25 years of age with at least one year of secondary education.

Infrastructure: This variable was identified as the capacity of kilowatts generated in each Metropolitan Area.

Learning by doing: This variable was measured as the growth rate in nominal terms of the fixed assets (activos fijos brutos) in states for the selected period.

Knowledge spillovers due to specialization: I use industrial specialization as a “proxy variable” for knowledge spillovers. It is acknowledged that the source of knowledge spillovers in specific agglomerations is due to specialization, where firms benefit from being near other firms with few selected industries, as suggested in Young (1927) and Romer (1986). In particular, I adapt a “ m -firm concentration ratio” (for $m < n$) which adds up the m highest shares of employment of a firm in relation to the total employment in industry i , such as $R_3 \equiv \sum \alpha_j$ (ordering the firms so that $\alpha_1 > \dots > \alpha_m > \dots > \alpha_n$). But, in place of firms I select manufacturing sectors. Specifically, I identify the next variable:

$$C_3 \equiv R_3 / (\alpha_1 + \alpha_2 + \alpha_3)$$

Where $R_3 \equiv \sum \alpha_j$ (ordering the share of employment in the sector l in relation to the total manufacturing employment for each state so that $\alpha_1 > \dots > \alpha_3 > \dots > \alpha_n$) and adding up the share in employment at national level of the three specific sectors selected as the three with the highest shares in the total employment in state i .

Table VI

Regressions Results on Pooled Sample Including an Interacting 1985-Dummy-Variable

Dependent variable: $(1/T)\ln(y_{i,t} / y_{i,o})$; y is output per worker

Ln Y initial	-0.0159 ^C
North cities "dummy"	-0.0198
Elementary Ed.	0.5055 ^A
Middle School Ed.	-0.4237 ^C
Learning-by-Doing	-0.0419
Infrastructure	0.0000
Knowledge spillovers	0.0039
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Ln Y initial*year 1985	-0.0415 ^B
North cities "dummy"*year 1985	-0.0403 ^A
Elementary Ed.*year 1985	0.1099
Middle School Ed.*year 1985	0.4712
Learning-by-Doing*year 1985	0.1373
Infrastructure*year 1985	0.0000
Knowledge spillovers*year 1985	-0.0251
<hr/>	
Number of observations: 120	
<hr/>	
R ²	0.51
<hr/>	

^Asignificance level at 5%

^Bsignificance level at 1%

^Csignificance level at 10%

*Interacting 1985=Dummy Variable

De León (2003) empirically examined the growth effects of trade liberalization in Mexico. I focused on the role of human capital, local knowledge spillovers, learning by doing, and infrastructure that encourage growth of pre-existing manufacturing centers and the locations with good access to foreign markets, which encourages the growth of states along the Mexican border. He compared productivity growth in Mexican urban manufacturing before and after trade liberalization. Consistent with the argument that productivity growth in the new areas (Northern cities) is restricted by the unavailability of non-physical capital in those areas, he found that manufacturing in the northern cities shows poor performance in productivity growth.

**Share of working-age population with completed primary education.
Mexico 1980-2010**

Regions	1980
Mexico City+	6.09
Northern states	2.68

Source: INEGI Database and own calculations

**Share of working-age population with completed primary education.
Mexico 1980-2010**

Regions	1980	1990	2000	2005	2010
Mexico City	6.09	2.65	4.78	6.5	5.91
Northern States	2.68	1.46	4.03	5.5	5.23

Source: INEGI Database and own calculations

**Share of working-age population with completed secondary education.
México 1980-2010**

Regions	1980
Mexico City*	1.48
Northern states**	0.57

Source: INEGI Database and own calculations

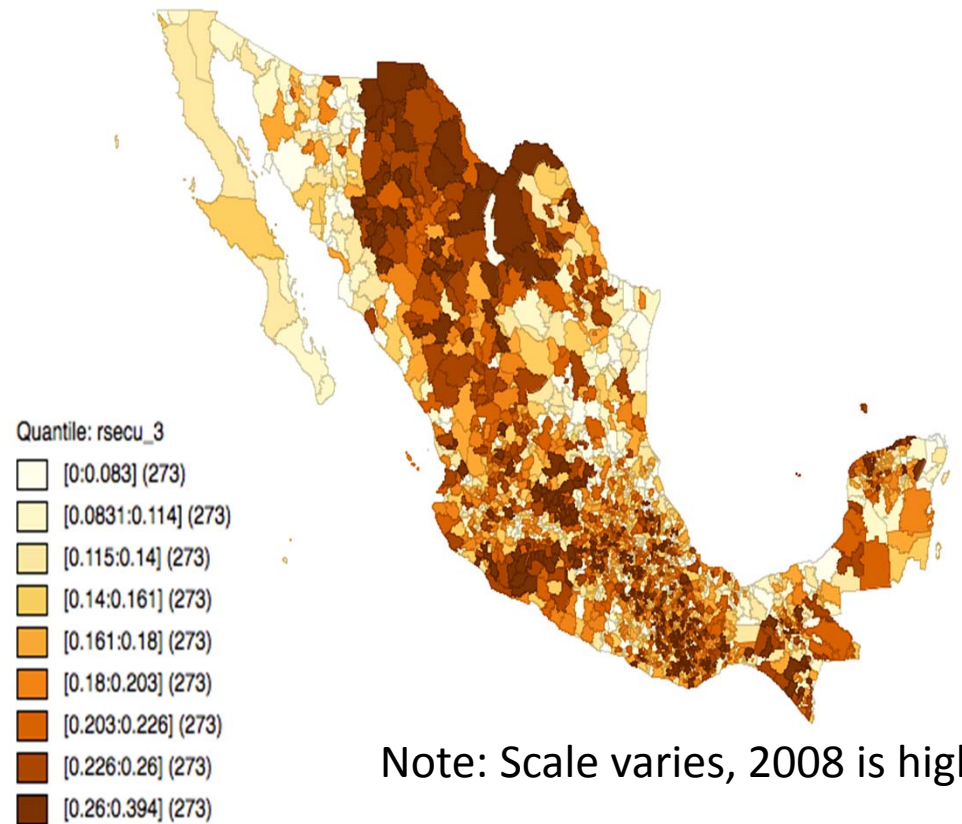
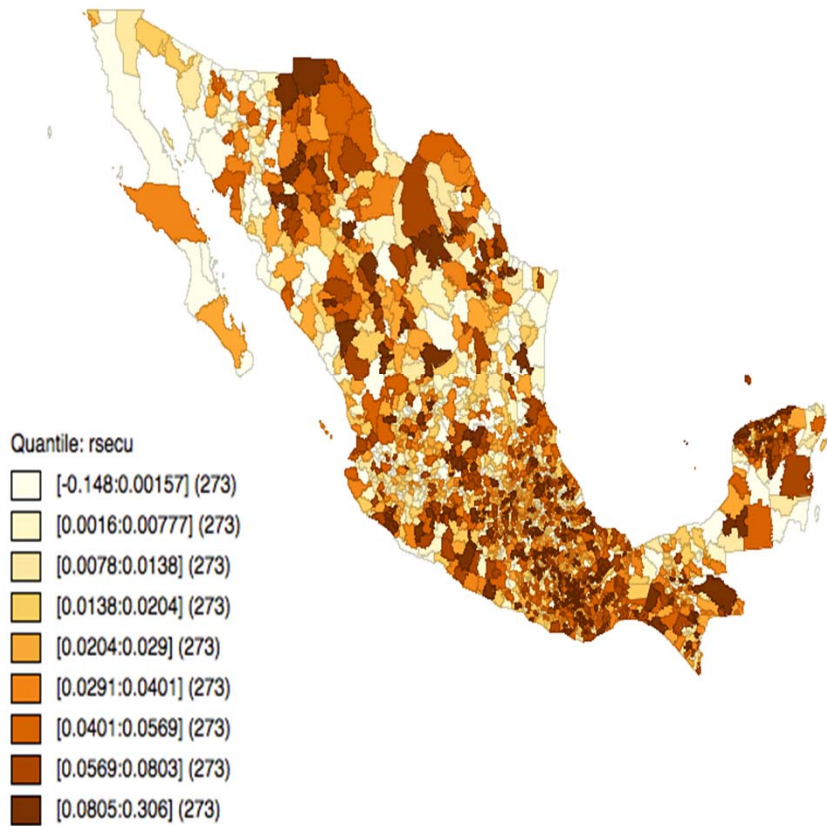
**Share of working-age population with completed secondary education.
México 1980-2010**

Regions	1980	1990	2000	2005	2010
Mexico City*	1.48	1.23	2.15	4.70	4.91
Northern States**	0.57	0.63	1.25	3.00	3.41

Source: INEGI Database and own calculations

Percentage of 25 years or older with middle school instruction. Mexican counties, 1988

Percentage of 25 years or older with middle school instruction. Mexican counties, 2008



Note: Scale varies, 2008 is higher

**Growth rate of the fixed assets in relation to the national total growth rate.
Mexico 1970-2014**

Regions	1970-1985
Mexico City*	-2.59
Northern States**	-0.42
Total	1

Source: INEGI Database and own calculations

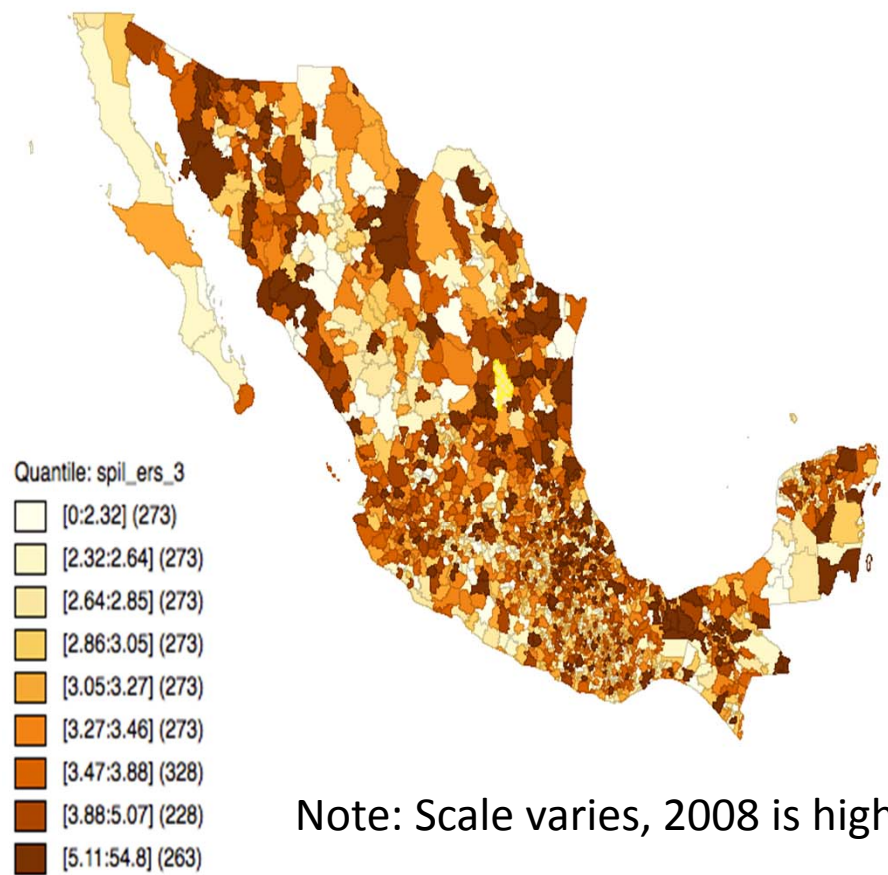
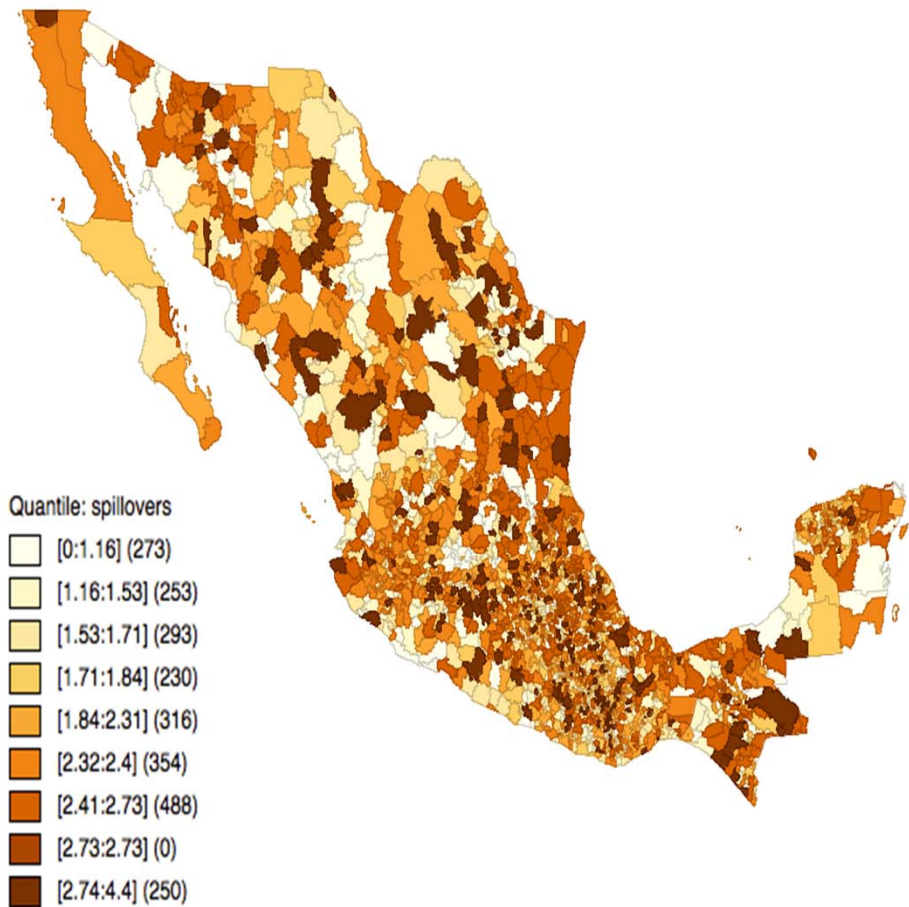
**Growth rate of the fixed assets in relation to the national total growth rate.
Mexico 1970-2014**

Regions	1970-1985	1985-1988	1988-1994	1994-1998	1998-2004	2004-2008	2008-2014
Mexico City*	-2.59	-5.09	-0.58	0.64	-3.86	0.29	-1.38
Northern States**	-0.42	-0.51	0.94	1.61	1.39	1.21	1.54
Total	1		1	1	1	1	1

Source: INEGI Database and own calculations

Knowledge Spillovers due to specialization
Mexican counties, 1988

Knowledge Spillovers due to specialization
Mexican counties, 2008



Note: Scale varies, 2008 is higher

**Share of electricity consumption by selected region in relation to the total national.
Mexico 1990-2014**

Regions	1990	1995
Mexico City	21.41	18.89
Northern States	22.73	22.02
Total	100	100

Source: CFE Database and own calculations

**Share of electricity consumption by selected region in relation to the total national.
Mexico 1990-2014**

Regions	1990	1995	2000	2005	2008	2010	2014
Mexico City	21.41	18.89	18.36	16.97	16.04	15.74	15.92
Northern States	22.73	22.02	24.89	24.97	24.97	24.66	22.78
Total	100	100	100	100	100	100	100

Source: CFE Database and own calculations

$$\left(\frac{1}{\tau}\right) \ln(y_{i,t}/y_{i,t-\tau}) = \alpha + \ln(y_{i,0}) + \beta X_{i,t} + \gamma North + \delta_i + \varepsilon_{i,t}$$

With $\varepsilon_{i,t} \sim N(0, \sigma_i^2)$

Table 9
Regressions Results on Pooled OLS (1988-2008), corrected for heteroscedasticity

Dependent Variable: $(1/T) \ln(y_{1,t}/y_{1,0})$; y is output per worker.

Equation #2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln(y) initial	-0.120*** (0.0335)	-0.120*** (0.0331)	-0.118*** (0.0315)	-0.0756** (0.0302)	-0.130*** (0.0344)	-0.136*** (0.0370)	-0.0913*** (0.0339)	-0.0867** (0.0356)
Elementary Ed.		0.284 (0.187)					0.0381 (0.173)	0.266 (0.234)
Middle School Ed.			0.404** (0.180)				-0.0310 (0.226)	-0.100 (0.378)
Learning-by-doing				0.300*** (0.0599)			0.279*** (0.0668)	0.300*** (0.0729)
Infrastructure					0.00744*** (0.00257)		0.00255 (0.00226)	0.00326 (0.00222)
Knowledge spillovers						-0.0451** (0.0221)	-0.0271 (0.0172)	-0.0185 (0.0183)
North States "dummy"	0.0242 (0.0156)						0.00855 (0.0169)	0.00379 (0.0184)
Includes year dummy variables	No	No	No	No	No	No	No	Yes
Constant	0.442*** (0.124)	0.386*** (0.111)	0.384*** (0.107)	0.292** (0.113)	0.450*** (0.121)	0.585*** (0.168)	0.382*** (0.135)	0.318** (0.137)
Observations	160	160	160	160	160	160	160	160
R-squared	0.244	0.250	0.266	0.453	0.282	0.272	0.474	0.497

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

$$\left(\frac{1}{\tau}\right) \ln \left(\frac{y_{i,t}}{y_{i,t-\tau}} \right) = \alpha + \beta_1 \ln(y_{i,0}) + \beta_2 X_{i,t} + \beta_3 North +$$

$$\beta_4 \ln(y_{i,0}) * postNAFTA + \beta_5 X_{i,t} * postNAFTA + \delta post_t * postNAFTA + \varepsilon_{i,t}$$

With $\varepsilon_{i,t} \sim N(0, \sigma_i^2)$

Table 10
Regressions Results on Pooled OLS (1988-2008), corrected for heteroscedasticity.
Including an Interacting post-NAFTA

Dependent Variable: $(1/T) \ln(y_{1,t}/y_{1,0})$; y is output per worker.

In(y) initial	-0.112** (0.0506)
Elementary Ed.	1.028** (0.406)
Middle School Ed.	-1.035 (0.955)
Learning-by-doing	0.308*** (0.0901)
Infrastructure	0.00898 (0.00596)
Knowledge spillovers	0.0107 (0.0425)
North States “dummy”	-0.00939 (0.0302)

In(y) initial * post-NAFTA	0.0528 (0.0412)
Elementary Ed. * post-NAFTA	-1.229*** (0.451)
Middle School Ed. * post-NAFTA	1.161 (1.030)
Learning-by-doing * post-NAFTA	-0.258* (0.147)
Infrastructure * post-NAFTA	-0.00884 (0.00607)
Knowledge spillovers * post-NAFTA	-0.0310 (0.0428)
North States “dummy” * post-NAFTA	0.0203 (0.0358)

post-NAFTA

Constant	0.288** (0.131)
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Observations	160
R-squared	0.519

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

$$\left(\frac{1}{\tau}\right) \ln \left(\frac{y_{i,t}}{y_{i,t-\tau}} \right) = \alpha + \beta_1 \ln(y_{i,0}) + \beta_2 X_{i,t} + \beta_3 North + \delta post_t +$$

$$\beta_4 \ln(y_{i,0}) * North + \beta_5 X_{i,t} * North + \delta post_t * North + \varepsilon_{i,t}$$

With $\varepsilon_{i,t} \sim N(0, \sigma_i^2)$

Table 11
Regressions Results on Pooled OLS (1988-2008), corrected for heteroscedasticity

Dependent Variable: $(1/T) \ln(y_{1,t}/y_{1,0})$; y is output per worker.

Equation # 4						
	Interaction with Northern States			Interaction with Mexico City		
	(1)	(2)	(3)	(4)	(5)	(6)
ln(y) initial	-0.0909** (0.0360)	-0.0871** (0.0375)	-0.0867** (0.0379)	-0.0898*** (0.0342)	-0.0847** (0.0357)	-0.0848** (0.0361)
Elementary Ed.	-0.0439 (0.194)	0.213 (0.260)	0.294 (0.276)	-0.00941 (0.181)	0.228 (0.251)	0.224 (0.256)
Middle School Ed.	0.0446 (0.262)	-0.0251 (0.387)	0.0106 (0.407)	0.0238 (0.236)	-0.116 (0.400)	-0.124 (0.404)
Learning-by-doing	0.291*** (0.0687)	0.308*** (0.0740)	0.311*** (0.0753)	0.284*** (0.0674)	0.302*** (0.0735)	0.301*** (0.0744)
Infrastructure	0.00254 (0.00258)	0.00304 (0.00256)	0.00323 (0.00260)	0.00195 (0.00336)	0.00220 (0.00355)	0.00214 (0.00360)
Knowledge spillovers	-0.0298 (0.0236)	-0.0206 (0.0256)	-0.0167 (0.0264)	-0.0264 (0.0171)	-0.0211 (0.0190)	-0.0217 (0.0194)
North States "dummy"	-0.244 (0.263)	-0.280 (0.295)	-0.0313 (0.279)	0.0110 (0.0226)	0.0106 (0.0275)	0.0113 (0.0279)
Includes year dummy variables	No	Yes	Yes	No	Yes	Yes
ln(y) initial	0.0303 (0.0617)	0.0307 (0.0678)	0.0359 (0.0640)	-0.102*** (0.0379)	-0.148*** (0.0360)	-0.366*** (0.0699)
Elementary Ed.	0.186 (0.402)	0.306 (0.487)	-0.514 (0.730)	1.751*** (0.462)	2.083*** (0.349)	3.530*** (0.692)
Middle School Ed.	-0.0412 (0.419)	-0.0221 (0.446)	-0.794 (1.059)	-1.283** (0.537)	-1.974*** (0.372)	0.0880 (1.146)
Learning-by-doing	-0.373*** (0.127)	-0.335*** (0.118)	-0.327** (0.141)	-0.272** (0.135)	-0.213** (0.0899)	-0.226*** (0.0706)
Infrastructure	0.00358 (0.00496)	0.00528 (0.00529)	0.00270 (0.00555)	0.0113 (0.0103)	0.0281*** (0.00868)	0.0446*** (0.00427)
Knowledge spillovers	0.0322 (0.0283)	0.0257 (0.0313)	0.0189 (0.0324)	0.101*** (0.0239)	0.118*** (0.0399)	0.308*** (0.0670)
1998 interaction with region			0.0774* (0.0457)			-0.156*** (0.0519)
2003 interaction with region			0.0563 (0.0775)			-0.281** (0.115)
2008 interaction with region			0.171 (0.124)			-0.415** (0.172)
Constant	0.394*** (0.148)	0.328** (0.153)	0.304* (0.156)	0.379*** (0.135)	0.321** (0.146)	0.323** (0.149)
Observations	160	160	160	160	160	160
R-squared	0.489	0.509	0.515	0.487	0.510	0.510

Robust standard errors in parentheses

Table 9
 Regressions Results on Pooled OLS (1988-2014), corrected for heteroscedasticity
 Dependent Variable: $(1/T) \ln(y_{1,t}/y_{1,0})$; y is output per worker.
 By Mexican counties

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln(y) initial	-0.0522*** (0.00264)	-0.0495*** (0.00217)	-0.0584*** (0.00287)	-0.0480*** (0.00244)	-0.0646*** (0.00377)	-0.0522*** (0.00224)	-0.0727*** (0.00655)	-0.0806*** (0.00670)
Elementary Ed.		0.0280** (0.0135)					-0.0815*** (0.0206)	0.0868*** (0.0232)
Middle School Ed.			0.443*** (0.0933)				0.350*** (0.0631)	0.648*** (0.0790)
Learning-by-doing				0.175*** (0.0152)			0.171*** (0.0165)	0.169*** (0.0156)
Infrastructure					0.0266*** (0.00420)		0.0231*** (0.00375)	0.0302*** (0.00341)
Knowledge spillovers						- 0.00300*** (0.000575)	- 0.00292*** (0.000738)	-0.00180** (0.000687)
North States "dummy"	0.0449*** (0.0161)						0.0424*** (0.0113)	0.0298*** (0.0106)
Includes year dummy variables	No	No	No	No	No	No	No	Yes
Constant	0.192*** (0.0130)	0.176*** (0.0155)	0.174*** (0.0147)	0.175*** (0.0104)	-0.216*** (0.0653)	0.207*** (0.0117)	-0.131** (0.0482)	-0.229*** (0.0431)
Observations	10,928	10,911	10,911	10,842	10,889	10,928	10,786	10,786
R-squared	0.130	0.125	0.154	0.176	0.174	0.128	0.247	0.276

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

What I argue we are learning

- Along economic integration, we can expect agglomeration induced by reduction of transport and transaction costs and increasing returns (mostly due to dynamic technological) externalities may generate some growth productivity. This growth over the time is reinforced by the accumulation of growth factors but their performance will depend of the learning capabilities of regions.