Mexico´s Manufacturing Trade Performance: A Global Value Chain Approach

Daniel Chiquiar*

* The opinions expressed in this presentation are the author's own and do not reflect the view of Banco de Mexico or its Board of Governors.

Outline

1. Introduction
2. General Trends
3. Measuring Upstreamness
4. Performance of the Mexican Manufacturing Trade
5. Conclusions

1. Introduction

- As properly acknowledged in this conference´s agenda, the global industrial climate has experienced significant changes in recent years, possibly bringing new challenges and opportunities for the economic landscape in North America. These changes have occurred in at least the following two dimensions:

  - Production Costs. While energy costs have fallen in North America, there is a presumption that China's wages have been rising over time. Unless this behavior is compensated with an equivalent or larger increase in productivity, North America's relative competitiveness could increase.

  - Emergence of Global Value Chains (GVCs). Technological improvements and trade liberalization in the last decades have facilitated the fragmentation of production processes, by allowing inputs to cross borders with relatively low transit costs. In this context, production entails the sourcing of inputs and components from multiple suppliers based in different countries (Feenstra, 1998; Hummels et al., 2001; Fally, 2011; Antràs et al., 2012; Chor et al., 2014).

1. Introduction

- As a result of these changes, the shape of market competition has changed:
  - Competition between China and Mexico. The changes in production costs and in trade-liberalization-induced market access may have altered Mexico's and China´s relative export performance to large markets.
  - Global Competition. In the GVC world countries specialize in specific stages of the production process, rather than in finished goods. This change in the nature of global competition has several implications:
    - Gross flows are not a good measure of the extent to which a country is inserted into GVCs. Instead, this insertion must be measured by the nature and number of production stages that are domestically-produced. This is a better measure of the country´s value added generated by trade.
    - In this context, countries must be thought of as having a comparative advantage in production stages rather than simply in finished goods.
    - That is, there is a new analytical paradigm under which the use of traditional comparative advantage instruments must be complemented with new GVC tools (Grossman and Rossi-Hansberg, 2008; Amador and Di Mauro, 2015).

1. Introduction

- This presentation combines the use of traditional comparative advantage instruments with the new analytical tools that have emerged in the context of GVCs. This combination is used to answer a number of questions stemming from the new global industrial climate:

  - Has the nature of competition between China and Mexico actually changed?
  - Has this enabled Mexico to recover some of the ground lost?
  - Has this potential gain been concentrated in specific sectors (e.g. automobiles)?
  - What are the implications of these changes for Mexico's insertion into GVCs?
  - Are China's and Mexico's processes of insertion into GVCs any different?

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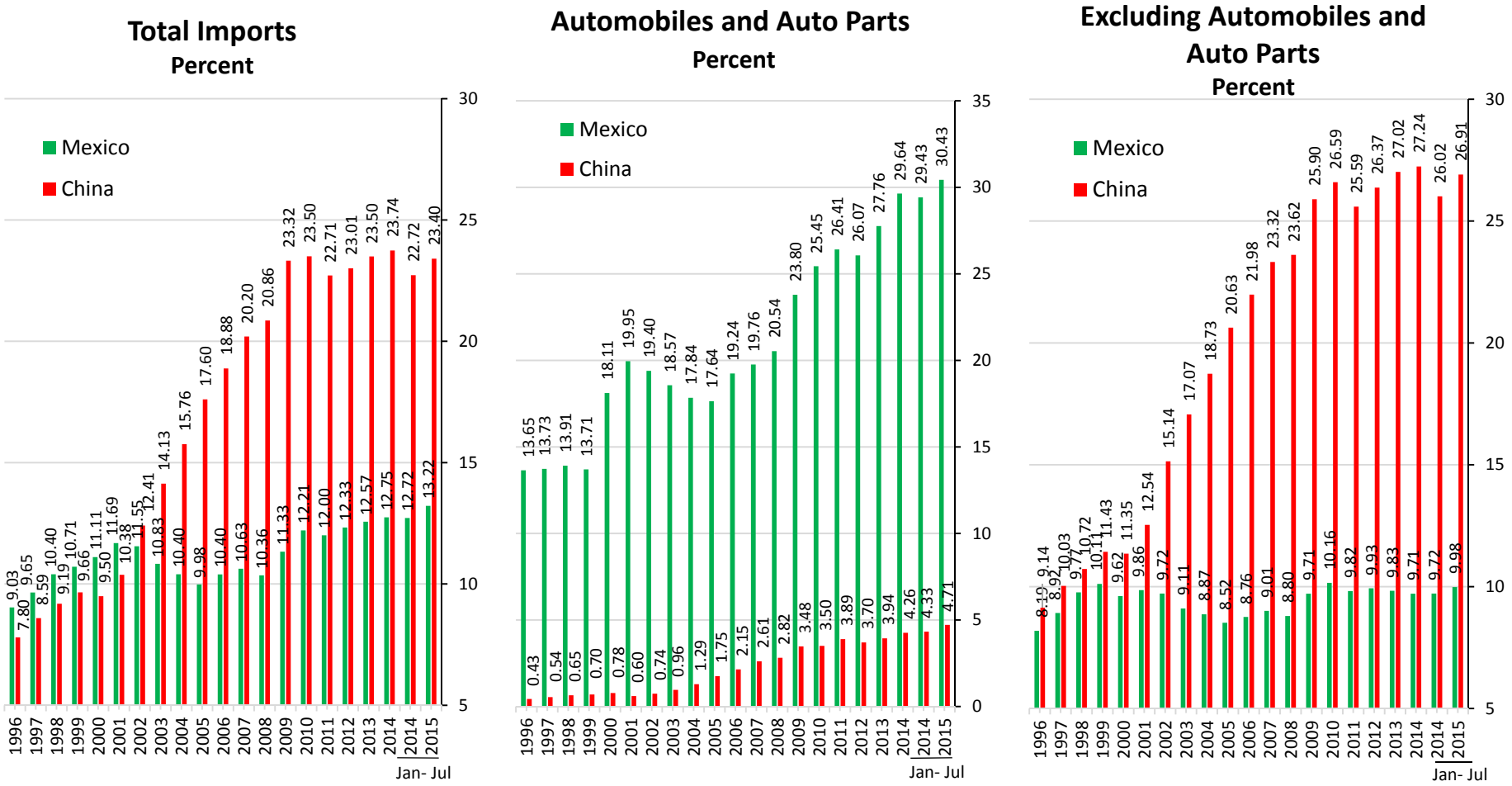
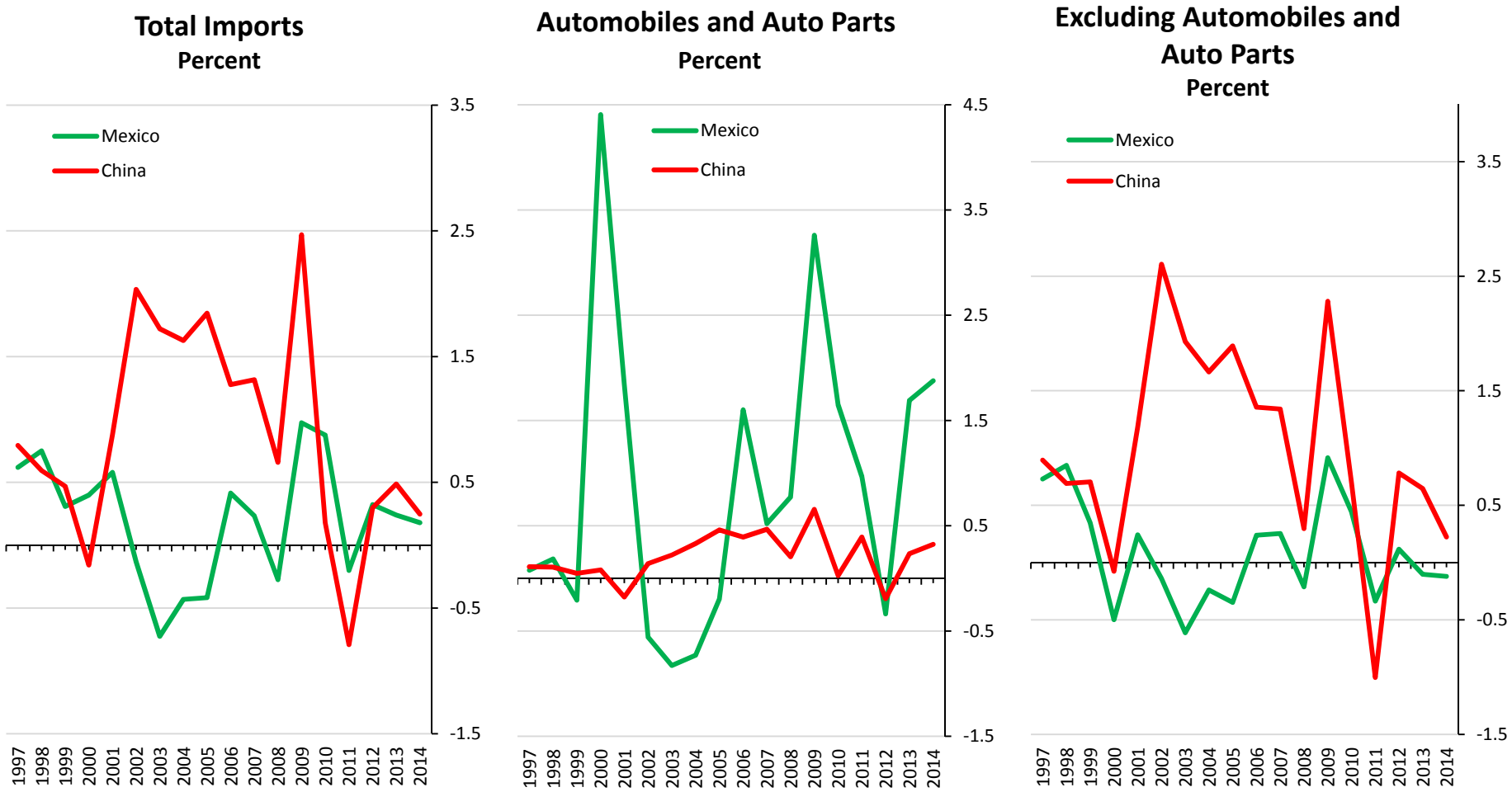
2. General Trends: Shares in U.S. Manufacturing Imports



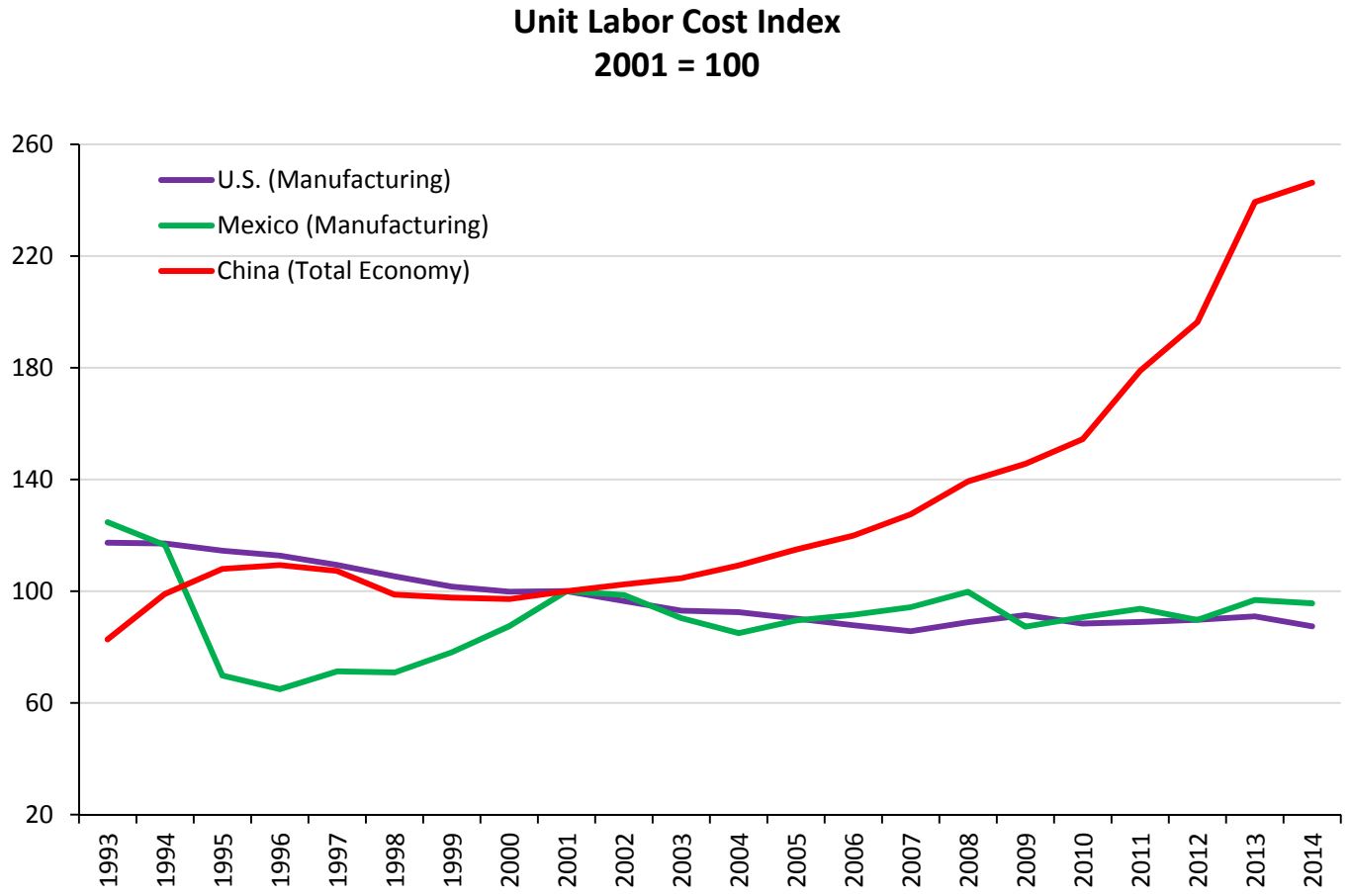
Source: Banco de Mexico´s calculations using U.S. Census Bureau (2000-2015) and United Nations´ COMTRADE (1996-1999) data.

2. General Trends: Changes in Shares in U.S. Manufacturing Imports



Source: Banco de México´s calculations using U.S. Census Bureau (2000-2014) and United Nations´ COMTRADE (1996-1999) data.

2. General Trends: Unit Labor Costs



Source: INEGI, Banco de México and Haver Analytics.

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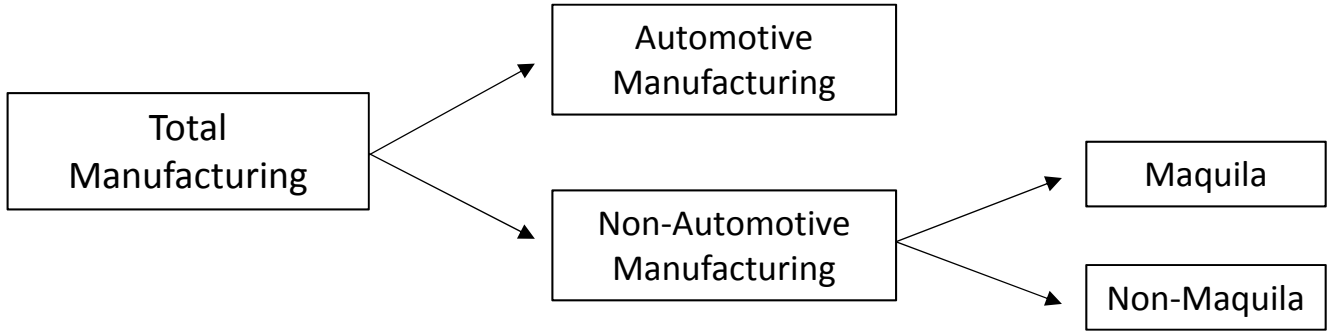
3. Measuring Upstreamness

- To measure the extent to which Mexico is inserted into GVCs, as well as the nature of this integration and the value added that could be generated by trade in manufacturing, we use the same measures of upstreamness as in Chor et al. (2014), Antràs et al. (2012) and Fally (2011). These measures provide an estimate of the average degree of upstreamness of Mexican imports and exports and of the average number of stages produced in Mexico, and are obtained in two steps:
  - Use I.O. data to construct measures of upstreamness at the industry-level.
  - Combining these industry-level measures with trade data.
- The results are compared with Chor and Manova's (2014) for China.
- Moreover, patterns over the following dimensions are explored:



3.1 First Step: Measuring Upstreamness at the Industry-Level

- According to the basic Input-Output identity, gross output in industry i (Y_i) can be decomposed into two types of uses:

$$Y_i = F_i + Z_i \quad (1)$$

where:

F_i: use of Y_i for consumption and investment (i.e., final use)

Z_i: use of Y_i as an input to other industries (intermediate use)

- In a economy with N industries, this can be written as:

$$Y_i = F_i + \sum_{j=1}^{N} d_{ij} Y_j \quad (2)$$

where:

d_{ij}: dollar amount of Y_i required to produce a dollar of Y_j.

3.1 First Step: Measuring Upstreamness at the Industry-Level

- Iteration of (2) yields

$$Y_i = F_i + \sum_{j=1}^{N} d_{ij}F_j + \sum_{j=1}^{N}\sum_{k=1}^{N} d_{ik}d_{kj}F_j + \cdots \qquad (3)$$

- Using (3), the "upstreamness" measure for industry i (U_i) is obtained as:

$$U_i = 1 \cdot \frac{F_i}{Y_i} + 2 \cdot \frac{\sum_{j=1}^{N} d_{ij}F_j}{Y_i} + 3 \cdot \frac{\sum_{j=1}^{N}\sum_{k=1}^{N} d_{ik}d_{kj}F_j}{Y_i} + \cdots \qquad (4)$$

- U_i is a weighted average number of stages away from final demand at which Y_i enters as an input in the production process.

3.2 Second Step: Combining Industry-Level measures with Trade Data

- Using U_i, we construct two separate measures that reflect the upstreamness of Mexican exports and imports as follows

$$U^X_{Mex,t} = \sum_{i=1}^{N} \frac{X_{Mex,it}}{X_{Mex,t}} U_i \qquad (4) \qquad \text{and} \qquad U^M_{Mex,t} = \sum_{i=1}^{N} \frac{M_{Mex,it}}{M_{Mex,t}} \qquad (5)$$

where:

$\frac{X_{Mex,it}}{X_{Mex,t}}$ and $\frac{M_{Mex,it}}{M_{Mex,t}}$: industry i's share in Mexican exports and imports, respectively, in year t;

$U^X_{Mex,t}$: weighted average degree of upstreamness for Mexican export in year t and

$U^M_{Mex,t}$: weighted average degree of upstreamness for Mexican import in year t.

- These two measures can be combined to obtain another measure that reflects the extent to which Mexico is inserted, or contributes, in GVCs as follows:

$$U^X_{Mex,t} - U^M_{Mex,t} = \sum_{i=1}^{N} \left(\frac{X_{Mex,it}}{X_{Mex,t}} - \frac{M_{Mex,it}}{M_{Mex,t}} \right) U_i \qquad (6)$$

- Higher absolute values of $U^X_{Mex,t} - U^M_{Mex,t}$ indicate that a greater number of stages are produced in Mexico and therefore, that this country contributes to a greater extent to GVCs.

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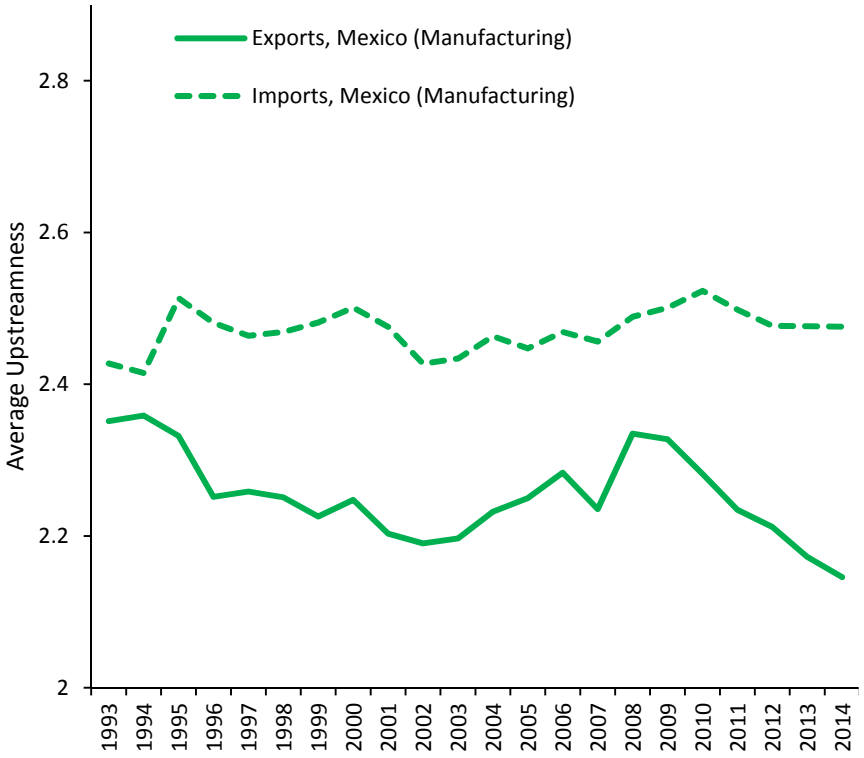
4.1 Performance of Total Manufacturing Trade

Mexico´s Level of Export and Import "Upstreamness" in Manufacturing ($U^X_{Mex,t}$ and $U^M_{Mex,t}$)

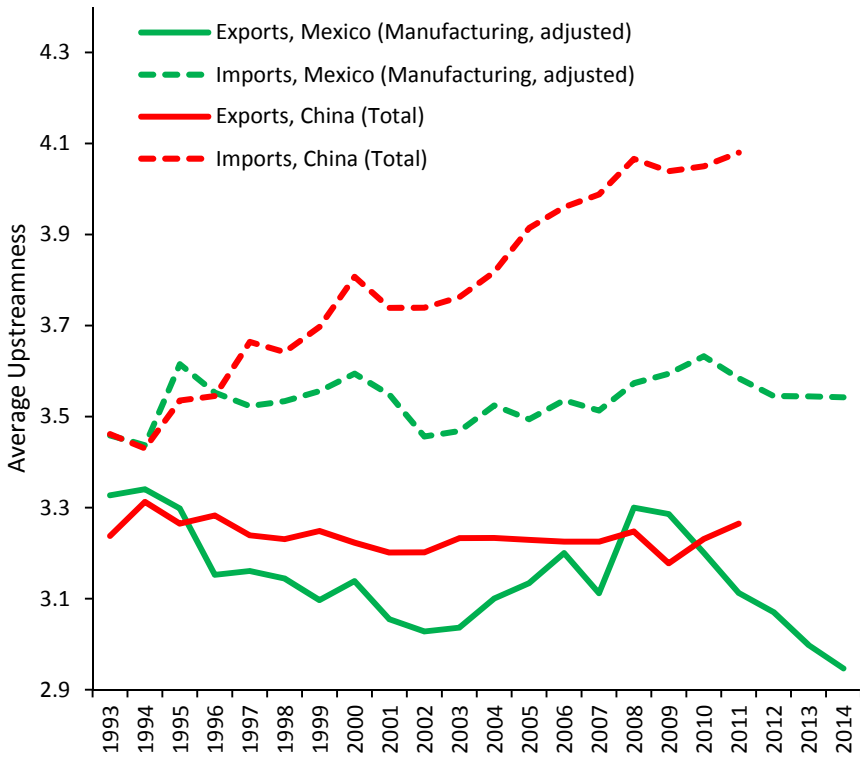


Difference in Mexico´s level of Export and Import "Upstreamness" in Manufacturing ($U^X_{Mex,t}$ - $U^M_{Mex,t}$)

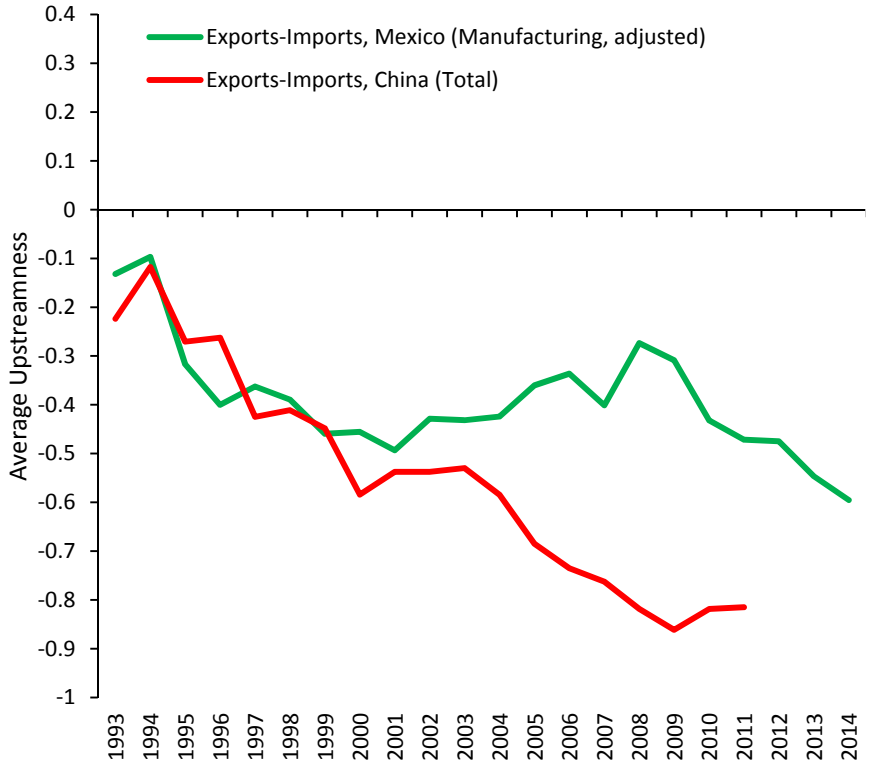
Source: Own calculations with Banco de Mexico´s data.

4.1 Performance of Total Manufacturing Trade

Mexico and China´s Level of Export and Import "Upstreamness"



Difference in the Level of Export and Import "Upstreamness" in Mexico and China



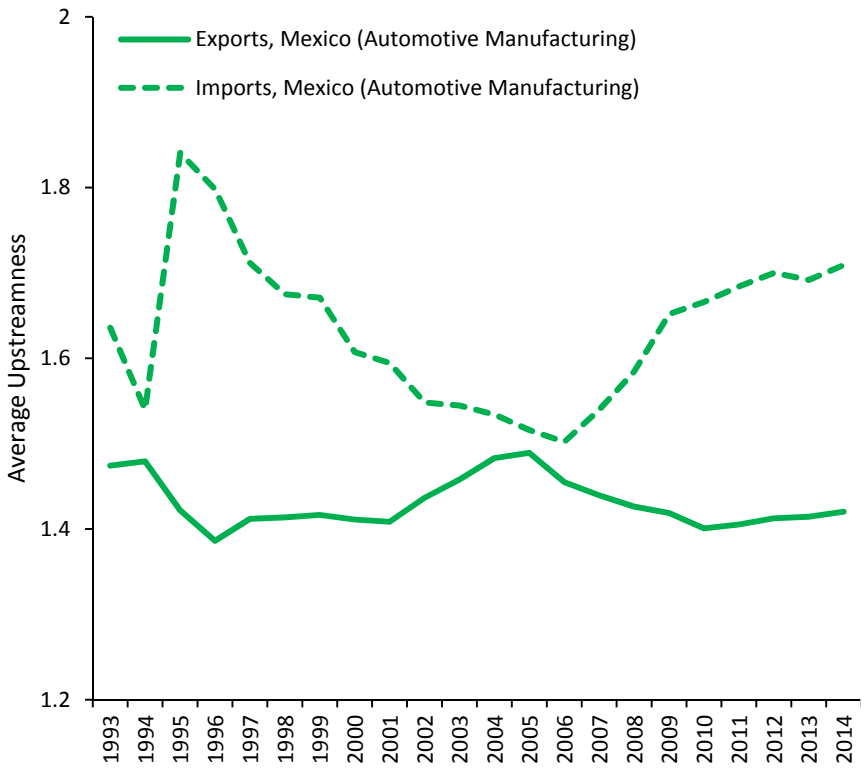
Source: Own calculations with Banco de Mexico´s data and Chor et al. (2014)

4.1 Performance of Total Manufacturing Trade

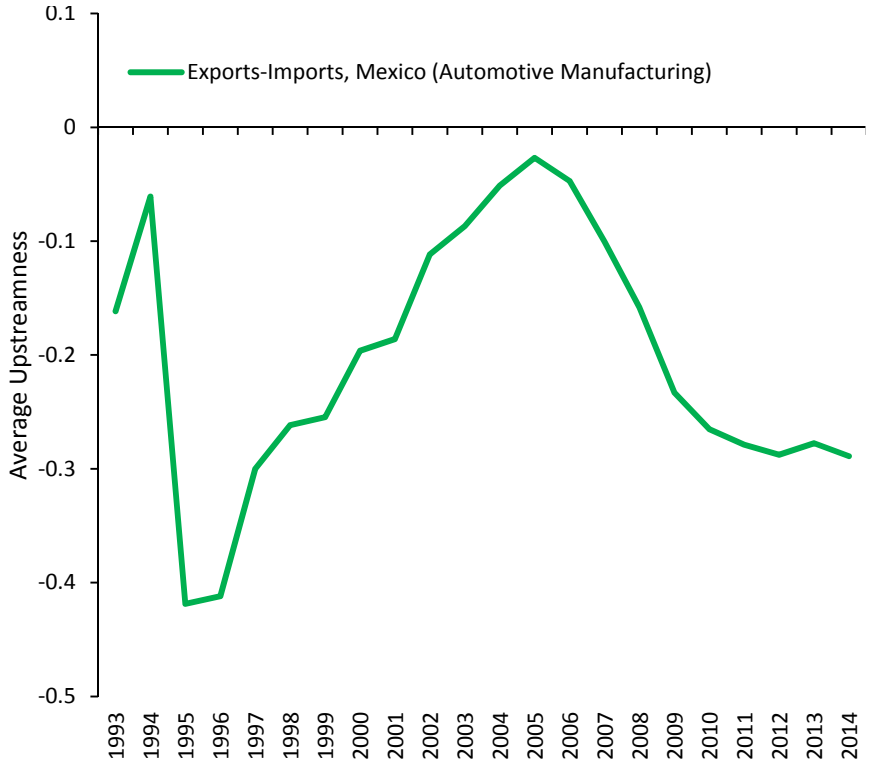
- Interestingly, while most of the time-variation in the Mexican measure can be explained by changes in the upstreamness of exports, in the Chinese case, this variation is mostly due to changes in the upstreamness of imports. This fact is consistent with the idea that China was able to substitute imported inputs with domestic products.
- At the same time, this result can be linked to the old Hirschman's hypothesis of backward and forward linkages (1958). Indeed, Andreosso and Yue (2004) provide evidence that the magnitude of backward and forward linkages has substantially increased in China during the 1990s.
- Moreover, the idea that fostering industrial linkages enabled to China to substitute imported inputs with domestic production and, through this channel, **increase its participation into industrial GVCs and boost economic growth** is also consistent with the evidence provided by Holz (2011). He shows that economic growth was stronger in Chinese provinces in which the magnitude of linkages increased to a larger extent.

4.2 Performance of Automotive Industry Trade

Mexico´s Level of Export and Import "Upstreamness" Automotive Manufacturing ($U^X_{Mex,t}$ and $U^M_{Mex,t}$)



Difference in Mexico´s Level of Export and Import "Upstreamness" in Automotive Manufacturing ($U^X_{Mex,t}$ - $U^M_{Mex,t}$)



Source: Own calculations with Banco de Mexico´s data.

4.2 Performance of Automotive Industry Trade

Export Share by Industry: Automotive Manufacturing

Industry	1994	1996	2001	2002	2005	2008	2010	2014
Automobiles and trucks manufacturing	48.87%	57.32%	54.75%	52.21%	46.74%	56.66%	59.26%	57.09%
Motor vehicle bodies and trailers manufacturing	7.47%	10.06%	10.80%	9.97%	10.23%	1.59%	1.57%	2.02%
Motor vehicle parts manufacturing	43.66%	32.62%	34.45%	37.82%	43.03%	41.75%	39.17%	40.89%
Total	100%	100%	100%	100%	100%	100%	100%	100%

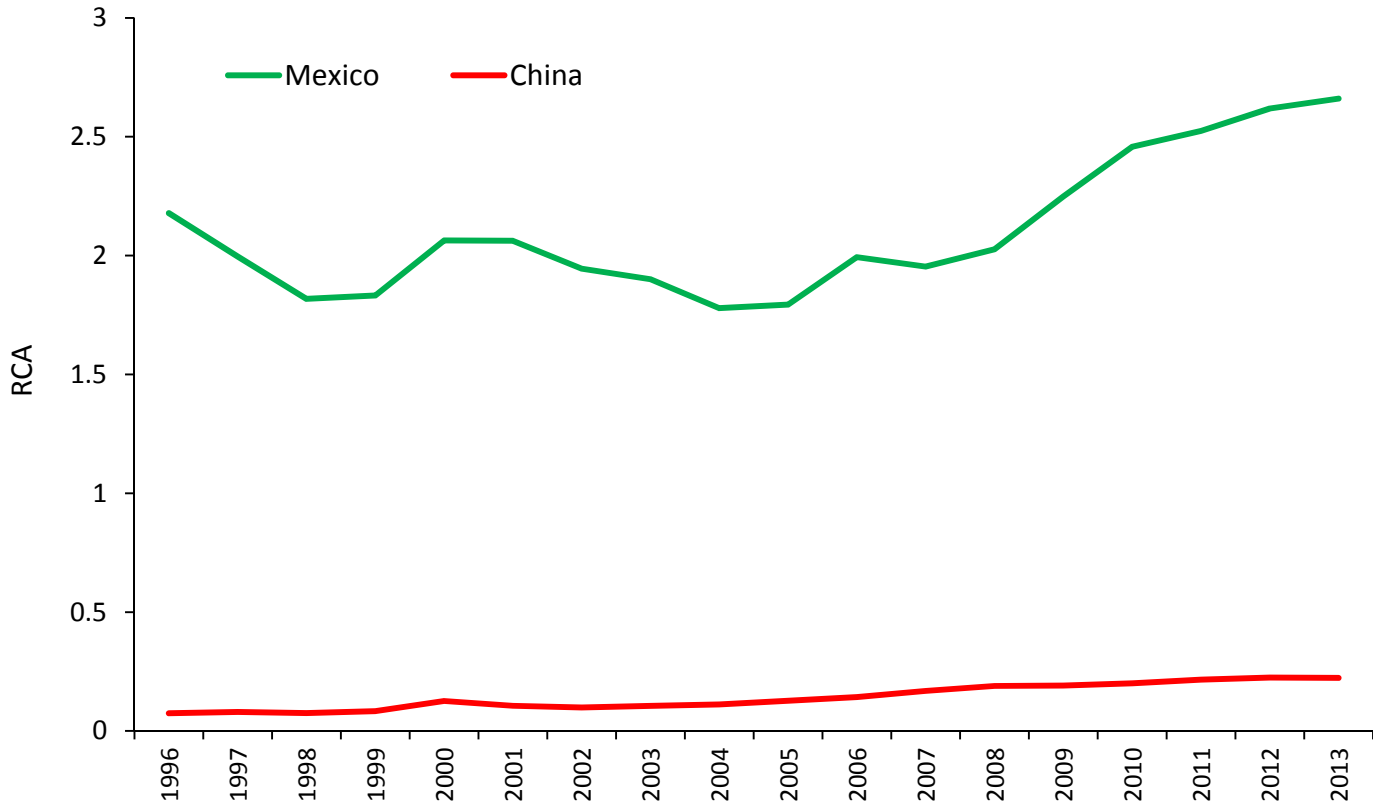
Import Share by Industry: Automotive Manufacturing

Industry	1994	1996	2001	2002	2005	2008	2010	2014
Automobiles and trucks manufacturing	43.02%	16.96%	37.75%	42.59%	45.96%	39.78%	31.66%	27.11%
Motor vehicle bodies and trailers manufacturing	6.61%	5.93%	5.90%	5.58%	5.40%	3.43%	2.90%	3.24%
Motor vehicle parts manufacturing	50.37%	77.11%	56.36%	51.83%	48.64%	56.79%	65.44%	69.65%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Source: Own calculations with Banco de Mexico´s data.

4.2 Performance of Automotive Industry Trade

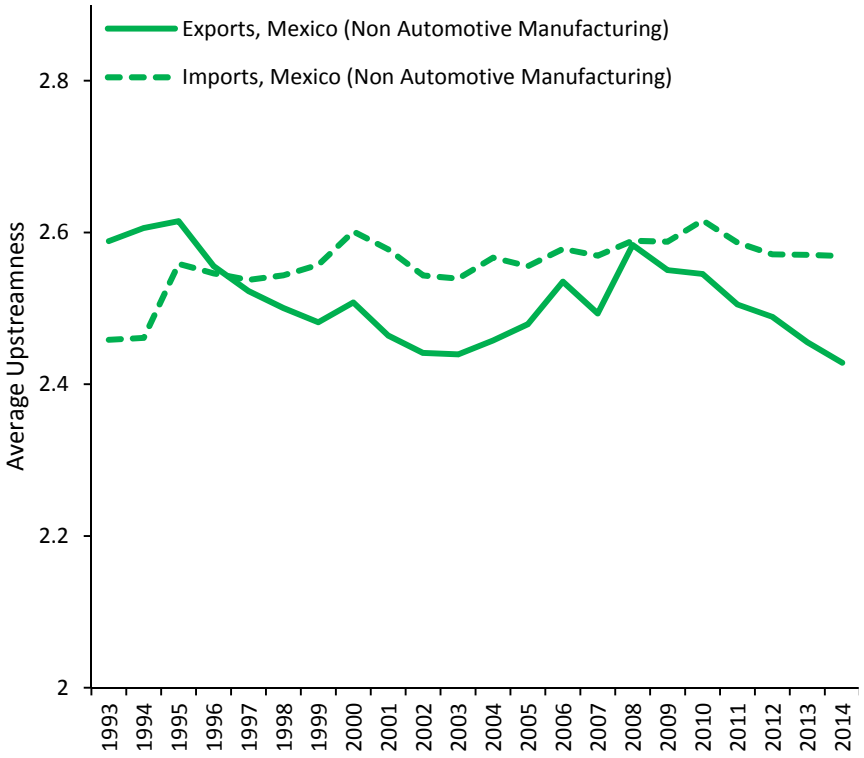
Revealed Comparative Advantage (RCA) in the World Market: Automotive Manufacturing



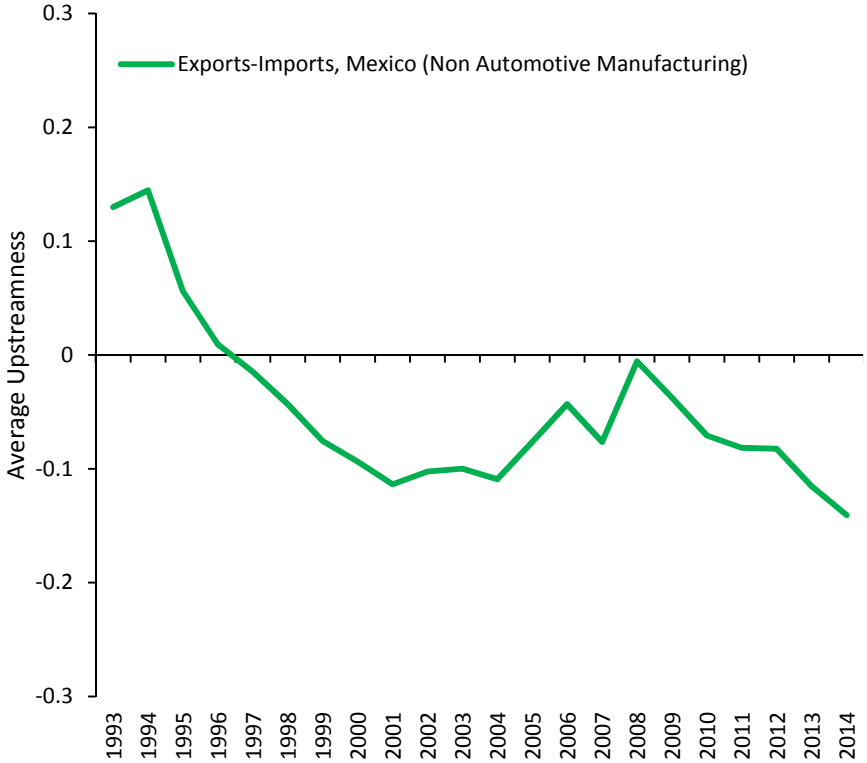
Source: Banco de Mexico´s calculations with United Nations´ COMTRADE data.

4.3 Performance of Non-Automotive Manufacturing Trade

Mexico´s Level of Export and Import "Upstreamness" in Non-Automotive Manufacturing ($U^X_{Mex,t}$ and $U^M_{Mex,t}$)



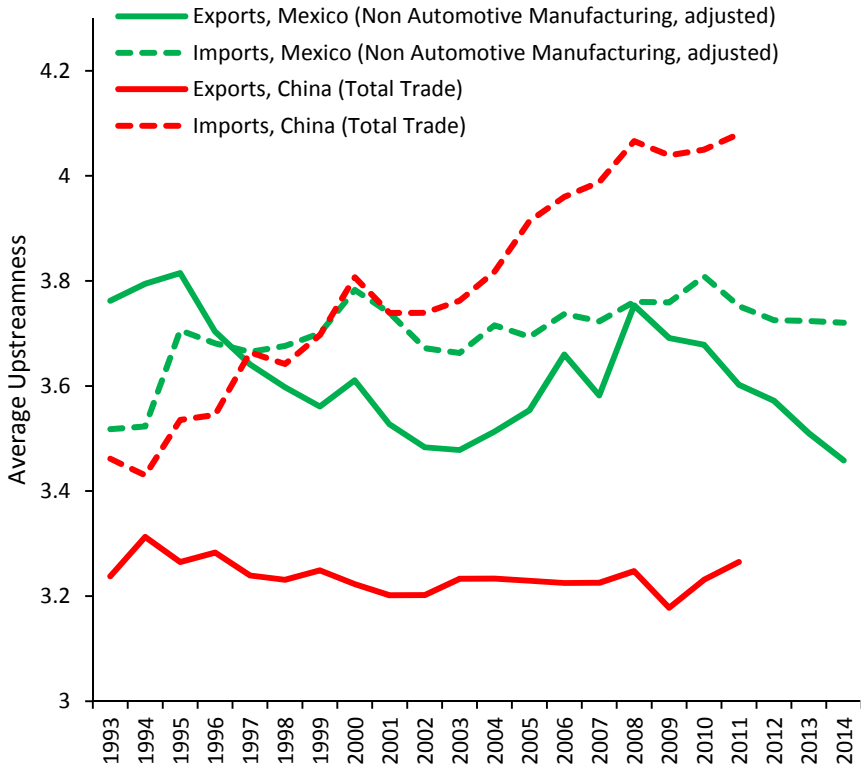
Difference in Mexico´s Level of Export and Import "Upstreamness" in Non-Automotive Manufacturing ($U^X_{Mex,t}$ - $U^M_{Mex,t}$)



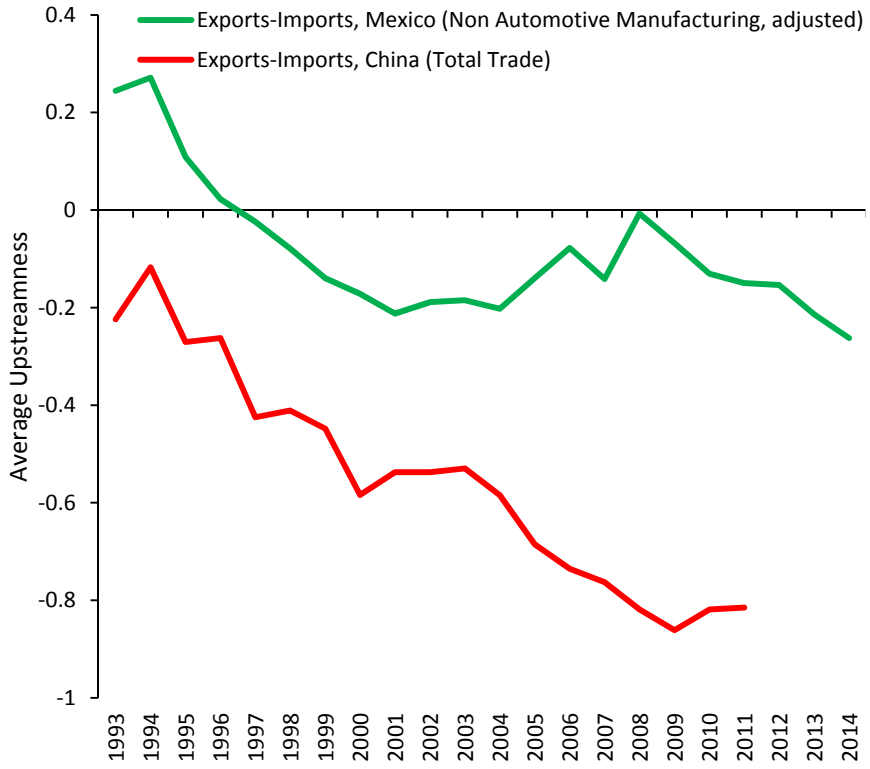
Source: Own calculations with Banco de Mexico´s data.

4.3 Performance of Non-Automotive Manufacturing Trade

Mexico´s and China´s Level of Export and Import "Upstreamness" in Non-Automotive Manufacturing



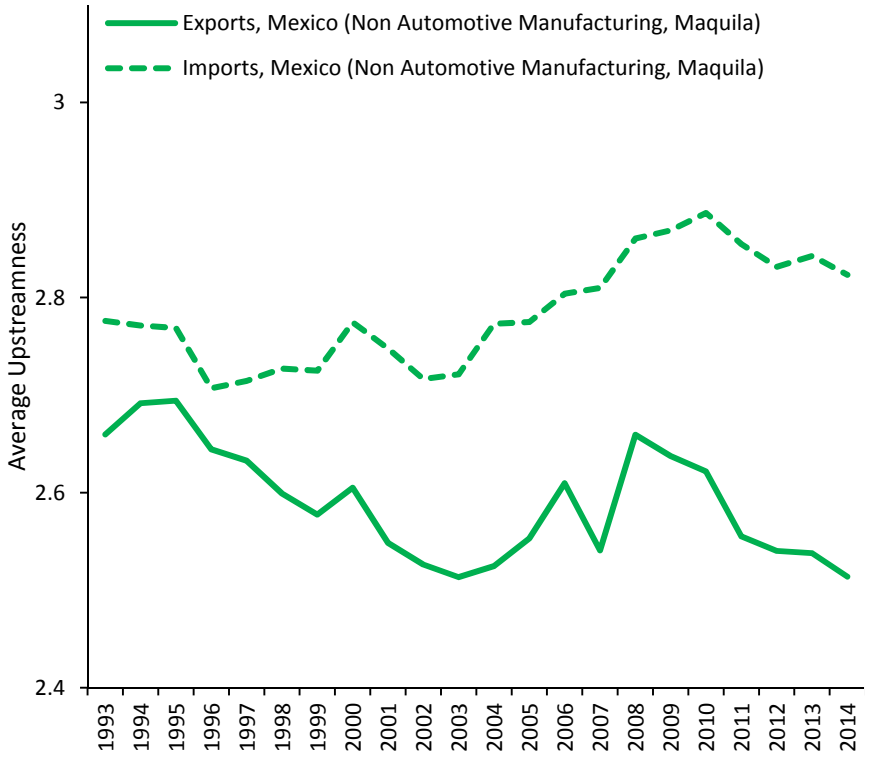
Difference in the Level of Export and Import "Upstreamness" in Mexico and China in Non-Automotive Manufacturing



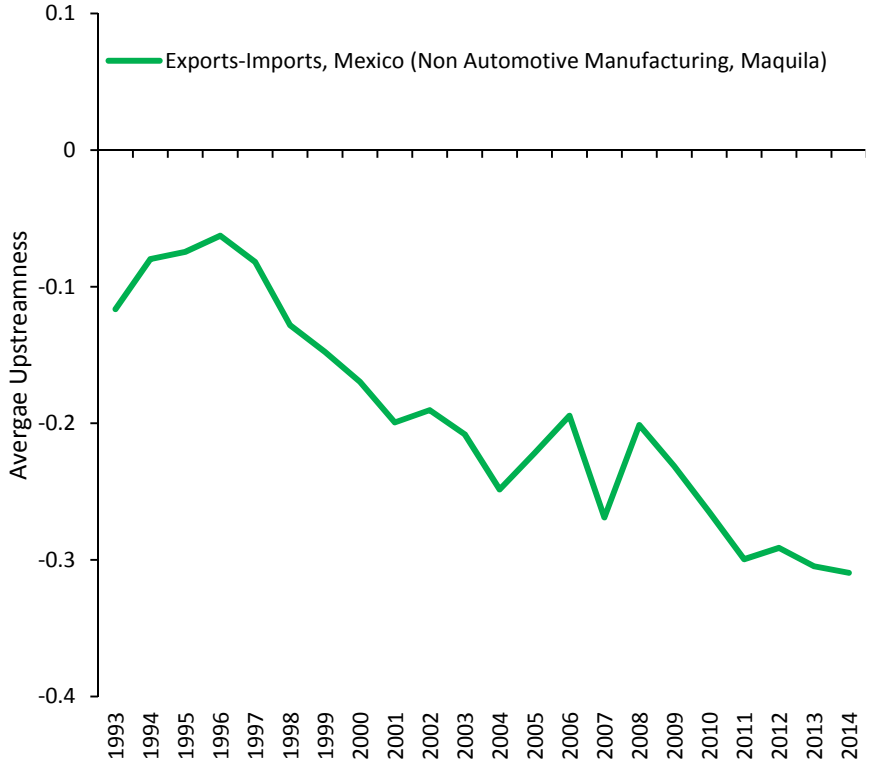
Source: Own calculations with Banco de Mexico´s data and Chor et al. (2014).

4.4 Performance of Non-Automotive Maquila Trade

Mexico´s Level of Export and Import "Upstreamness" in Non Automotive Manufacturing (Maquila) ($U^X_{Mex,t}$ and $U^M_{Mex,t}$)



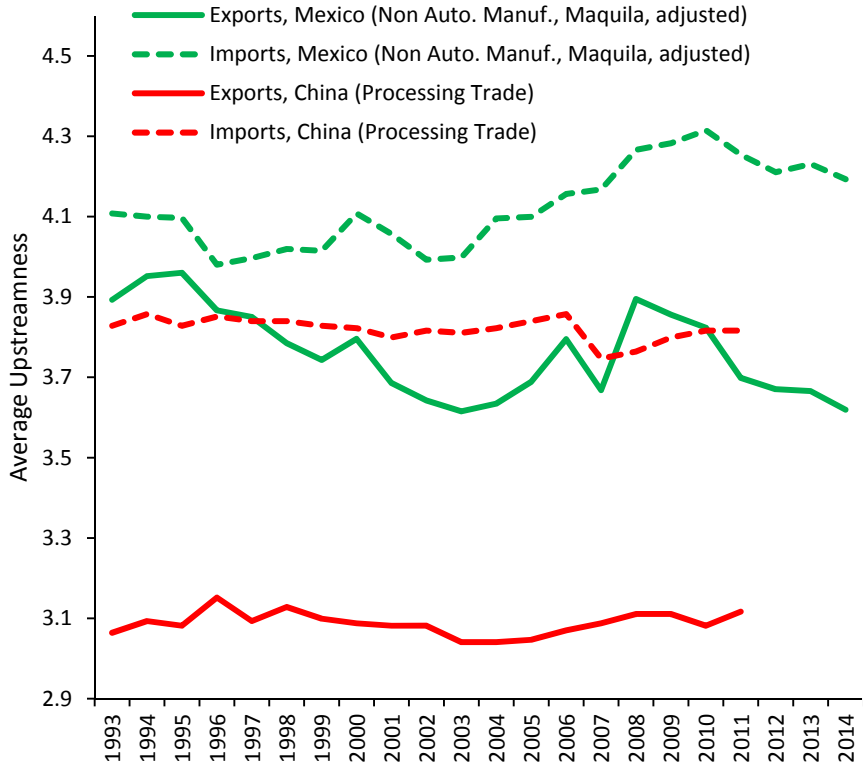
Difference in Mexico´s Level of Export and Import "Upstreamness" in Non Automotive Manufacturing (Maquila) ($U^X_{Mex,t}$ - $U^M_{Mex,t}$)



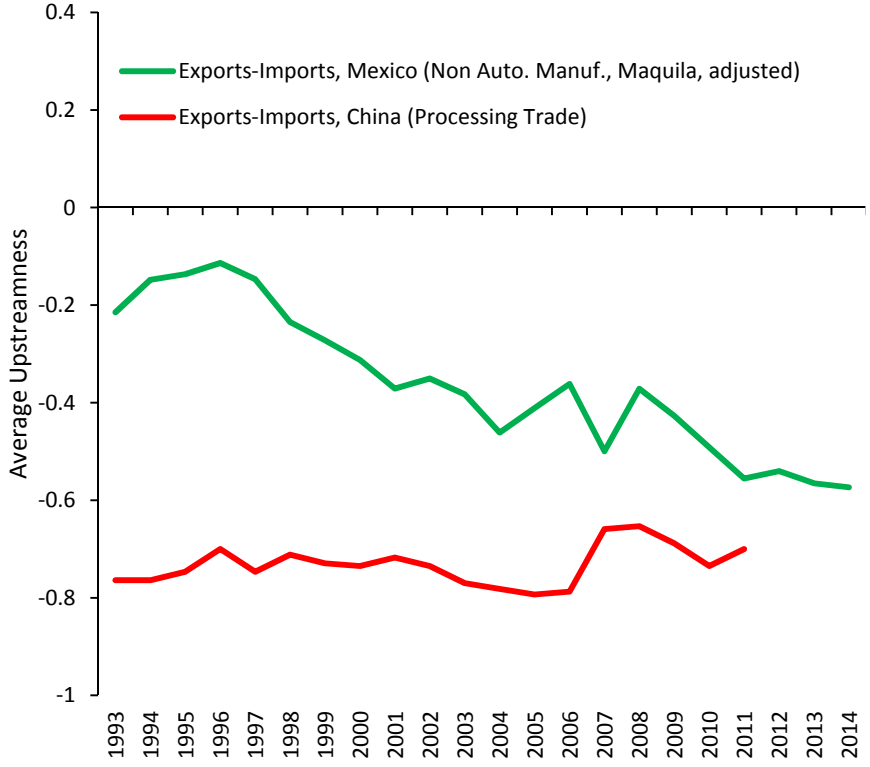
Source: Own calculations with Banco de Mexico´s data.

4.4 Performance of Non-Automotive Maquila Trade

Mexico and China´s Level of Export and Import "Upstreamness" in Non Automotive Manufacturing (Maquila)



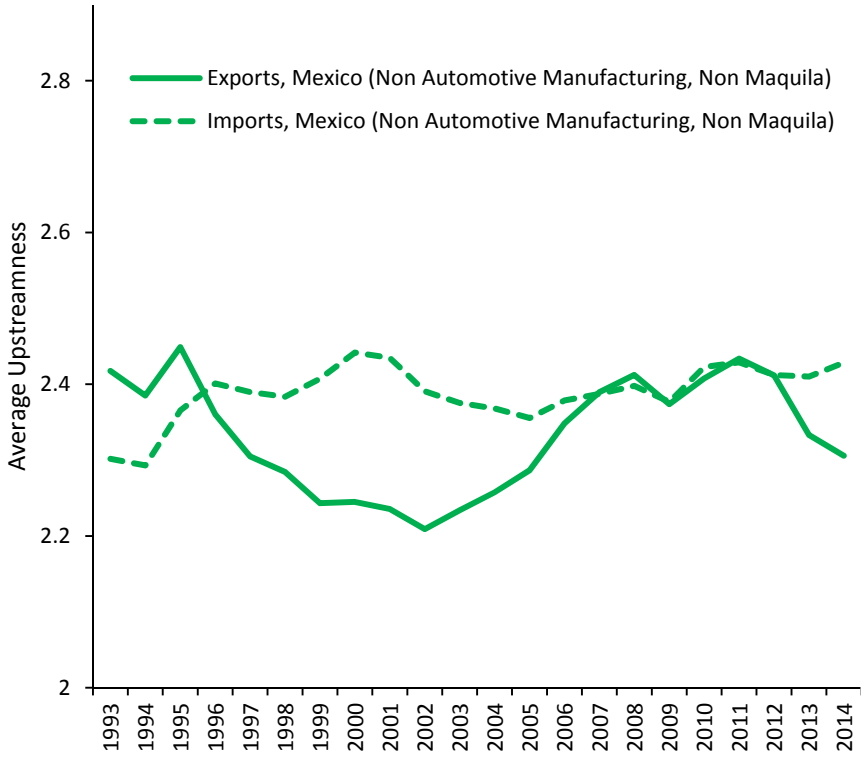
Difference in the Level of Export and Import "Upstreamness" in Mexico and China in Non Automotive Manufacturing (Maquila)



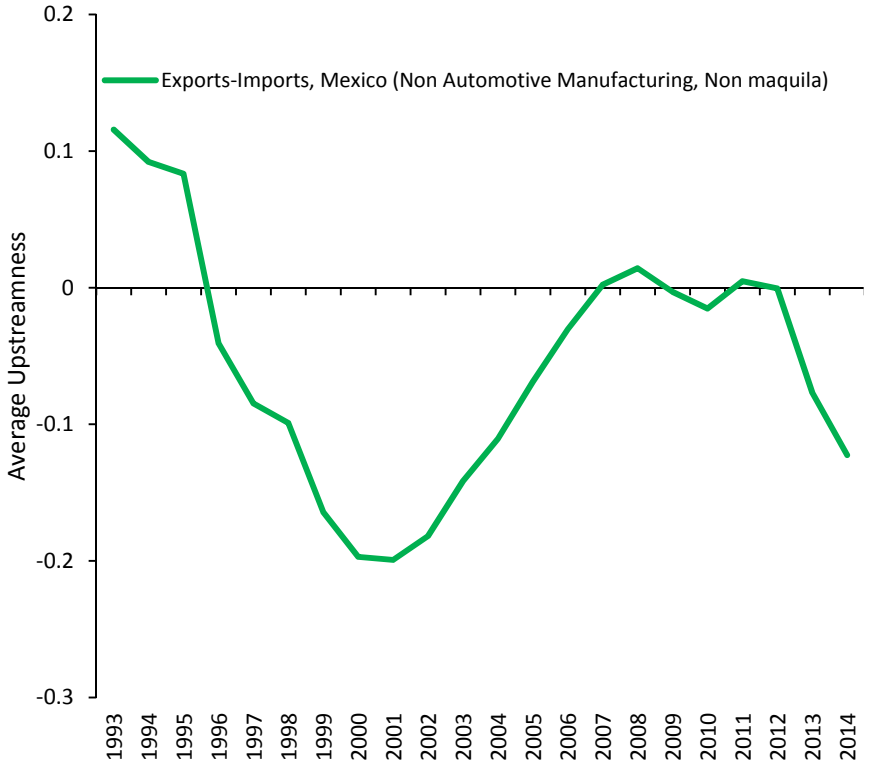
Source: Own calculations with Banco de Mexico´s data and Chor et al. (2014).

4.5 Performance of Non-Automotive Non-Maquila Trade

Mexico´s Level of Export and Import "Upstreamness" in Non Automotive Manufacturing (Non Maquila) ($U^X_{Mex,t}$ and $U^M_{Mex,t}$)



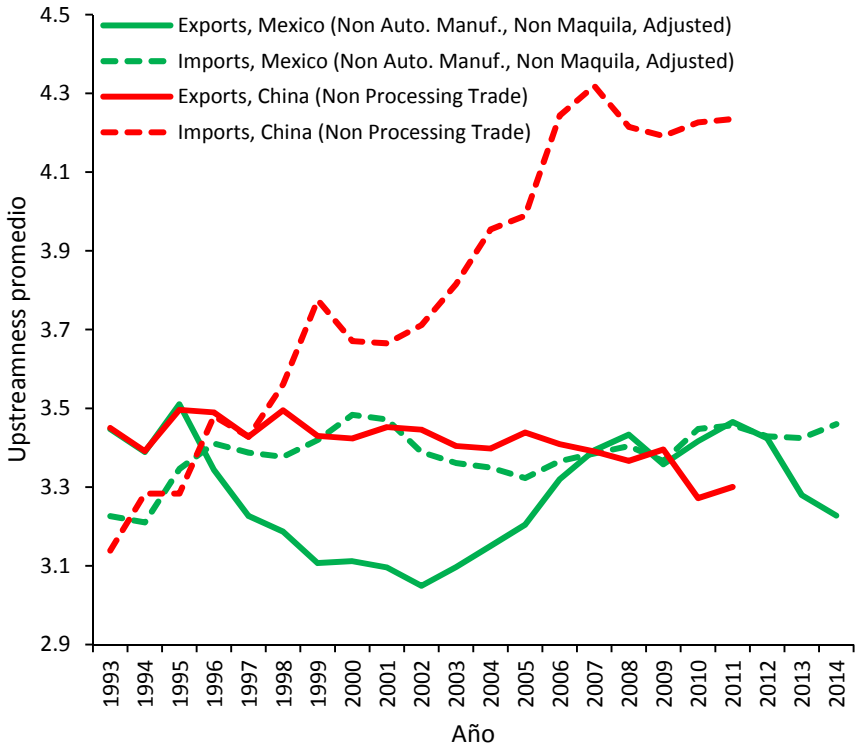
Difference in Mexico´s Level of Export and Import "Upstreamness" in Non Automotive Manufacturing (Non Maquila) ($U^X_{Mex,t}$ - $U^M_{Mex,t}$)



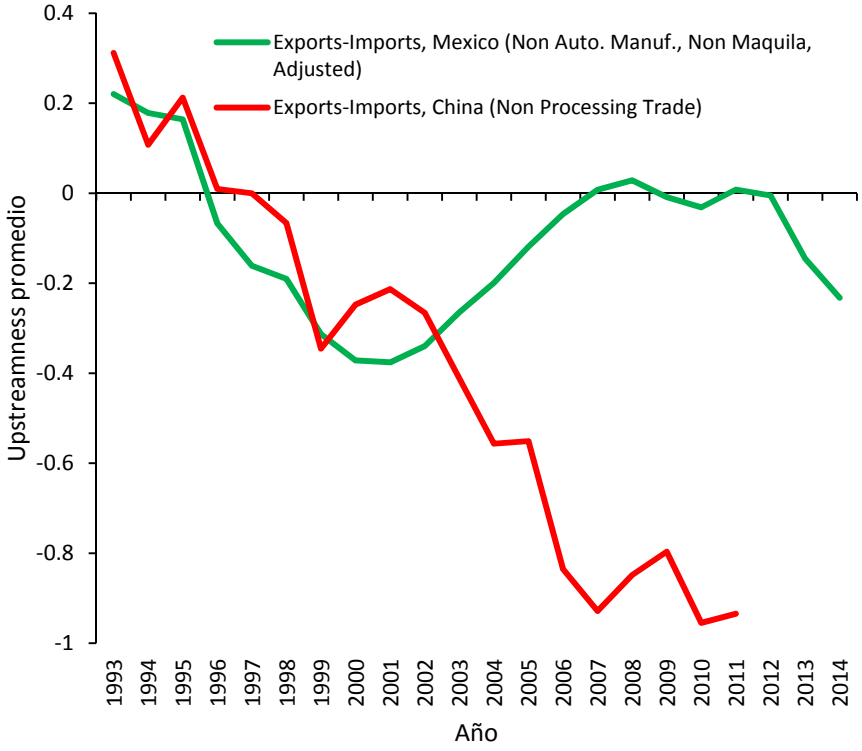
Source: Own calculations with Banco de Mexico´s data.

4.5 Performance of Non-Automotive Non-Maquila Trade

Mexico and China´s Level of Export and Import "Upstreamness" in Non Automotive Manufacturing (Non Maquila)



Difference in the Level of Export and Import "Upstreamness" in Mexico and China in Non Automotive Manufacturing (Non Maquila)



Source: Own calculations with Banco de Mexico´s data and Chor et al. (2014).

4.6 Non Automotive Trade Disaggregation

Export Share by Industry: Non Automotive Manufacturing

Industry	1994	1996	2001	2002	2005	2008	2010	2014
Textile Inputs Manufacturing, and Textiles Finishing	1.15%	1.35%	0.94%	0.88%	0.70%	0.57%	0.55%	0.57%
Textile Products Manufacturing, except Apparel	1.08%	1.05%	0.84%	0.98%	0.69%	0.55%	0.47%	0.50%
Apparel Manufacturing, Leather and Fur Tanning and Finishing, and Manufacturing of Leather, Fur and Allied Materials Products	5.70%	7.91%	8.93%	8.55%	6.65%	3.04%	2.68%	2.42%
Manufacturing of Products derived from Petroleum and Coal	1.11%	0.88%	0.82%	0.91%	2.20%	3.14%	2.34%	2.17%
Chemical Industry	7.57%	7.18%	5.38%	5.55%	5.99%	6.38%	6.20%	6.05%
Basic Metal Industry	5.17%	6.30%	2.50%	2.85%	4.63%	6.88%	7.33%	5.68%
Metal Products Manufacturing	4.07%	4.02%	4.47%	4.85%	4.68%	4.07%	3.57%	4.13%
Machinery and Equipment Manufacturing	10.75%	8.87%	8.81%	9.08%	10.77%	10.26%	11.66%	13.15%
Manufacturing of Computer, Communications, and Measuring Equipment, and Other Electronic Equipment, Components and Appliances Manufacturing	31.02%	30.57%	38.26%	36.35%	34.52%	34.81%	35.95%	31.36%
Electric Appliances, Accessories and Electric Power Generation Equipment Manufacturing	14.68%	14.07%	13.04%	13.11%	11.43%	11.29%	10.25%	10.90%
Transportation Equipment Manufacturing	1.00%	0.85%	1.33%	1.33%	1.15%	2.83%	2.45%	5.12%
Others	16.70%	16.94%	14.67%	15.55%	16.58%	16.18%	16.55%	17.94%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Source: Own calculations with Banco de Mexico´s data.

4.6 Non Automotive Trade Disaggregation

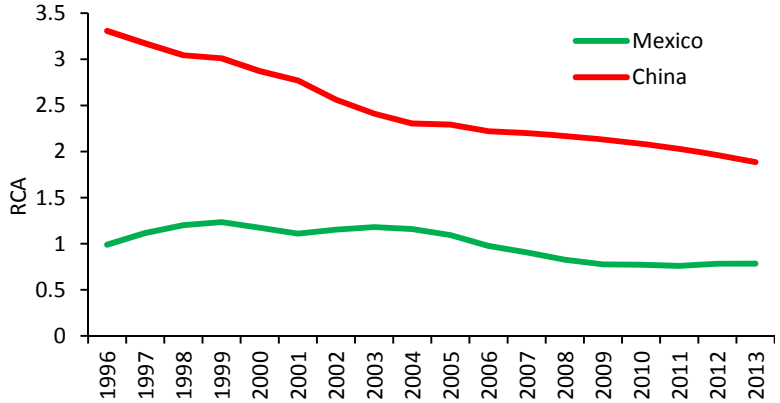
Import Share by Industry: Non Automotive Manufacturing

Industry	1994	1996	2001	2002	2005	2008	2010	2014
Textile Inputs Manufacturing, and Textiles Finishing	2.70%	2.36%	3.15%	3.32%	2.72%	1.75%	1.72%	1.59%
Textile Products Manufacturing, except Apparel	0.58%	0.48%	0.48%	0.51%	0.41%	0.30%	0.31%	0.35%
Apparel Manufacturing, Leather and Fur Tanning and Finishing, and Manufacturing of Leather, Fur and Allied Materials Products	4.02%	4.29%	3.54%	3.53%	2.55%	1.61%	1.50%	1.91%
Manufacturing of Products derived from Petroleum and Coal	1.70%	1.70%	2.34%	1.44%	4.10%	7.08%	6.33%	6.33%
Chemical Industry	10.54%	10.79%	9.74%	10.72%	11.82%	15.55%	14.60%	15.15%
Basic Metal Industry	5.54%	5.65%	4.80%	4.71%	5.70%	6.22%	5.43%	5.38%
Metal Products Manufacturing	5.78%	6.34%	5.64%	5.81%	5.50%	4.83%	4.89%	5.25%
Machinery and Equipment Manufacturing	14.10%	15.56%	14.89%	14.58%	14.02%	13.32%	11.78%	13.10%
Manufacturing of Computer, Communications, and Measuring Equipment, and Other Electronic Equipment, Components and Appliances Manufacturing	20.25%	22.48%	27.79%	26.05%	25.56%	23.04%	26.90%	23.84%
Electric Appliances, Accessories and Electric Power Generation Equipment Manufacturing	8.71%	8.90%	7.90%	8.23%	7.39%	7.12%	7.32%	7.58%
Transportation Equipment Manufacturing	1.59%	0.41%	0.72%	0.76%	0.74%	1.45%	1.10%	1.60%
Others	24.50%	21.04%	19.00%	20.34%	19.48%	17.72%	18.14%	17.92%
Total	100%	100%	100%	100%	100%	100%	100%	100%

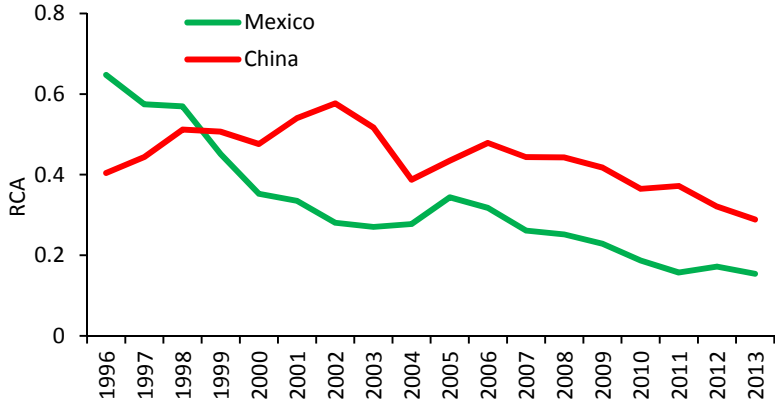
Source: Own calculations with Banco de Mexico´s data.

4.7 Relative Comparative Advantage (RCA) in Selected Industries

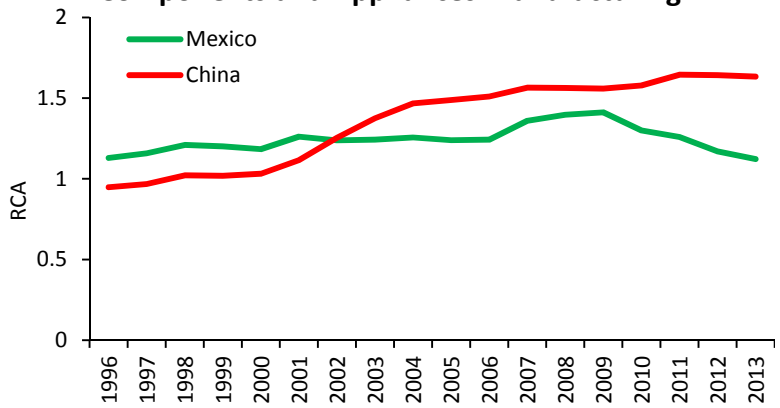
Apparel Manufacturing, Leather and Fur Tanning and Finishing, and Manufacturing of Leather, Fur and Allied Materials Products



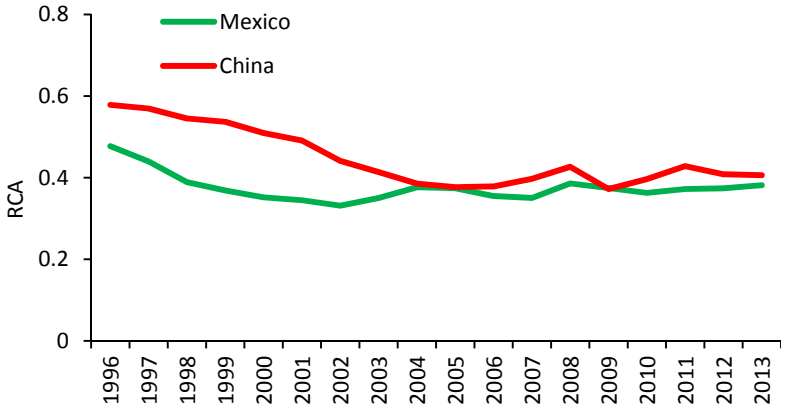
Manufacturing of Products derived from Petroleum and Coal



Manufacturing of Computer, Communications, and Measuring Equipment, and Other Electronic Equipment, Components and Appliances Manufacturing



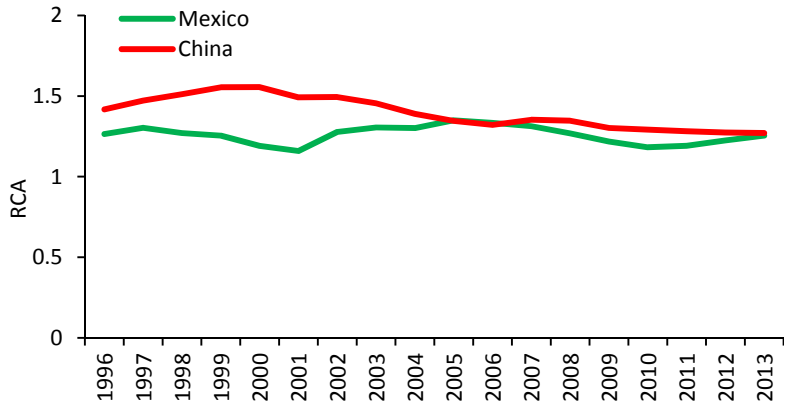
Chemical Industry



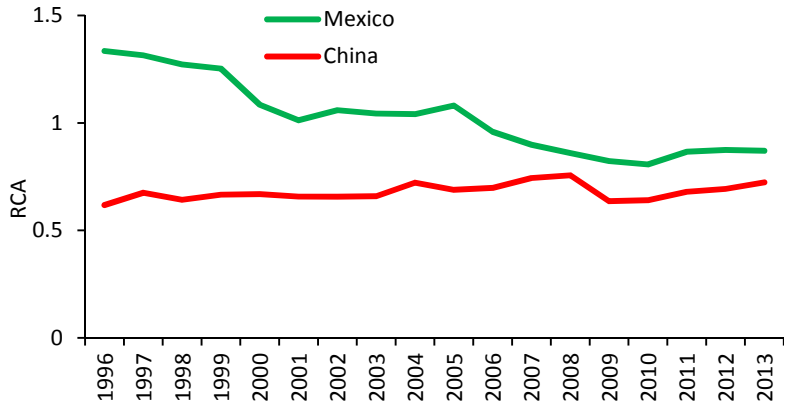
Source: Own calculations with United Nations´ COMTRADE data.

4.7 Relative Comparative Advantage (RCA) in Selected Industries

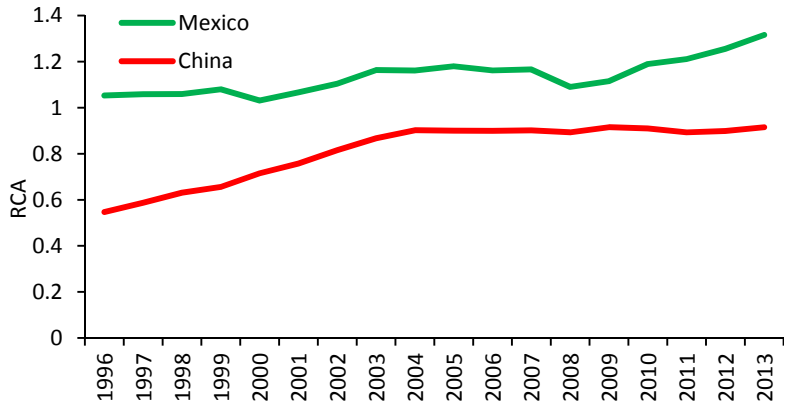
Electric Appliances, Accessories and Electric Power Generation Equipment Manufacturing



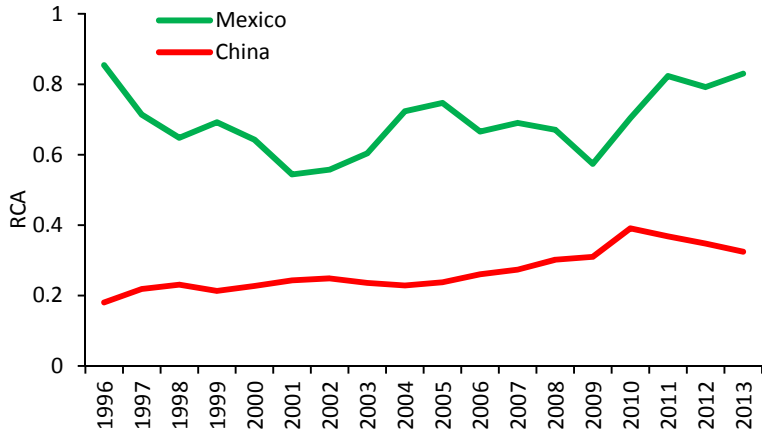
Basic Metal Industry



Machinery and Equipment Manufacturing



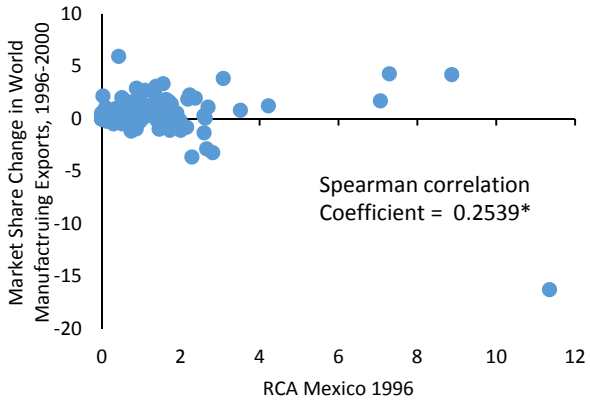
Transportation Equipment Manufacturing (Non-Automotive



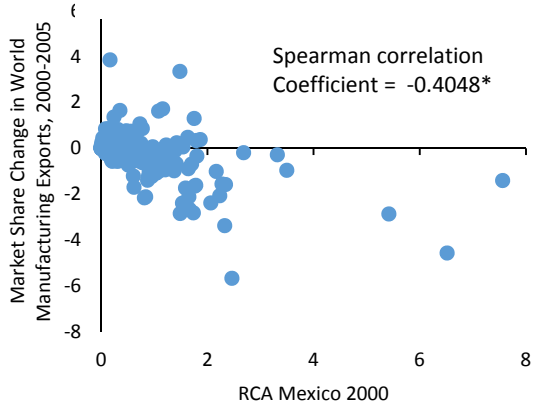
Source: Own calculations with United Nations´ COMTRADE data.

4.8 Revealed Comparative Advantage (RCA) and Market Shares

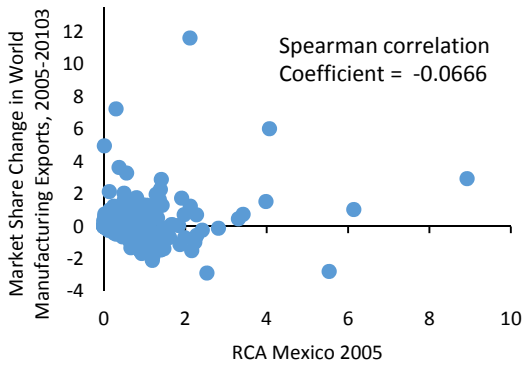
In World Manufacturing Exports 1996-2000



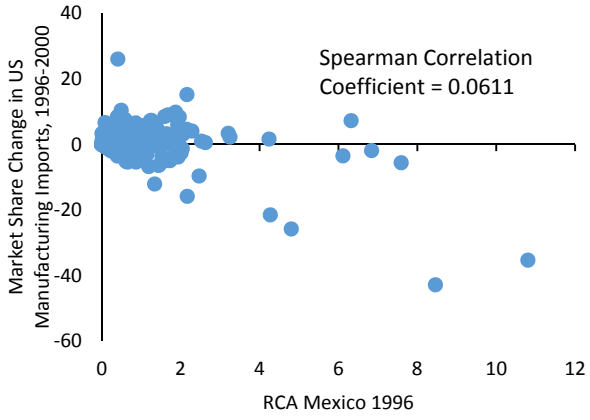
In World Manufacturing Exports 2000-2005



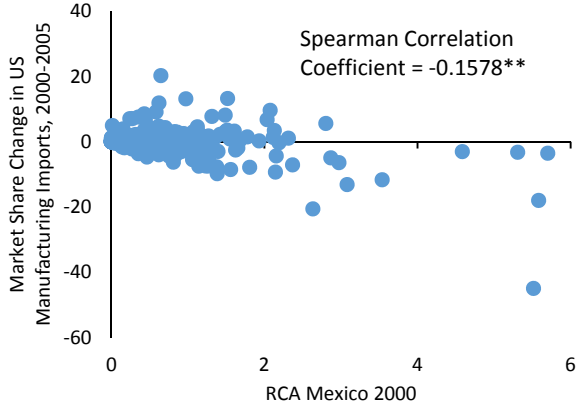
In World Manufacturing Exports 2005-2013



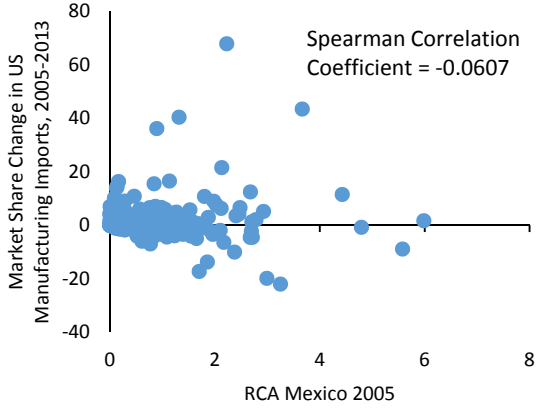
In U.S. Manufacturing Imports 1996-2000



In U.S. Manufacturing Imports 2000-2005



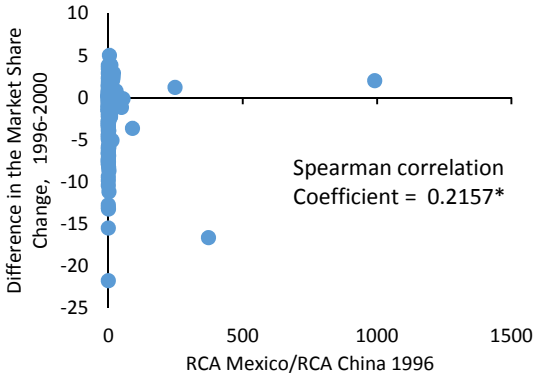
In U.S. Manufacturing Imports 2005-2013



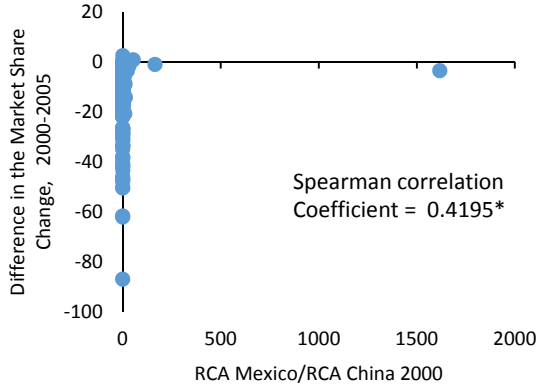
Notes: * significant at the 1% level, ** significant at the 5% level; * significant at the 10% level.**
Source: Own calculations with United Nations´ COMTRADE data.

4.8 Revealed Comparative Advantage (RCA) and Market Shares

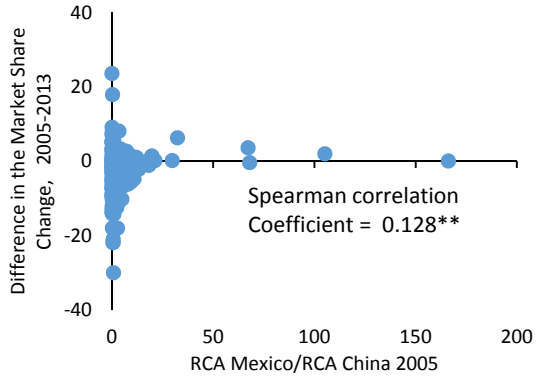
In World Manufacturing Exports 1996-2000



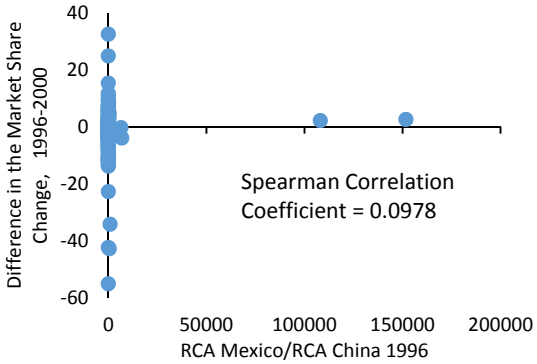
In World Manufacturing Exports 2000-2005



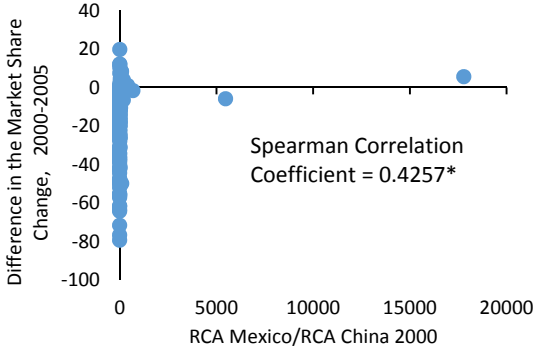
In World Manufacturing Exports 2005-2013



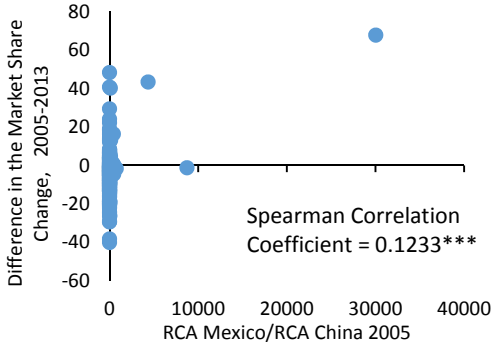
In U.S. Manufacturing Imports 1996-2000



In U.S. Manufacturing Imports 2000-2005



In U.S. Manufacturing Imports 2005-2013

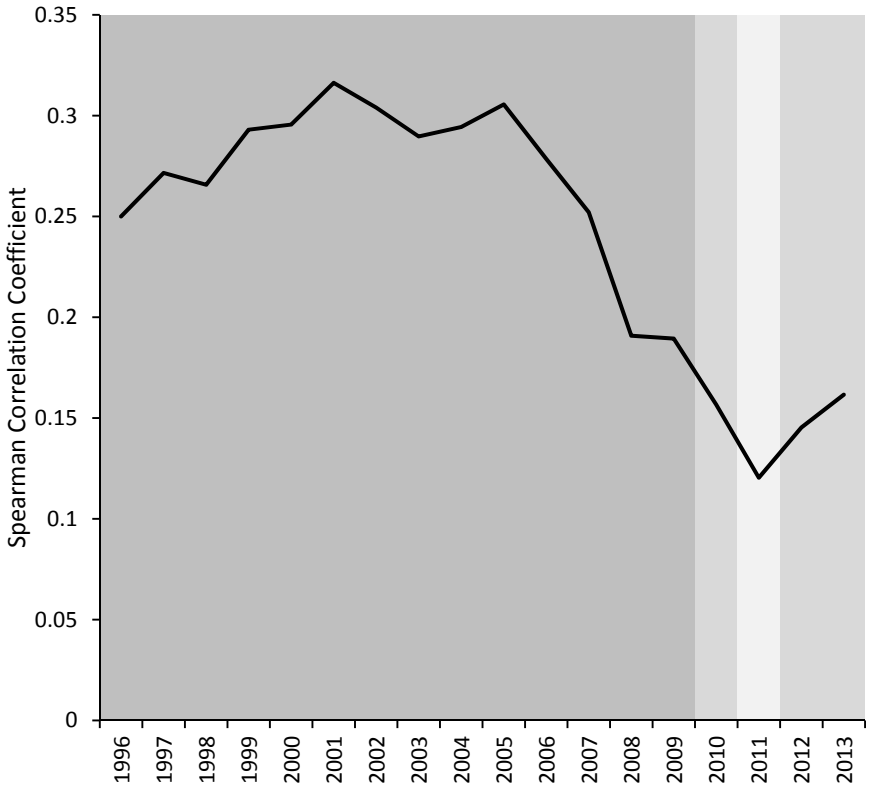


Notes: * significant at the 1% level, ** significant at the 5% level; * significant at the 10% level.**

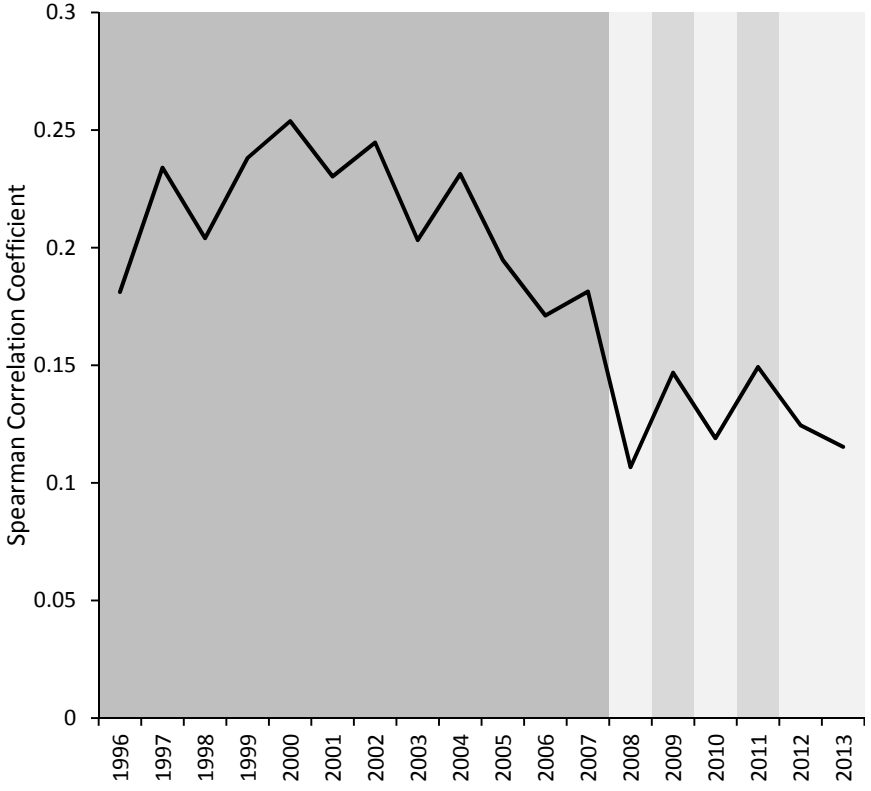
Source: Own calculations with United Nations´ COMTRADE data.

4.9 Trade Competition between Mexico and China

Correlation between Mexico and China´s Revealed Comparative Advantage Indices in the World Market



Correlation between Mexico and China´s Revealed Comparative Advantage Indices in the U.S. Market



Significant at the 1% level Significant at the 5% level Significant at the 10% level

Source: Own calculations with United Nations´ COMTRADE data.

Outline

1. Introduction
2. General Trends
3. Measuring Upstreamness
4. Performance of the Mexican Manufacturing Trade
5. Conclusions

5. Conclusions and Further Work

- Mexico has inserted into industrial GVCs very differently from China. In particular, the variation in the number of stages produced in Mexico over time seems to respond primarily to changes in the upstreamness of its exports.
- As previously hypothesized, Mexico has gained world market shares since the late 2000s and, thus, reverted the negative pattern that was observed after China's insertion into the WTO. Both the loss and subsequent gains in world market shares are reflected in the innovative analysis we have performed, which has enabled us to conclude that Mexico has increased its contribution to industrial GVCs both after NAFTA and back after the late 2000s.
- Nonetheless, the results suggest that the gains in Mexico's world market shares, and presumably the ensuing greater contribution to industrial GVCs, reflect both a better performance in the automotive industry and a change in Mexico's export patterns. Moreover, this change could in principle be interpreted as a "market reaction" to the China's entrance into the WTO.
- There is still much work to be done to assess whether this change in Mexico's export pattern has been efficient. In this sense, further work could explore the characteristics of industries and production stages in which has gained market shares, in terms, for instance, of relative skilled-labor intensity. This further analysis would show whether the above-mentioned gains are alligned with traditional sources of comparative advantage.

6. References

- Amador, J., and di Mauro, F. (2015). "The Age of Global Value Chains". *VOX CEPR's Policy Portal*, available at http://www.voxeu.org/article/age-global-value-chains.
- Andreosso-O'Callaghan, B., and Yue, G. (2004). "Intersectoral linkages and key sectors in China, 1987–1997." *Asian Economic Journal*, *18*(2), 165-183.
- Antràs, P., Chor, D., Fally, T., and Hillberry, R. (2012). Measuring the Upstreamness of Production and Trade Flows. *The American Economic Review*, *102*(3), 412-416.
- Chor, D., Manova, K., and Yu, Z. (2014). "The Global Production Line Position of Chinese Firms.", *Working Paper*.
- Fally, T. (2011). "On the Fragmentation of Production in the US." *Mimeo*.
- Feenstra, R. (1998). "Integration of Trade and Disintegration of Production in the Global Economy". *The Journal of Economic Perspectives, 12* (4), 31-50.
- Holz, C. A. (2011). "The unbalanced growth hypothesis and the role of the state: The case of China's state-owned enterprises." *Journal of development economics*, *96* (2), 220-238.
- Hummels, D., Ishii, J., and Yi, K. M. (2001). "The Nature and Growth of Vertical Specialization in World Trade". *Journal of International Economics, 54* (1), 75-96.
- Grossman, G. M., and Rossi-Hansberg, E. (2008). Trading Tasks: A Simple Theory of Offshoring. *The American Economic Review*, *98*(5), 1978-1997.
- Pierce, J. R., and Schott, P. K. (2012). "A concordance between ten-digit US Harmonized System codes and SIC/NAICS product classes and industries (No. 2012-15)". Board of Governors of the Federal Reserve System (US).