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## **Don't Expect Apples From a Pear Tree: Foreign Direct Investment and Innovation in Mexico<sup>1</sup>**

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**The Working Group on Development and Environment in the Americas**, founded in 2004, brings together economic researchers from several countries in the Americas who have carried out empirical studies of the social and environmental impacts of economic liberalization. The Working Group's goal is to contribute empirical research and policy analysis to the ongoing policy debates on national economic development strategies and international trade. The Working Group held its inaugural meeting in Brasilia, March 29-30, 2004. This paper is one of eight written for the Brasilia meetings. They are the basis for "**Globalization and the Environment: Lessons from the Americas**," a policy report published by the Heinrich Böll Foundation in July 2004.

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# **Don't Expect Apples From a Pear Tree:**

## **Foreign Direct Investment and Innovation in Mexico**

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### **Executive Summary**

In the very best case, nations that liberalize their foreign direct investment regimes hope that FDI will come to the country, and that it will generate “knowledge spillovers” that will create positive economy-wide effects that can pull it from underdevelopment. The jewel among these effects is innovation. If foreign firms come to a nation and take part in innovative activities, it is hoped that such activities can spur similar effort in the domestic economy and help the nation climb the development ladder.

This comprehensive report analyses the extent to which FDI into Mexico was able to attract FDI that stimulated innovation. The main finding, among many, is that foreign firms’ innovative contributions have been very limited and need to be better targeted. This is of concern given Mexico’s lackluster performance in terms of competitiveness. Moreover, Mexico’s poor FDI performance in terms of innovation may be accentuating the already potent levels of inequality and polarization in the Mexican economy.

Some of the specific findings of the report are as follows:

- Mexico’s state and national laws for screening, evaluating and encouraging technologically sophisticated FDI are not being implemented.
- R&D in Mexico has been falling sharply since the 1990s and this is in part due to poor performance in terms of R&D in foreign firms.
- R&D and Science and Technology spending by foreign firms is very polarized from a regional perspective, with the North of Mexico experiencing some promise of innovation while the South lags far behind.
- Domestic firms without FDI account for higher levels of innovation and employment than firms with FDI.

To address the shortcomings of FDI in Mexico, Mexico needs to revamp its current policies and think in a more long-term and systemic manner.

## **Introduction**

At least since the 1990s Latin America and Mexico have increasingly acknowledged that macroeconomic policies only are not sufficient for structural change and an overall increasing competitiveness. Theory, practice and policies have also slowly allowed for a more pragmatic vision of a set of micro, meso, macro and territorial policies to enhance competitiveness in the context of globalization and Asian competition. Territorial experiences in particular segments of value-added chains have been of substantial relevance for national institutions, as well as for overall learning processes. In this discussion the potential linkages between foreign direct investment (FDI) and innovation are substantial: according to the Economic Commission for Latin America and the Caribbean (ECLAC 2008), Mexico has been the most successful Latin American recipient of FDI for 2003-2007, averaging annually \$20.6 billion US dollars, and accounting for 28.50% of the region's FDI inflows; since 1994 realized FDI accounted for more than \$250 billion \$US in Mexico alone. Until today, however, it is not clear in which direction policies should engage regarding territorial-national policies in terms of the effects of FDI on innovation, spillovers and externalities, among other variables.

From this perspective, the goal of this document is to discuss in detail Mexico's FDI territorial specialization since the last decade, and to evaluate the effects –and association- of FDI on innovation processes from a territorial perspective within Mexico and at a disaggregated level, i.e. including sectors, branches and economic classes in Mexico. From this perspective, the document will present new information and analysis based on the Economic Census of 2004.

It is in this context that the present document will be structured in five chapters. The first outlines an overview of national and state policies to attract FDI, emphasizing the potential links between national and territorial policies, and in particular incentives and privileges granted to FDI. The second chapter presents a brief literature review on the main effects of FDI on innovation in Mexico, as well as on other variables such as spillovers and externalities, technology transfer and improvement in labor capacities. The third and fourth chapters analyze in more depth the main characteristics of Mexico's state-level FDI and productive specialization. The third chapter analyzes the main FDI characteristics, dynamism and specialization from a regional perspective within Mexico. The fourth chapter provides a more in-depth analysis and explanation of Mexico's innovation processes and linking these with FDI and other relevant socioeconomic variables. Thus, the chapter presents a branch-level typology of Mexico's expenditures in Science and Technology (S&T) processes for big manufacturing firms at the state level for 2003 and linked with branches in which FDI has a minority, a controlling stake or no presence at all. The results in terms of the main variables such as productivity, wages, imports and exports, but also in terms of expenditures of S&T will be substantial –and an important contribution- for understanding Mexico's national and territorial innovation development. The fifth and last chapter concentrates on policies and recommendations for FDI at the national, but in particular at the territorial level with an emphasis on innovation systems.

## **Overview of National and State Policies to Attract FDI**

Mexico's national policies regarding FDI have gone through at least two important phases since the 1970s. The first was a result of import-substitution until the end of the 1970s and the Law to Enhance National Investment and to Regulate Foreign Investment of 1973. While the law was an important policy instrument to regulate FDI according to import-substitution –and in many cases policy decisions were arbitrary-, four types of activities for FDI were established: a) Those reserved to the State (such as oil, basic petrochemicals, electricity and railways, among others), b) those reserved to Mexicans (such as forestry, radio and television), c) those with specific sectorial regulations (such as secondary petrochemicals and telecommunications), and d) all the other activities in which FDI was not allowed to be above 49%. In general, these laws –and including several changes until the beginning of the 1990s- were to enhance technological development, exports, employment generation, import substitution, as well as decentralizing FDI beyond the largest states (Gurría Treviño 1994; Dussel Peters et. al 2003, 2007; Peres Nuñez 1990).

The FDI law of 1973 was modified several times until the beginning of the 1990s through different reforms and regulations, and these changes were formally introduced in the Foreign Investment Law of December of 1993. This new federal law has to be understood in the context of the implementation of the new overall macroeconomic strategy since the end of the 1990s (Aspe Armella 1993; Dussel Peters 2000) and is consistent with the chapter of the North American Free Trade Agreement (NAFTA) on investments, providing national and non-discriminatory treatment for regional foreign investment. Particularly NAFTA established a divide for Mexico's socioeconomy and overall regulation from a sectorial perspective, but also regarding cross-sectorial issues such as trade, investment, transportation and temporary imports, among others (DOF 1993).<sup>2</sup>

Which are the main legal regulations regarding FDI today and in respect to the prior period? In general, FDI norms –also through sectorial regulations since 1993 in the financial sector, for example- were deeply deregulated and procedures were simplified for FDI and for the Foreign Investment National Commission (FINC) of the Ministry of Economics (Secretaría de Economía, SE). The new law kept the prior four types of activities of Mexico's economy for FDI, but reduced substantially sectors reserved to Mexicans and to the State<sup>3</sup>, while abolishing all performance requirements that existed historically (for example regarding exports and minimum domestic value-added in particular sectors such as automobiles).<sup>4</sup> The *affirmativa ficta* regulation was also significant, since FINC had to resolve applications within 45 days or, otherwise, applications were approved automatically: foreign investments requiring applications and not exceeding 165 million \$US were also automatically approved, unless the law restricted the specific activity. Most relevant for the current law is that Article 29 of the law established 4 criteria for allowing for FDI: a) impact on employment and training of workers, b) its technological contribution, c) compliance with ecological dispositions, and d) in general, its support for Mexico's competitiveness. These criteria, however, were not implemented and used in effective policy-making until 2008.

Within this framework, only very few activities were reserved to the State –such as oil, basic petrochemicals, electricity and the control and supervision of airports and ports- and to Mexicans –such as passenger, tourism and cargo transportation-. In addition, the concept of “neutral investment” allows for foreign investments in all sectors, since it includes all legal rights, with the exception of voting rights.<sup>5</sup>

Since the implementation of the Law in 1993 –and up to the end of 2008- several items of the law have been discussed<sup>6</sup>, including: a) the possibility of abolishing “neutral investments”, since they are highly confusing and allow for misconducts according to goals of the law, b) the liberalization of the oil sector –which has been publicly discussed since 2007 under the heading of the privatization and liberalization of the property of specific activities of the main state-owned oil firm, PEMEX-, including the possibility of retail sales of gasoline and liquid petroleum gas for foreigners, c) the liberalization of the electricity sector, allowing FDI in the production and distribution of electricity to the public. Finally, other sectorial regulations –such as in the financial sector, but in particular in trade- have affected FDI incentives. Mexico has signed 35 Agreements for the Reciprocal Promotion and Protections of Investments (ARPI) –the last one signed with China in 2008- affecting FDI with 48 countries. In addition, 12 free trade agreements with 44 countries –such as NAFTA- have also involved changes in FDI regulation.<sup>7</sup>

In Mexico national FDI-regulation has so far not allowed for a homogenization of FDI-incentives and benefits at the state level. Considering that until 2007 states should not grant direct fiscal incentives in real terms –with the notable exception of the 2% state payroll tax<sup>8</sup> since 2008- most of the benefits that states offer refer to particular expenditures of the respective transnational firm, i.e. in terms of reducing costs of real estate, infrastructure, water, electricity, training and other specific costs. As a result of an increasing decentralization of economic policies (OECD 2003), most of Mexico’s states since the 1990s have started to develop industrial, micro, small and medium firm, but also R&D and technological policies. Jalisco, Mexico City, Chihuahua and Sonora, among others, have led this process. In some specific cases, and given the arbitrary decision-taking process in the respective states, competition for attracting FDI of specific firms have led to a “down-to-the-bottom-race”, i.e. for example granting free real estate and infrastructure costs incurring in high economic costs that in some cases even increased the uncertainty of the respective multinational firm.<sup>9</sup>

The topic, i.e. the lack of coordination of federal and state-level policies to attract FDI, in addition to a missing long-term strategy at both levels has been acknowledged by several public and academic sectors with respective policy proposals. So far, however, these have not been implemented (CNE 2006; Dussel Peters et al. 2007; PEF 2007; SE 2008/a/b). More complex policies to link FDI with innovation, R&D, but also micro and small firms have also been indicated and proposed by these authors and institutions, but they seem to be far more complex in its effective implementation in the short term; until 2008 there is no realistic sign that such a coordination and long-term strategy will be implemented and funded. It is also not clear that any of the political sectors that propose these changes will have the sufficient political power to be even discussed in the Executive and Legislative

sectors in the short and medium terms, given the difficult and highly polarized political agenda since 2007-2008.<sup>10</sup>

The former lack of coordination is also reflected even at the statistical level, since state-level and federal statistics on FDI differ substantially and state governments do not have access to firm-level statistics of their own state; only federal agencies have access to this information today. In several cases –and according to different methodologies to register FDI- statistics differ from 15%-160% of those presented by SE (Dussel Peters et al. 2007:338-339). In order to share this kind of information, each of the respective states and Secretaría de Economía formally require specific agreements that most of the states do not have until 2008.

It is also relevant to stress that until 2008 the federal government does not have specific institutions for the promotion of FDI, and independently of laws and other formal norms: NCFI in the best of the cases is today able to register FDI. However, and in a rather chaotic form, governments at the state level promote FDI through specific and not coordinated strategies.<sup>11</sup> In addition, FDI-statistics in Mexico –as in other countries- present a serious limitation for territorial analysis, since the final destination of FDI –i.e. the place where FDI is actually pursued- cannot be tracked by current statistics. As a result, current FDI-statistics overvalue the main states and cities –where firms establish their fiscal sites- and undervalue the rest of the country where FDI is actually pursued.<sup>12</sup>

In spite of these important efforts of the Mexican government since the 1990s, the current evaluation of FDI-policies in comparison with other non-OECD countries has been disappointing; Mexico has been outperformed by countries such as Argentina, Brazil and Chile in Latin America and even China in specific sectors (Koyama and Golub 2006; OECD 2007).

### **Brief Literature Review on the Effects of FDI on Innovation in Mexico**

It is relevant to highlight that competitiveness, FDI and innovation literature has made important contributions and developments in Mexico and internationally in the last years. Several issues stand out.

First, the relevance of systemic competitiveness, since competitiveness should be understood at the micro, meso or institutional and macroeconomic levels of analysis (Meyer-Stamer 2005; Messner 2002); only a macroeconomic perspective such as implemented in most of Latin America since the 1980s and until 2008, is not sufficient. Such a systemic perspective is particularly relevant for understanding the effects of FDI on innovation since the effects can vary depending on the specific level of analysis.

Second, there are at least four forms to channel technology, knowledge, organizational methods and learning processes in general: a) the imitation and use of processes, methods and technologies, b) the acquisition of skills, c) export-promotion, and d) increasing competition generated by FDI. Technology transfer, from this perspective, can take place at

different levels of analysis.<sup>13</sup> In addition, typologies and specific characteristics of global commodity chains, as well as the mesoeconomic and institutional level of analysis are critical, as well as the degree of integration between firms that allows for different levels of learning, innovation and collective efficiency (Humphrey 2004; OECD 2001).

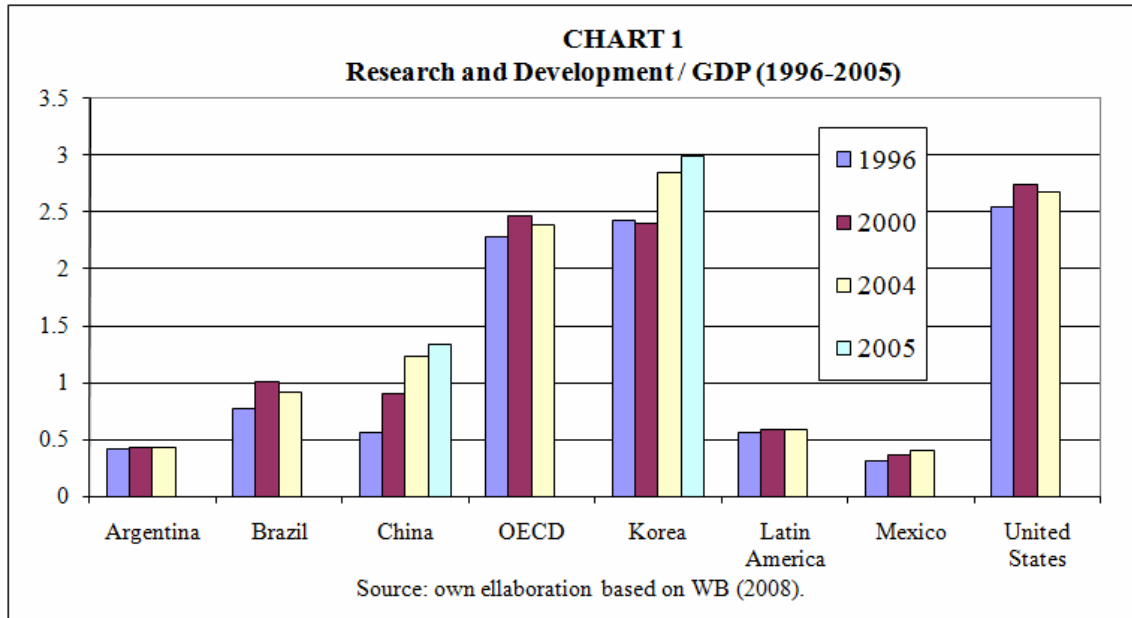
Third, and even though the approaches aforementioned are relevant in the context of the dominance of microeconomic and/or macroeconomic approaches to competitiveness, they lack a “territorial endogeneity” perspective, i.e. the specific form in which these territories integrate to global commodity chains and the specific form of systemic competitiveness in terms of products and processes<sup>14</sup> of firms and value-added chains. In other words, it is not only the firms but territories or regions which are the socioeconomic starting point for the analysis and for specific processes of upgrading and its respective policy proposals, for example (Bair and Dussel Peters 2006; Vázquez Barquero 2005).

Fourth, and more specifically regarding the topic of innovation, Lester and Piore (2004) highlight the relevance of this mesoeconomic level in terms of the concept of the “interpretative process” that generates processes of creativity in the economy and in contrast with processes only based on efficiency, competition and market-mechanisms. As a result, the authors argue for the creation of protected spaces that enhance this interpretative process in educational institutions, management and engineering, for example. From another perspective, Rodrik (2006) also establishes profound changes in China’s exports in the last decades, resulting from long-term public industrial policies that allowed for an effective upgrading and innovation process (Yusuf 2004). These topics allow for a deeper understanding of Dunning’s (2006) eclectic approach on FDI.

Which have been Mexico’s FDI general effects on R&D and innovation, based on the existing and rather limited literature concretely on the topic? At least several general topics have to be stated briefly first, also from an international perspective:

1. Mexico’s expenditures on R&D are rather small compared to other countries and, more relevant, have not increased since the opening of its economy since the late 1980s. According to different sources such as the OECD and World Bank, Mexico presents coefficients of R&D over GDP far below OECD countries, 1/3 of China, but also below Latin America as a region and countries such as Argentina and Brazil (see Chart 1).
2. According to OECD (OECD 2006), Mexico’s R&D also presents special features, i.e in general Mexico’s private sector share on total R&D expenditures is very low in comparison to other OECD countries –34.7% in 2004 for Mexico and 61.9% for the OECD’s average-, but are also very low in comparison to non-OECD member countries: in 2003-2004 private R&D / GDP accounted for 0.15% in Mexico and 0.81% in China. Mexico’s Science and Technology Council (CONACYT 2007/a) also estimates that only the education and energy sectors accounted for 64.7% of total federal science and technology expenditures in 2002, compared to 5.1% in the

US. Thus, the public and educational sectors today play a critical role in Mexico's R&D processes.

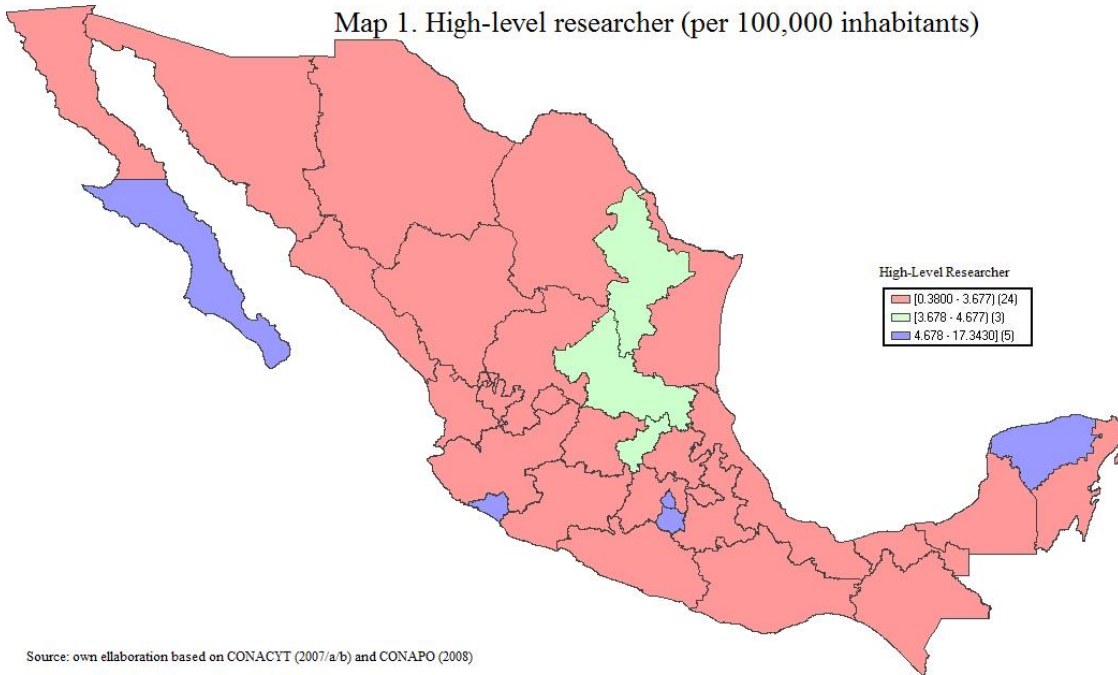


3. The federal science and technology expenditure –as a percentage of GDP- has been relatively stable at low levels throughout the period 1996-2006, below 0.4% and achieving its highest level in 1998 with 0.46%. In 2006 federal science and technology expenditure as a percentage of GDP fell to its lowest level since 1996, to just 0.36% (CONACYT 2007/b).
4. Probably one of the most important question regarding R&D expenditures and processes in Mexico is why the coefficient has not increased –since the 1990s and with the opening of Mexico's economy-, but also in comparison with other countries, as discussed earlier. As a result of Mexico's increasing openness, Mexico specialized in an export-oriented industrialization since the end of the 1980s based on processes of temporary imports to be exported (during 1993-2006 78% of Mexican exports depended on these kind of export incentives). Against initial expectations, these export-oriented processes –in many cases led by multinational corporations and FDI- have specialized in assembly processes, while more sophisticated segments of value-added chains and processes are done in other global sites. As a result, Mexico's socioeconomy presented a highly polarized development, since only a few households, firms, branches, sectors and states achieved an integration through exports to the world market, and even in these cases, with low R&D coefficients. Even more surprising, and until the mid-2000s,

manufacturing activities with high shares of FDI are also positively correlated with exports and productivity, but negatively with R&D expenditures (Dussel Peters et. al 2007).

5. This process of polarization has also occurred at other levels of Mexico's science and technological development, for example regarding the highest-ranking researchers in Mexico that receive a grant from CONACYT through the Nation Research System (SNI). As presented in Table 1, three topics stand out:
  - a) The total group of researchers is highly concentrated in only a few states: Mexico City, Morelos and Jalisco accounted for 61% of all researchers in 2000 and 54% in 2006. At the same time, this data also reflects an important decentralization process of Mexico's senior and highest-ranked researchers, and in particular against Mexico City in relative terms. In addition, the North-South cleavage is also evident for states such as Chiapas, Guerrero, Oaxaca and Tabasco, with very low levels of researchers throughout the period (see Map 1).
  - b) Table 1 also reflects the low level of the coefficient of high-level researchers per 100,000 inhabitants in Mexico in general –of 5.6 in 2006- and the increasing level of concentration of these researchers from a territorial perspective: only four states –Distrito Federal, Morelos, Chihuahua and Baja California Sur- increased their coefficient by more than 8 researchers over 100,000 inhabitants during 2000-2006. The case of Mexico City is particularly relevant: with an almost constant population for the period, the coefficient for the highest-ranked researchers per inhabitant increases from 14 to 32 during 2000-2006. The North-South cleavage is also evident in this case, since the aforementioned states in the South all present coefficients far below Mexico's average (see Map 1).
  - c) Similar territorial features are revealed when aggregating Mexico's states in 6 regions according to INEGI.<sup>15</sup> As a result, and in addition to the decentralization process analyzed above, only the Central Region stands out for increasing both senior and medium-level researchers during 2000-2006 –with the exception of the Pacific Region with low and medium-level researchers- above the national average. This process also highlights that the concentration of researchers at all levels –and independently of the growth of researchers in all regions- continues to be a substantial issue until today.

Map 1. High-level researcher (per 100,000 inhabitants)



Source: own elaboration based on CONACYT (2007/a/b) and CONAPO (2008)

Table 1  
 Researchers of low/medium and high level per 100,000 inhabitants (2000 and 2006) (a, b, c)

	2000				2006				Change 2006-2000			
	Total number of researchers	High-level researchers (per 100,000 inhabitants)	Low and medium level researchers (per 100,000 inhabitants)	Share over total researchers	Total number of researchers	High-level researcher (per 100,000 inhabitants)	Low and medium level researcher (per 100,000 inhabitants)	Share over total researchers	Total number of researchers	High-level researcher (per 100,000 inhabitants)	Low and medium level researcher (per 100,000 inhabitants)	Share over total researchers
AGUASCALIENTES	33	0.413	2.997	0.45	68	2.941	3.309	0.50	35	2.528	0.312	0.06
BAJA CALIFORNIA	230	2.050	7.574	3.12	417	5.709	8.632	3.09	187	3.658	1.058	-0.03
BAJA CALIFORNIA SUR	103	2.287	21.266	1.40	181	10.314	24.256	1.34	78	8.027	2.991	-0.06
CAMPECHE	10	0.141	1.272	0.14	57	2.864	4.556	0.42	47	2.722	3.284	0.29
CHIAPAS	53	0.124	1.195	0.72	120	0.871	1.880	0.89	67	0.747	0.685	0.17
CHIHUAHUA	47	0.131	1.410	0.64	145	1.671	2.734	1.08	98	1.539	1.324	0.44
COAHUILA	95	0.512	3.542	1.29	185	2.279	4.990	1.37	90	1.767	1.448	0.08
COLIMA	46	1.327	7.394	0.62	105	8.657	9.523	0.78	59	7.330	2.128	0.15
DISTRITO FEDERAL	3,763	14.315	28.952	51.09	5,895	31.658	35.161	43.72	2,132	17.343	6.208	-7.37
DURANGO	20	0.068	1.290	0.27	60	1.371	2.547	0.44	40	1.303	1.257	0.17
ESTADO DE MEXICO	435	0.614	2.765	5.91	800	2.080	3.542	5.93	365	1.467	0.777	0.03
GUANAJUATO	223	0.967	3.720	3.03	406	3.442	4.730	3.01	183	2.475	1.010	-0.02
GUERRERO	11	0.064	0.288	0.15	39	0.444	0.793	0.29	28	0.380	0.505	0.14
HIDALGO	31	0.044	1.315	0.42	176	3.274	4.113	1.31	145	3.230	2.798	0.88
JALISCO	292	0.794	3.753	3.96	683	4.281	5.699	5.06	391	3.487	1.945	1.10
MICHOACAN	149	0.767	2.919	2.02	386	3.497	6.144	2.86	237	2.730	3.225	0.84
MORELOS	434	6.812	21.344	5.89	754	20.003	26.121	5.59	320	13.191	4.777	-0.30
NAYARIT	7	0.000	0.747	0.10	17	0.832	0.936	0.13	10	0.832	0.189	0.03
NUEVO LEON	182	0.565	4.107	2.47	441	4.416	5.888	3.27	259	3.851	1.781	0.80
OAXACA	33	0.199	0.740	0.45	120	1.914	1.464	0.89	87	1.715	0.724	0.44
PUEBLA	327	1.400	5.047	4.44	528	4.325	5.310	3.92	201	2.925	0.263	-0.52
QUERETARO	169	3.201	8.559	2.29	279	7.613	9.517	2.07	110	4.412	0.957	-0.23
QUINTANA ROO	27	0.332	2.652	0.37	48	1.701	2.382	0.36	21	1.370	-0.270	-0.01
SAN LUIS POTOSI	91	0.895	2.984	1.24	251	4.737	5.513	1.86	160	3.842	2.529	0.63
SINALOA	49	0.193	1.703	0.67	146	1.478	4.056	1.08	97	1.285	2.353	0.42
SONORA	123	0.751	4.684	1.67	250	3.772	6.479	1.85	127	3.021	1.795	0.18
TABASCO	3	0.052	0.104	0.04	77	2.032	1.784	0.57	74	1.980	1.681	0.53
TAMAULIPAS	36	0.071	1.210	0.49	110	1.430	2.145	0.82	74	1.359	0.935	0.33
TLAXCALA	16	0.304	1.317	0.22	69	2.663	3.673	0.51	53	2.359	2.355	0.29
VERACRUZ	139	0.313	1.665	1.89	308	1.662	2.603	2.28	169	1.349	0.938	0.40
YUCATAN	143	1.121	7.315	1.94	272	6.107	8.593	2.02	129	4.986	1.278	0.08
ZACATECAS	46	0.291	3.051	0.62	92	2.096	4.554	0.68	46	1.806	1.504	0.06
Northern Border	816	0.675	4.072	11.08	1,729	3.452	5.618	12.82	913	2.777	1.546	1.74
Southern Region	97	0.131	0.779	1.32	279	1.084	1.437	2.07	182	0.953	0.658	0.75
Pacific Region	543	0.648	3.094	7.37	1,337	3.528	5.371	9.91	794	2.880	2.277	2.54
Center-North Region	582	0.987	3.722	7.90	1,156	3.778	5.081	8.57	574	2.791	1.359	0.67
Center-Region	5,006	4.782	11.134	67.96	8,222	11.178	13.265	60.97	3,216	6.397	2.132	-6.99
Gulf and Caribbean	322	0.375	2.250	4.37	762	2.425	3.422	5.65	440	2.050	1.172	1.28
<b>TOTAL</b>	<b>7,366</b>	<b>1.926</b>	<b>5.557</b>	<b>100.00</b>	<b>13,485</b>	<b>5.604</b>	<b>7.254</b>	<b>100.00</b>	<b>6,119</b>	<b>3.678</b>	<b>1.698</b>	<b>0.00</b>

/a Refers to researchers with level recognized by the National System of Researchers of Conacyt.

/b Researchers of low and medium level refer to researchers with the level of candidates and level 1, high-level researchers to those of levels 2, 3 and emeritum.

/c Researchers living in foreign countries were not included.

Source: own elaboration based on CONACYT (2007) (a,b) and CONAPO (2008).

In this general context, several authors and studies have allowed for deepening some features of Mexico's state-level innovation and R&D processes related to FDI:

- a) The study of Ruiz Durán (2006) shows that the main characteristic of Mexico's territorial restructuring since the 1990s has been the decentralization of processes in Mexico City and its "*Hinterland*" (including Estado de México, Morelos, Tlaxcala, Hidalgo and Puebla, several of them with their own and independent economic activities) towards Northern states close to the US-boarder such as Baja California, Sonora, Chihuahua, Coahuila, Nuevo León and Tamaulipas) and states of reindustrialization (Jalisco, Aguascalientes, Guanajuato, Querétaro and San Luis Potosí). This new territorial pattern of development reflects one of the main features

of Mexico's export-oriented industrialization since the late 1980s; the more resource-based South of Mexico was not integrated to this process.

- b) Several studies of Corona Treviño (1999, 2005) reflect on the national system of innovation, firms of technological base, technological research centers by industrial activity and region, in particular in the regions of El Bajío, Cuernavaca, Guadalajara, Monterrey and Mexico City. In general, technological activities are scarce; firms with technological base are on average small firms of national capital: only 15.5% of innovating firms are controlled by foreign capital. As a result of field research the analysis points out that that innovation in Mexico could be divided in three periods: i. Centralized take-off in Mexico City until 1958, ii. Regionalized growth (1958-1994), and iii. Fall (1994-2000). Particularly in the latter period expenditures in science and technology and institutional weaknesses<sup>16</sup> affect the national system of innovation, while deepening the lack of integration with Mexico's South.
- c) Micro-level analysis on territorial clusters highlight that FDI is not necessarily the source of backward and forward linkages in Mexico. In contrast, in specific regional clusters such as the leather-shoes commodity chain (Rabelloti 1995, 1997; Romo Murillo 2005), electronics (Dussel Peters et. al 2007; Padilla Pérez 2008) and maquiladoras (Carrillo and Hualde Alfaro 1998; Hualde Alfaro 2001), among others (Botzman 1999; Flores Méndez 2008), the lack of standardization in the new measurement system, the vertical integration of original equipment manufacturers (OEMs) and clients and intrafirm standards present strong limitations on these forms of industrial organization in order to allow for learning and innovation processes from FDI and to integrate local and national suppliers to chains led by transnational corporations.
- d) Another recent study (Dussel Peters et. al 2007) examines the performance of Mexico's FDI from a micro, meso, macro and territorial perspective and concludes that FDI is positively associated with GDP, employment, wages and exports, among other variables, although the share of FDI in Mexico's total economy is rather small and not sufficient for 'pushing' the rest of the economy. Moreover, FDI has deepened territorial polarization and the North-South cleavage –and is positively correlated with the United Nations Development Programme Human Development Index at the state level- and is associated to expenditures in technological R&D, which is negative in manufacturing: the coefficient of R&D over production fell substantially since the 1990s for the main 10 and 20 economic classes according to their share in terms of FDI and was lower than for the rest of Mexico's manufacturing sector.

## **Territorial Characteristics and Specialization of FDI**

This chapter will highlight the state and branch-level specialization of Mexico's FDI for the period 1994-2007. This analysis will be significant to understand –in chapter 4- the main associations and causalities between FDI, expenditures in science and technology, wages, productivity employment and trade, among other variables, at the state and branch-level. The first part of the chapter will briefly examine the general performance of FDI during 1994-2007, while the second discusses in more detail the main FDI patterns from a territorial perspective, calculating a specialization index at the branch-level for 1999-2007.

### **General Performance of FDI**

FDI has played a significant macroeconomic role, as well as for Mexico's total investments. For the period 1994-2007 FDI accounted for 2.4% of Mexico's GDP and 16.24% of its gross formation of fixed capital. In both cases FDI's contribution has fallen during the period (chart 2).

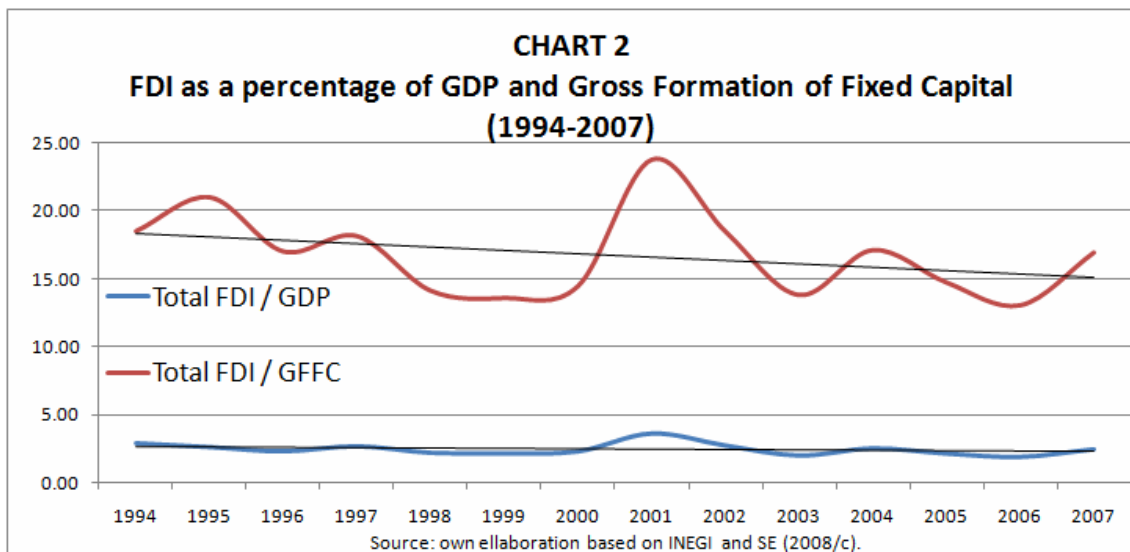


Table 2 reflects several of the main features of FDI's performance since the 1990s<sup>17</sup>, including:

- a) The period 1994-2007 can clearly be divided in two subperiods: i. 1994-2001, with an average annual growth rate (AAGR) of 10.1% of FDI inflows and under the boom of FDI as a result of NAFTA, and ii. 2002-2007, a period with a higher uncertainty, several years of negative growth rates, and affected by the US-stagnation during 2001-2003 and increasing competition with Asia and China. As a result, in the second period FDI's AAGR was of 1.6% and with much higher growth rates –compared with the period 1994-2001- in accounts between companies.<sup>18</sup>

- b) The share of new investments during 1994-2007 has fallen significantly and below levels of 30% of total FDI in 2006. As a result, intra and interfirm arrangements have increasingly substituted for new and fresh investments.

Table 2  
FDI in Mexico: General Trends (1994-2007)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1994-2007	1994-2001	2002-2007
<b>US-DOLLARS</b>																	
<b>TOTAL</b>	15,046	9,648	9,952	14,176	12,248	13,823	17,953	29,528	23,055	16,682	22,943	21,829	19,331	25,019	251,233	122,373	128,861
New Investments	9,745	6,960	6,296	10,462	6,095	6,320	8,360	22,661	15,049	7,335	13,936	11,744	5,708	11,688	142,358	76,899	65,460
Reinvested Profits	2,367	1,572	2,590	2,150	2,864	2,333	3,851	3,857	2,468	2,077	2,345	3,487	4,179	5,062	41,202	21,584	19,618
Accounts between companies	2,038.8	-250.4	-350.2	-116.1	1,178.7	5,169	5,742	3,010	5,538	7,271	6,662	6,598	9,444	9,280	61,215	16,422	44,793
<b>SHARE OVER TOTAL</b>																	
New Investments	64.8	72.1	63.3	73.8	49.8	45.7	46.6	76.7	65.3	44.0	60.7	53.8	29.5	46.7	56.7	62.8	50.8
Reinvested Profits	15.7	16.3	26.0	15.2	23.4	16.9	21.4	13.1	10.7	12.4	10.2	16.0	21.6	20.2	16.4	17.6	15.2
Accounts between companies	13.6	-2.6	-3.5	-0.8	9.6	37.4	32.0	10.2	24.0	43.6	29.0	30.2	48.9	37.1	24.4	13.4	34.8
<b>GROWTH RATE</b>																	
<b>TOTAL</b>	--	-35.9	3.1	42.4	-13.6	12.9	29.9	64.5	-21.9	-27.6	37.5	-4.9	-11.4	29.4	4.0	10.1	1.6
New Investments	--	-28.6	-9.5	66.2	-41.7	3.7	32.3	171.1	-33.6	-51.3	90.0	-15.7	-51.4	104.8	1.4	12.8	-4.9
Reinvested Profits	--	-33.6	64.7	-17.0	33.2	-18.5	65.0	0.2	-36.0	-15.9	12.9	48.7	19.8	21.1	6.0	7.2	15.4
Accounts between companies	--	-112.3	39.9	-66.8	-1,115.2	338.6	11.1	-47.6	84.0	31.3	-8.4	-1.0	43.1	-1.7	12.4	5.7	10.9

Source: own elaboration based on SE (2008/c).

- c) An additional important change through the period has been the fall of manufacturing's share over total FDI: the share for the period was of 46%, reaching its highest level in 1999 with 66% of total FDI, and falling strongly since then at levels below 50%. In contrast, the service sector's share increased from levels below 20% during 1994-1999 to levels above 30% in most of the years since then. Within the service sector the banking sector has played an important role, and particularly during 2000-2004 in the era of the privatization of the sector (see Annex 1).
- d) The sources of Mexico's FDI have also shifted since 1994: while until 2001 FDI from the US predominated, since then it has fallen to levels below 40% in several years, while the European Union and other countries, in particular Asia, but also Switzerland and other Latin American countries have increased their presence (see Annex 2).
- e) From a regional perspective –and according to the formal territorial distribution of Mexican states of Instituto Nacional de Estadística, Geográfica e Informática (INEGI)-, FDI's has changed substantially. The Northern Border has received more than 30% of Mexico's FDI since the end of the 1990s, while the share of the Center-Region fell by 20 points during 1994-2007 (see Table 3 and Annex 3). The Pacific Region, and in particular Jalisco, have also increased their share. However, none of the other regions –the Golf and Caribbean, Center-North and South- have increased their share. The situation of the three states of the Southern Region is particularly

dramatic with a share of 0.14% of Mexico's FDI during 1994-2007 and with negative inflows in several years.

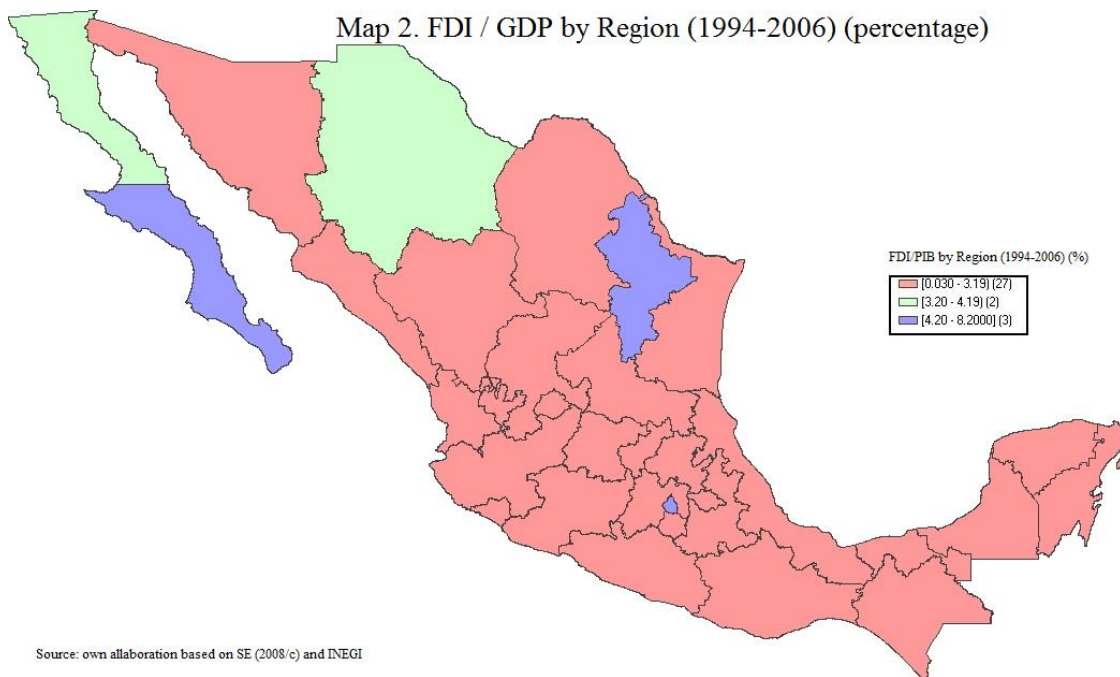
**Table 3**

Mexico: FDI by regions (1994-2007) (percentage over total)

	1994	2000	2005	2007	1994-2007
Northern Border	19.25	31.10	39.39	31.05	25.66
Southern Region	0.07	0.07	0.16	-0.07	0.14
Pacific Region	2.13	6.98	6.84	8.85	4.11
Center-North Region	2.32	3.61	2.74	3.31	2.78
Center-Region	75.30	57.00	48.98	55.41	65.97
Golf and Caribbean	0.93	1.24	1.90	1.45	1.34
<b>TOTAL</b>	100.00	100.00	100.00	100.00	100.00

Source: own elaboration based on SE (2008/c).

- f) Table 4 also reflects another territorial angle regarding the differentiated effects of FDI. The calculated coefficient of FDI over the respective GDP during 1994-2006 analyzes the potential effects of FDI on the respective state in Mexico, i.e. states with low levels of FDI in general, but also related to its GDP, do also present smaller opportunities to engage in learning and innovation processes with FDI. In general –and with the exception of the Center-North region- the coefficient of FDI/GDP increases for all regions and total economy from the period 1994-2001 to 2002-2006, and contrary to the FDI-dynamism discussed earlier. On the other hand, the FDI/GDP coefficient also clearly deepens Mexico's North-South cleavage: the Center and Northern Border regions account for coefficients that double the rest of the regions, while in 4 regions –the Southern, Pacific, Center-North, and Golf and Caribbean regions- FDI accounts for less than 1% of GDP during 1994-2006. Or, in other word, initially only 2 out of Mexico's 6 regions seem to have an important learning and innovation potential based on FDI inflows (see Map 2).



**Table 4**

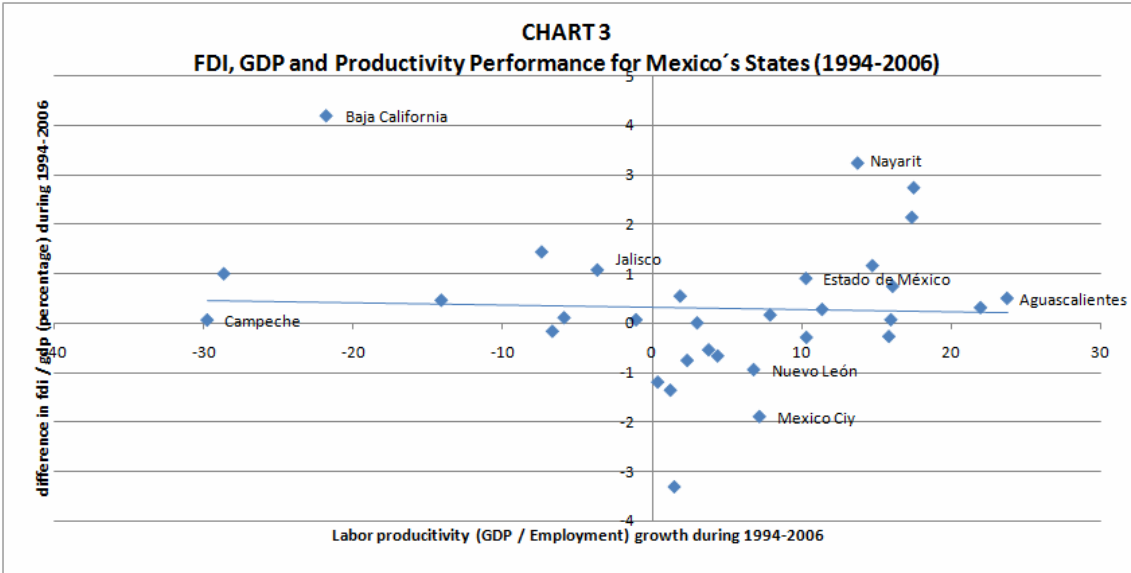
Mexico: FDI / GDP by regions (1994-2006) (percentage)

	1994	2000	2005	2006	1994-2006	1994-2001	2002-2006
Northern Border	2.38	4.41	4.85	2.71	3.36	3.01	3.14
Southern Region	0.04	0.05	0.10	0.11	0.11	0.09	0.12
Pacific Region	0.48	2.10	1.88	1.14	1.02	0.85	1.03
Center-North Region	0.65	1.26	0.84	0.38	0.88	0.78	0.72
Center-Region	5.09	5.06	4.02	4.29	5.65	3.88	5.61
Golf and Caribbean	0.27	0.47	0.61	0.46	0.46	0.29	0.50
<b>TOTAL</b>	<b>2.76</b>	<b>3.51</b>	<b>3.14</b>	<b>2.55</b>	<b>3.29</b>	<b>2.47</b>	<b>3.20</b>

Source: own elaboration based on SE (2008/c) and INEGI.

Finally, Chart 3 shows that the state-level performance in Mexico during 1994-2006 between productivity growth –measured as GDP / employment- and FDI dynamism – measured as the change of FDI / GDP during 1994-2006- is not conclusive: apparently the most successful case is Nayarit in Mexico’s Pacific coast and with an important dynamism in FDI and productivity growth; the State of Mexico is another positive case under this perspective. Other states, however, such as Baja California, Jalisco and Mexico City, present a much more complicated performance with only positive results under one of both variables. Jalisco, for example, presents an important dynamism in FDI which is not associated with productivity growth, while the State of Mexico accounts for a productivity

growth of 7.2% for 1994-2006, but its FDI / GDP share fell by 1.9% for the same period. In general, the association between both variables presents a slight negative slope, which runs against initial expectations.



**Branch-level Specialization Patterns of Mexico's FDI: a Regional Perspective**

So far the prior chapters have analyzed the increasing polarization of Mexico's economy and the territorial concentration of S&T indicators and FDI in Mexico since the 1990s. Annex 5 also reflects that a few branches –at the branch-level Mexico's FDI information is divided in 127 branches- account for the largest share in Mexico's FDI-inflows for 1999-2007. According to their weight in 1999-2007, the main 10 branches accounted for 60.29% of total FDI during the period. Of these branches, 4 were part of services –particularly in banking, telecommunications and trade-, while the rest of manufacturing (such as automobiles, basic industries of iron and steel, beverages, fabrication of electronic accessories, and chemical products).

**Table 5**  
Mexico: National FDI by main 10 branches (1999-2007)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	1999- 2007	1999	2001	2002	2007	1999- 2007
	US million										share over total				
1 811000 Servicios de instituciones crediticias, bancarias y auxiliares de crédito.	306	2,229	15,129	5,155	2,568	5,085	306	3,448	4,487	38,712	2.21	51.22	22.37	19.61	20.59
2 384100 Industria automotriz.	2,195	1,612	1,410	1,306	1,157	2,467	2,039	1,421	1,794	15,400	15.83	4.77	5.67	7.84	8.19
3 720000 Comunicaciones.	219	-1,968	2,629	3,285	2,209	1,193	1,142	792	570	10,070	1.58	8.90	14.26	2.49	5.36
4 612000 Comercio de productos no alimenticios al por mayor. Incluye alimentos para animales.	969	1,049	1,172	1,195	746	562	1,781	776	684	8,934	6.99	3.97	5.19	2.99	4.75
5 951000 Prestación de servicios profesionales, técnicos y especializados. Excluye los agropecuarios.	777	1,241	1,029	561	932	195	1,888	1,903	484	8,790	5.61	3.48	2.43	2.03	4.67
6 371000 Industria básica del hierro y del acero.	242	241	426	288	26	-137	2,733	260	3,801	7,680	1.74	1.44	1.25	15.74	4.08
7 313000 Industria de las bebidas.	112	222	488	1,863	471	316	845	1,208	807	6,332	0.81	1.65	8.08	3.53	3.37
8 383100 Fabricación y/o ensamble de maquinaria, equipo y accesorios eléctricos. Incluso para la generación de energía eléctrica.	741	840	588	414	537	883	734	604	728	6,068	5.35	1.99	1.80	3.18	3.23
9 352200 Fabricación de otras sustancias y productos químicos.	511	506	552	514	369	1,201	462	1,577	266	5,958	3.68	1.87	2.23	1.16	3.17
10 390000 Otras industrias manufactureras.	575	1,313	540	508	391	461	558	637	428	5,411	4.15	1.83	2.20	1.87	2.88
REST	7,216	11,215	5,572	7,956	7,240	10,676	9,220	6,527	9,054	74,675	52.05	18.87	34.52	39.57	39.71
<b>TOTAL</b>	<b>13,883</b>	<b>18,501</b>	<b>29,536</b>	<b>23,044</b>	<b>16,645</b>	<b>22,902</b>	<b>21,508</b>	<b>19,152</b>	<b>22,882</b>	<b>188,031</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>

Source: Own elaboration based on SE (2008/c).

Considering this branch-level examination and the already analyzed state-level specialization, which have been the main state-level specialization patterns at the branch-level? For this analysis we have included an index that allows for highlighting state-level specialization in reference to the national specialization, based on the respective share over total FDI, i.e.:

$$FDI_{\text{specialization index}} = (FDI_{Si} / FDI_{Stot}) / FDI_{Nati} / FDI_{Nat-tot})$$

Where:

$FDI_{Si}$  = Foreign direct investment of a particular state in branch i

$FDI_{Stot}$  = Total foreign direct investment of a particular state

$FDI_{Nati}$  = National foreign direct investment in branch i

$FDI_{Nat-tot}$  = Total national foreign direct investment

As a result, the coefficient can vary from negative values –when FDI is negative either in the respective state or at the national level- to positive values. In general, however, the coefficient will vary from 0 to positive values. Values between 0 and 1 imply that the respective state presents a lower specialization pattern than national FDI in that particular branch, while coefficients above 1 reflect a higher territorial specialization for the branch. One of the shortcomings of the index is that the more disaggregated the data set, the more options for very high values of the index in specific items where no other state receives FDI, independently of its absolute value and relevance. Additionally, and as a result of important annual changes, the index might vary significantly from year to year, i.e. it also makes sense to calculate the index for a period of time.

Which are the main regional –and according to the prior definition of regions within Mexico- specialization patterns of FDI at the branch-level during 1999-2007? Several issues stand out, in the context of the already discussed regional and state-level patterns of FDI in Mexico (see table 6):

1. The Northern Border region presents high coefficients in manufacturing –and three branches related to transport equipment and automobile branches-, as well as in services related to these processes.
2. The Center region has also specialized in infrastructure, in the autoparts-automobiles chain and manufacturing and trade-related activities in food and beverage branches; six out of the main 10 branches are related to manufacturing.
3. The Center-North region is highly specialized in agroindustry activities such as wood and food products, as well as in services for these activities.
4. The rest of the regions –in particular the Southern, Pacific and Gulf and Caribbean regions-, present high specialization patterns in services and agriculture. Fishery, construction and tourism play an important role in the Gulf and Caribbean regions.

Table 7, finally, accounts for the branch-level specialization of FDI in Mexico's states and in particular for the autoparts-automobile value-added chain, as well as for electronics.<sup>19</sup> This rich information highlights that:

1. In the autoparts-automobile chain, which accounted for more than 15 billion \$US in FDI-inflows during 1999-2007, FDI does not take part in the Southern and Gulf and Caribbean Regions. The Center-North Region is the only one –out of the six regions- that presents a coefficient above 1 or above Mexico's average. At the state level, Hidalgo, Guanajuato and Baja California Norte present the highest specialization patterns in the chain, followed by Coahuila and Chihuahua in Mexico's North.
2. In the electronics chain, again, the Southern and Gulf and Caribbean regions do not present any significant FDI, as well as the Center-North region. Very clearly the Pacific region is the mostly specialized in this branch, and in particular Jalisco, with FDI for 2.3 \$US billion and a specialization coefficient of 7.99 for 1999-2007.

**Table 6**  
Regional FDI specialization patterns in Mexico (1999-2007)  
(only including the main 5 branches during 1999-2007)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	1999-2007
<b>Northern Border</b>										
384200 Fabricación, reparación y/o ensamble de equipo de transporte y sus partes. Excluye automóviles y camiones.	1.22	0.40	0.95	-0.23	0.64	0.14	-0.71	357.53	-0.15	14.03
961200 Servicio de reparación y mantenimiento automotriz.	-4.68	0.00	8.99	0.00	0.00	0.00	0.00	0.00	0.00	11.14
381200 Fabricación de estructuras metálicas, tanques y calderas industriales. Incluye trabajos de herrería.	2.03	0.41	6.97	1.77	1.63	-0.70	0.17	4.12	3.72	4.91
941200 Servicios de esparcimiento relacionados con la cinematografía, teatro, radio y televisión prestados por el sector público.	--	--	6.48	--	4.88	--	--	--	--	3.99
210000 Extracción y/o beneficio de carbón mineral.	--	--	--	--	--	--	--	--	3.22	3.99
925000 Servicios de asociaciones comerciales, profesionales y laborales.	--	--	--	--	--	--	--	3.66	--	3.99
220000 Extracción de petróleo y gas natural.	3.28	3.21	--	--	--	--	--	0.00	--	3.97
314000 Industria del tabaco.	3.04	3.49	-5.24	0.00	4.88	0.00	2.54	3.66	3.22	3.82
625000 Comercio al por menor de automóviles. Incluye llantas y refacciones.	0.00	0.00	0.00	--	0.00	0.00	--	3.66	--	3.76
372000 Industrias básicas de metales no ferrosos. Incluye el tratamiento de combustibles nucleares.	3.29	2.61	6.03	4.97	2.13	5.80	2.21	5.04	3.13	3.71
<b>Southern Region</b>										
922100 Servicios de investigación científica prestados por el sector privado.	334.77	1491.99	1767.09	1047.44	197.75	-341.49	616.50	1450.89	-1430.09	1963.81
311700 Fabricación de aceites y grasas comestibles.	350.96	--	0.00	--	293.56	62.72	66.98	0.00	-925.35	116.67
971000 Servicios para la agricultura y la ganadería. Incluye distribución de agua en obras de riego.	--	0.00	0.00	--	0.00	0.00	0.00	0.00	0.00	110.81
501100 Edificación.	0.00	0.00	452.29	0.00	0.00	0.00	0.00	92.73	-10.91	44.82
611000 Compra-venta de material de desecho.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-290.18	0.00	32.78
932000 Hoteles y otros servicios de alojamiento temporal.	45.22	18.59	32.41	25.67	22.43	20.89	34.80	4.85	-2.53	25.53
614000 Comercio de productos alimenticios, bebidas y tabaco al por mayor.	6.26	-0.74	0.00	16.02	21.03	115.18	2.04	3.69	0.00	17.73
821200 Otros servicios inmobiliarios.	0.95	1.41	6.49	3.60	10.71	9.59	1.23	4.17	-2.20	3.53
369100 Fabricación de cemento, cal, yeso y otros productos a base de minerales no metálicos.	0.00	0.00	798.29	0.00	0.00	0.00	0.00	0.00	0.00	2.88
621000 Comercio de productos alimenticios, bebidas y tabaco al por menor en establecimientos especializados.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.26	1.80
<b>Pacific Region</b>										
973200 Servicios relacionados con el transporte por agua.	5.59	0.00	0.00	0.00	39.20	31.37	14.77	19.75	11.82	19.65
971000 Servicios para la agricultura y la ganadería. Incluye distribución de agua en obras de riego.	--	10.23	34.20	--	-2.92	19.79	0.00	-3.29	0.00	19.40
311800 Industria azucarera.	22.37	0.00	0.00	--	40.84	#DIV/0!	#DIV/0!	19.75	0.00	19.04
111100 Agricultura.	21.18	7.16	16.83	-50.86	4.63	11.20	0.94	20.54	10.60	17.31
972000 Servicios relacionados con la construcción.	22.37	15.43	47.63	--	0.00	0.00	0.00	0.00	--	13.16
382300 Fabricación y/o ensamble de máquinas de oficina, cálculo y procesamiento informático.	12.27	5.10	14.20	-27.82	14.63	10.77	12.63	12.53	7.62	11.17
311100 Industria de la carne.	4.18	0.00	7.84	-28.16	40.84	32.06	14.63	19.75	11.30	10.64
712000 Transporte por agua.	--	14.33	--	55.16	40.84	35.62	27.75	3.70	11.30	9.94
611000 Compra-venta de material de desecho.	0.00	0.00	0.00	-2.42	-25.52	7.12	1.38	-23.70	0.00	9.56
711200 Autotransporte de carga.	0.00	--	48.09	62.57	0.00	11.17	0.00	0.00	0.00	9.10
<b>Center-North Region</b>										
331100 Fabricación de productos de aserradero y carpintería. Excluye muebles.	0.00	-2.63	-67.93	61.12	0.00	0.00	0.00	1.82	-3.78	213.59
331200 Fabricación de envases y otros productos de madera y corcho. Excluye muebles.	48.57	41.49	46.83	-1.87	16.22	110.59	46.21	0.00	0.00	183.71
311300 Elaboración de conservas alimenticias. Incluye concentrados para caldos. Excluye las de carne y leche exclusivamente.	16.21	25.22	26.73	29.60	-8.35	-34.09	19.70	-3.32	-9.30	36.12
923200 Servicios médicos, odontológicos y veterinarios prestados por el sector público.	--	--	--	--	0.00	--	16.58	63.78	--	23.16
502000 Instalaciones.	0.00	0.00	0.00	0.00	14.74	32.61	0.00	0.00	0.00	20.07
111200 Ganadería y caza.	1.92	1.79	32.39	43.46	14.74	49.52	0.00	0.00	--	19.46
971000 Servicios para la agricultura y la ganadería. Incluye distribución de agua en obras de riego.	--	2.63	0.00	--	0.00	16.31	36.48	74.40	30.23	19.02
292000 Extracción y/o beneficio de otros minerales no metálicos.	-0.98	3.19	-8.61	0.00	0.00	0.00	28.75	56.86	4.22	17.49
323000 Industria del cuero, pieles y sus productos. Incluye los productos de materiales sucedáneos. Excluye calzados y prendas de vestir de cuero, piel y materiales sucedáneos.	-3.72	2.21	16.79	1.30	22.11	0.00	4.05	57.30	6.05	15.99
621000 Comercio de productos alimenticios, bebidas y tabaco al por menor en establecimientos especializados.	0.00	0.33	6.85	28.49	23.88	57.07	25.39	4.78	44.29	8.49
<b>Center Region</b>										
502000 Instalaciones.	1.59	1.75	1.27	1.33	0.69	0.43	2.04	1.56	-0.18	27.13
384200 Fabricación, reparación y/o ensamble de equipo de transporte y sus partes. Excluye automóviles y camiones.	0.48	0.10	0.01	-0.02	0.86	0.83	0.00	8.42	-0.03	5.87
711200 Autotransporte de carga.	1.68	--	0.08	0.22	0.00	2.16	5.24	1.28	1.80	4.19
942100 Servicios culturales prestados por el sector privado.	1.68	--	1.27	--	--	--	--	--	0.00	3.42
624000 Comercio de productos no alimenticios al por menor, en tiendas de departamentos y almacenes.	-0.69	-0.05	0.00	1.33	1.38	--	--	--	--	2.56
311200 Elaboración de productos lácteos.	-1.63	1.84	1.21	1.21	1.38	1.29	2.03	1.56	1.78	1.58
351300 Industria de las fibras artificiales y/o sintéticas.	1.91	1.78	9.09	1.03	1.45	1.55	1.04	1.56	1.80	1.53
975000 Servicios de intermediarios de comercio.	1.68	1.75	1.27	1.33	1.38	1.29	1.99	1.56	0.00	1.51
353000 Refinación de petróleo.	--	--	--	--	--	--	--	--	--	1.80
711100 transporte ferroviario, metro, tranvías y trolebuses.	1.68	1.75	1.27	1.33	1.38	1.29	2.04	1.56	1.80	1.51
<b>Gulf and Caribbean</b>										
922100 Servicios de investigación científica prestados por el sector privado.	0.00	0.00	5.11	0.00	25.34	0.00	0.00	0.00	0.00	91.29
130000 Pesca.	151.76	44.92	0.00	0.00	97.05	0.00	0.00	0.00	0.00	62.25
501400 Otras construcciones.	0.00	0.00	75.96	67.33	93.92	90.46	0.00	10.73	40.75	50.57
503000 Trabajos especiales.	103.44	77.02	0.00	62.10	0.00	45.85	20.76	18.92	0.00	38.22
501200 Construcción de obras de urbanización.	46.78	42.62	0.00	0.00	184.95	59.35	31.66	33.48	4.46	37.35
979000 Servicios de agencias de viajes y almacenaje.	16.93	1.03	90.33	21.15	8.82	9.85	0.37	14.31	2.99	33.64
384200 Fabricación, reparación y/o ensamble de equipo de transporte y sus partes. Excluye automóviles y camiones.	0.00	-2.12	11.66	0.00	-1.24	5.19	0.00	0.00	-0.28	27.89
501100 Edificación.	-110.26	-65.89	0.00	0.11	26.47	6.98	9.49	22.77	49.06	24.41
923100 Servicios médicos, odontológicos y veterinarios prestados por el sector privado.	0.00	0.00	0.00	9.97	74.36	0.00	0.00	0.00	0.00	15.18
932000 Hoteles y otros servicios de alojamiento temporal.	17.44	15.73	30.83	2.45	8.85	12.54	7.98	10.77	15.80	13.28

Source: own elaboration based on SE (2008:c).

This broad specialization pattern will be deepened in the next chapter at the state-level; table 7 clearly allows for additional in-depth spatial analysis. In addition, in the next chapter this specialization index will allow us to calculate the territorial relevance of the autoparts-automobile and electronics commodity chains in Mexico according to this criteria. Tamaulipas, Mexico City and Chihuahua are the other three important states with a substantial specialization in electronics, while in the rest of Mexico FDI is minor.

Table 7  
Regional FDI specialization patterns in Mexico in autoparts, automobiles and electronics (1999-2007)

	Automobiles				Autoparts				Autoparts and Automobiles				Electronics			
	FDI for 1999-2007	Specialization Index			FDI for 1999-2007	Specialization Index			FDI for 1999-2007	Specialization Index			FDI for 1999-2007	Specialization Index		
	1999	2007	1999-2007		1999	2007	1999-2007		1999	2007	1999-2007		1999	2007	1999-2007	
National	15,400	---	---	---	30	---	---	---	15,430	---	---	---	9,783	---	---	
AGUASCALIENTES	666	0.75	13.36	8.63	---	---	---	---	666	0.74	14.80	8.87	26	2.03	0.00	
BAJA CALIFORNIA NORTE	203	0.05	0.30	0.29	61	3.92	-1.05	44.80	264	0.10	0.45	0.38	2,268	1.78	6.69	
BAJA CALIFORNIA SUR	---	---	---	---	0	0.51	0.00	1.53	0	0.01	0.00	0.00	---	---	---	
CAMPUCHE	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
COAHUILA	517	1.83	4.06	3.46	---	---	---	---	517	1.81	4.50	3.45	79	0.15	1.52	
COLIMA	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
CHIHUAHUA	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
CHIHUAHUA	2,229	0.77	4.36	3.05	4	0.00	-0.01	2.55	2,233	0.76	4.83	3.05	1,469	1.96	3.06	
DISTRITO FEDERAL	5,557	1.67	0.41	0.61	113	0.62	-0.03	6.56	5,469	1.66	0.45	0.62	874	0.33	0.02	
DURANGO	31	0.00	4.44	0.71	2	10.33	0.00	17.77	33	0.13	4.92	0.74	---	---	---	
GUANAJUATO	844	3.33	7.25	7.70	1	0.00	0.00	4.73	845	3.29	8.03	7.69	---	---	---	
GUERRERO	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
HIDALGO	48	0.00	0.00	9.69	4	0.00	0.00	289.12	72	0.00	0.00	10.23	---	---	---	
MEXICO	1,063	0.31	1.27	1.20	---	0.00	0.00	0.00	1,063	0.31	1.41	1.20	330	3.15	4.50	
JALISCO	285	-0.04	0.60	0.64	-207	8.35	91.05	-242.94	78	0.06	-0.12	0.18	2,245	4.25	17.19	
MICHOACÁN	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
MORRELOS	92	0.05	1.73	0.86	---	---	---	---	92	0.05	1.91	0.86	14	0.71	0.00	
NAVARIT	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
NEUVO LEÓN	1,154	0.30	0.42	0.70	---	---	---	---	1,154	0.30	0.47	0.69	672	0.27	-0.07	
OAXACA	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
PUEBLA	1,719	-0.50	6.86	4.66	---	---	---	---	1,719	-0.49	7.59	4.65	249	0.01	2.07	
QUERÉTARO	340	0.24	5.04	3.14	3	0.00	0.00	13.41	343	0.23	5.58	3.16	26	0.00	0.48	
QUINTANA ROO	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
SAN LUIS POTOSÍ	174	0.37	6.40	1.96	---	---	---	---	174	0.36	7.09	1.96	4	0.10	0.30	
SINALOA	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
SONORA	140	0.36	0.15	0.67	---	---	---	---	140	0.36	0.17	0.67	583	1.86	2.95	
TABASCO	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
TAMAULIPAS	510	1.08	1.62	1.87	40	1.09	-0.35	72.29	570	1.08	1.83	2.01	910	2.24	6.74	
TLAXCALA	18	5.38	0.00	0.91	---	---	---	---	18	5.32	0.00	0.91	-1	0.28	0.00	
VERACRUZ	---	---	---	---	12	0.00	-7.73	135.80	12	0.00	0.83	0.26	0	0.00	0.00	
YUCATÁN	0	0.00	0.08	0.01	---	---	---	---	0	0.00	0.09	0.01	13	0.36	0.66	
ZACATECAS	---	---	---	---	---	---	---	---	---	---	---	---	23	0.00	5.29	
Northern Border	4,745	0.11	0.38	0.28	104	0.44	-0.06	4.15	4,849	0.11	0.44	0.29	5,980	0.22	0.38	
Southern Region	---	---	---	---	---	---	---	---	---	---	---	---	0	0.00	0.00	
Pacific Region	280	-0.03	0.11	0.43	-207	7.27	12.06	-157.04	82	0.06	-1.18	0.12	2,245	3.70	2.28	
Center-North Region	2,052	1.06	7.74	4.73	5	0.41	0.00	6.46	2,058	1.05	8.57	4.73	79	0.33	0.51	
Center-Region	8,314	1.37	0.63	0.82	116	0.48	-0.03	5.87	8,429	1.35	0.70	0.83	1,466	0.75	0.24	
Gulf and Caribbean	0	0.00	0.01	0.00	12	0.00	-0.28	27.89	12	0.00	0.04	0.06	13	0.12	0.09	

Source: own elaboration based on SE (2008:c).

## FDI and Science and Technology Expenditures: A Territorial Perspective

Based on the prior 3 chapters, this section will discuss in detail the relationship between FDI and science and technology expenditures, among other variables, to understand the effects of FDI on innovation, but also on other variables such as trade, employment and wage variables. The source of this chapter will be Mexico's Economic Census of 2004. As a result, the chapter will be divided in two sections. The first will introduce the national and territorial performance of Mexico based on the branch-level science and technology expenditures (S&T), and in particular for the electronics and autoparts-automobile chains, as defined earlier. This general performance will allow to discuss the characteristics of this unique data set and present a typology of Mexico's manufacturing big firms divided in three groups: a) those with FDI from 0.1% to 49%, b) those without FDI, and c) those with a FDI share above 50% of its capital. These three groups of manufacturing big firms will prove to be very significant for understanding their respective performance in terms of science and technology expenditures and their overall socioeconomic performance. The second part will elaborate on several econometric models in order to associate S&T with other variables such as productivity, trade and investment by the 3 groups of branches according to their level of FDI, also by state and for the autoparts-automobile and electronic branches.

It is important to highlight that the specific universe of firms, i.e. the Big Manufacturing Firms (BMF), is biased considering that the manufacturing sector is the most dynamic in terms of FDI and S&T activities, in addition to high levels of trade and productivity compared to the rest of Mexico's economy and other segments of smaller firms (Dussel Peters et. al 2007).

It is also relevant to briefly discuss the source of the data presented below, since it is the first time it has been used to analyze this specific topic in Mexico. Mexico's Economic Census –which is published every 5 years and for the last time in 2004 with information of 2003- represents the best socioeconomic information in Mexico, based on more than 4 million firms and a vast number of variables (INEGI 2008). In this case, INEGI directly allowed us to have access to a part of branch and state-level data of Mexico's Economic Census of 2004 based on the percentage of FDI over social capital (question D312 of the Economic Census).<sup>20</sup> Based on this criteria, we obtained from INEGI information for all Mexican states and their respective branches<sup>21</sup> for the big manufacturing firms (the only ones for which this specific questionnaire was done). INEGI's criteria for selecting in 2003 big manufacturing firms were: a) more than 50 workers, or b) annual income above 5 million pesos (or around 500,000 \$US), or c) firms that presented establishments in at least two states in Mexico (INEGI 2008/b). As a result, the total universe of big manufacturing firms accounts for 40,004 companies that responded to more than 250 questions.

The data set obtained from INEGI was additionally disaggregated according to the answer of the big manufacturing firms on their FDI / social capital share, i.e. those with no FDI, those with a share below 50% and those above 50%. The former structure allows to differentiate according to this criteria –and one of the main topics of this paper- and to associate branch and state-level information with other variables such as S&T depending on the controlling stake of FDI by branch and state in Mexico.<sup>22</sup>

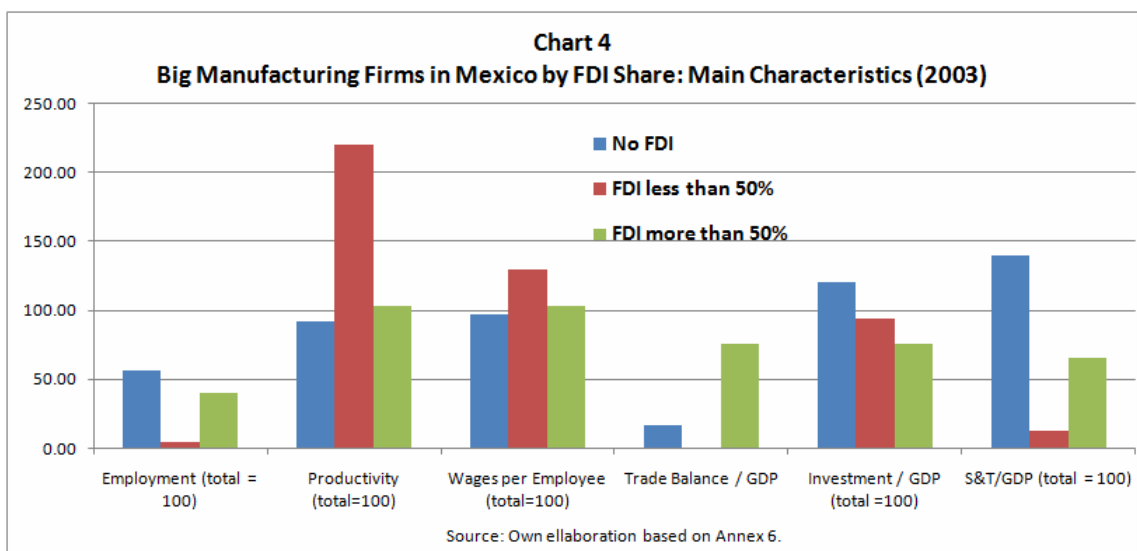
We are very thankful to the Instituto Nacional de Estadísticas, Geografía e Informática (INEGI) for their support.

## **Overall Productive Specialization Patterns**

Table 8 presents the main characteristics of Mexico's big manufacturing firms (BMF) and depending on the share of FDI on total social capital of the respective firm. Several issues stand out:

1. A relatively low coefficient of Science and Technology (S&T) expenditure over total GDP (understood as the Census' value-added) of 4.32% for all BMF. Surprisingly, branches with no FDI at all present the highest coefficient (of 6% of GDP), while branches with FDI present significantly lower coefficients (of 0.51% and 2.82% for branches with less and more than 50% of FDI over the respective social capital).

2. Chart 4 also presents the main results when comparing the three groups of firms according to their share over their respective social capital, in addition to their S&T performance. BMF branches with no FDI at all account for 56% of total employment and the lowest productivity levels (and only slightly below those branches with more than 50% of FDI); the same group of branches also presents the highest levels of investments / GDP (of 15.8%) and a positive trade balance.
3. Firms with a FDI in BMF present a much higher export-orientation than the rest of the firms –of 148% of their GDP for the case of an FDI / social capital above 50% and thus reflecting a high share of processes based on temporary imports to be reexported-, but the lowest rate in terms of investments and S&T coefficients.<sup>23</sup>
4. Rather surprisingly, firms with an FDI share over total social capital below 50% present the highest results in terms of productivity and wages; in both cases results are significantly above firms with no FDI and those with a controlling stake.



5. Table 8 and Annex 7 also offer a very detailed picture of the main branches and their conditions in terms of productivity, wages, trade, investment and S&T. In general, it stands out that some branches present S&T / GDP coefficients above 100%, mostly in branches related to navigational equipment, telecommunications, and electrical equipment. In addition, out of the total 86 branches, only 9 present S&T coefficients above the BMF average. On the opposite side, i.e. branches with the lowest S&T / GDP coefficient, 20 branches or almost 25% of all BMF branches, present coefficients or practically no S&T at all.

Table 8  
Main Characteristics of Mexico's Big Manufacturing Firms (at the branch level) (2003)

Branch	All Big Manufacturing Firms							All Big Manufacturing Firms, no FDI							All Big Manufacturing Firms, FDI more than 50% of social capital							
	Employment (total = 100)	Productivity (total=100)	Wages (per employee, total=100)	Imports / GDP	Exports	Investment / GDP	S&T / GDP	Employment (total = 100)	Productivity (total=100)	Wages (per employee, total=100)	Imports / GDP	Exports	Investment / GDP	S&T / GDP	Employment (total = 100)	Productivity (total=100)	Wages (per employee, total=100)	Imports / GDP	Exports	Investment / GDP	S&T / GDP	
TOTAL	100.00	100.00	100.00	62.94	101.21	13.18	4.32	57.96	90.98	96.56	56.92	72.86	15.75	6.00	39.53	102.78	102.51	72.59	148.00	9.91	2.82	
Ten Branches with highest S&T / GDP coefficient (for all Big Manufacturing Firms)																						
RAMA 1345 FABRICACION DE INSTRUMENTOS DE NAVEGACION, MEDICION, MEDICION Y DE CONTROL	0.26	47.30	71.14	58.00	210.45	5.39	186.45	0.16	32.82	50.85	93.85	146.63	11.50	622.64	0.18	59.64	87.62	43.45	242.34	2.52	0.14	
RAMA 1342 FABRICACION DE EQUIPO DE COMUNICACION	0.87	57.40	71.87	61.78	187.62	2.52	93.38	0.11	97.01	91.09	49.23	97.30	1.76	185.03	0.76	51.15	70.07	66.15	215.98	0.69	44.19	
RAMA 1314 Industria de maquinas no ferreas, excepto automotrices	0.31	228.16	126.96	106.55	243.07	24.09	83.27	1.30	231.59	128.85	109.72	242.88	24.14	84.56	0.00	0.00	0.00	0.00	0.00	...	0.00	
RAMA 1319 FABRICACION DE OTROS EQUIPOS Y ACCESORIOS ELECTRICOS	1.34	83.35	89.65	47.63	119.35	6.50	70.96	0.51	79.93	86.54	90.77	115.99	8.46	210.51	0.76	75.78	86.79	20.60	123.47	5.03	0.42	
RAMA 1341 FABRICACION DE COMPUTADORAS Y EQUIPO PERIFERICO	1.36	76.30	91.63	459.22	564.74	3.01	134.85	0.14	172.83	128.60	1065.88	1161.03	-18.52	0.60	1.18	66.25	88.11	288.33	402.14	8.88	0.29	
RAMA 1316 OTORILLAS INDUSTRIALES MANUFACTURERAS	1.74	50.91	70.00	29.94	89.68	6.64	29.92	1.30	43.97	64.82	29.42	41.51	8.22	45.93	0.84	58.34	74.71	28.12	132.59	4.97	0.27	
RAMA 1321 DISEÑOS Y DISEÑOS DE CONFECCION	1.40	64.20	87.37	16.01	16.73	10.66	12.77	1.33	64.38	87.69	12.07	1.21	11.37	14.34	0.22	63.81	82.46	28.61	74.12	5.94	0.22	
RAMA 1322 FABRICACION DE PRODUCTOS DE PAPEL Y CARTON	1.73	98.84	93.57	61.06	34.90	19.44	10.31	1.33	78.16	88.45	36.20	12.43	19.92	17.97	0.41	174.28	101.26	70.85	65.30	15.01	0.51	
RAMA 1312 FABRICACION DE TELAS	1.53	64.01	86.62	52.87	69.45	7.59	8.52	1.56	56.82	87.87	44.56	41.65	-0.39	10.81	0.13	114.17	85.02	61.52	126.64	49.61	0.00	
RAMA 1363 FABRICACION DE PARTES PARA VEHICULOS AUTOMOTORES	12.92	88.86	94.84	52.29	142.09	13.20	3.20	2.94	116.21	101.30	48.58	129.86	12.09	6.83	9.48	79.47	92.37	46.27	148.17	13.29	0.06	
Ten Branches with lowest S&T / GDP coefficient (for all Big Manufacturing Firms)																						
RAMA 1328 RECUBRIMIENTOS Y TERMINACIONES METALICAS	0.44	173.79	112.72	26.76	70.01	4.02	0.03	0.32	196.43	116.16	28.63	65.72	4.28	0.03	0.05	56.10	91.10	0.92	140.79	0.42	0.11	
RAMA 1311 ABRIGADO Y CONSERVACION DE LA MADERA	0.12	32.57	41.35	1.45	7.45	2.12	0.03	0.29	31.99	40.68	1.49	4.38	2.19	0.03	0.00	74.35	89.13	0.00	102.74	0.00	1.17	
RAMA 1313 TIEMPO DE PIEDRAS DE VENTIL DE PUNTO	0.45	40.55	52.00	13.96	68.72	6.15	0.02	0.66	43.56	53.03	8.02	52.68	7.31	0.02	0.09	31.14	46.54	41.52	136.05	4.36	0.00	
RAMA 1318 FABRICACION DE MOTORES DE COMBUSTION INTERNA, TURBINAS Y TRANSDUCIDORES	0.31	162.09	135.10	112.74	238.87	9.87	0.02	0.10	204.21	83.54	151.63	255.23	15.62	0.01	0.22	138.87	174.27	69.93	236.88	2.36	0.18	
RAMA 1319 CONFECCION DE ACCESORIOS DE VEHICULOS	0.04	42.81	53.49	42.89	124.98	3.19	0.02	0.05	51.08	46.93	60.48	122.21	4.38	0.03	0.02	31.06	62.82	1.75	131.44	0.42	0.05	
RAMA 1323 FABRICACION DE HERRAJES Y CERRAJERIAS	0.31	72.06	80.69	12.24	97.99	1.41	0.01	0.12	58.43	61.42	5.46	4.28	-4.62	0.00	0.19	86.22	89.56	17.28	126.83	0.25	0.13	
RAMA 1311 PREPARACION E HILADO DE FIBRAS TEXTILES Y FABRICACION DE FILAS	0.38	60.92	56.99	60.64	55.66	11.90	0.01	0.57	53.84	55.43	24.41	53.23	13.49	0.01	0.05	124.31	71.98	81.18	52.80	7.46	0.15	
RAMA 1364 FABRICACION DE EQUIPO AEROSPAZIAL	0.18	67.44	108.63	4.67	206.84	2.28	0.00	0.05	78.98	134.80	8.60	137.55	1.56	0.00	0.11	62.11	96.54	2.37	247.53	2.70	1.88	
RAMA 1366 FABRICACION DE EMBARCACIONES	0.03	46.91	85.68	3.03	89.15	-0.74	0.00	0.01	40.74	107.05	2.40	5.40	-2.83	0.00	0.01	51.77	68.86	3.41	141.02	0.56	0.00	
RAMA 1341 FABRICACION DE PRODUCTOS DERIVADOS DEL PETROLEO Y DEL CARBON	5.92	-184.47	418.93	-43.74	-19.35	-34.32	-0.01	1.37	-508.72	428.13	-41.96	-18.68	-33.46	-0.01	0.02	324.64	74.02	42.70	2.47	9.12	0.48	

Source: own elaboration based on DISEG (see Annex 6).

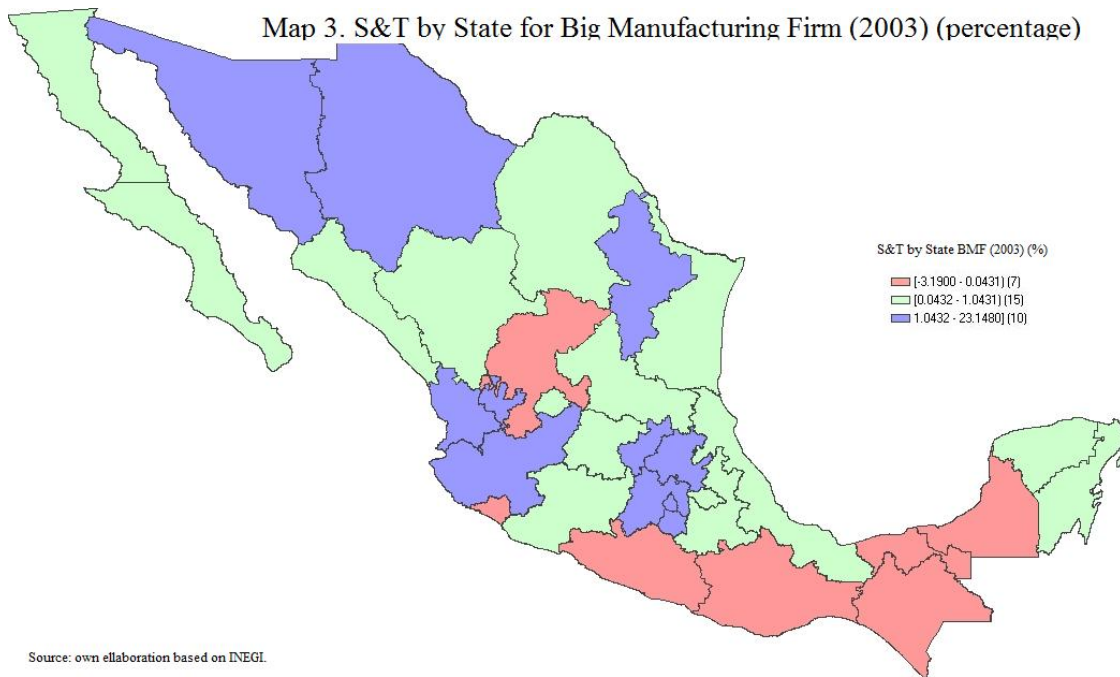
Table 10  
Main Characteristics of Mexico's Big Manufacturing Firms in the Airports and Automobile Chain by State (2003)

	All Big Manufacturing Firms							All Big Manufacturing Firms, no FDI							All Big Manufacturing Firms, FDI less than 50% of social capital							All Big Manufacturing Firms, FDI more than 50% of social capital						
	Employment (total = 100)	Productivity (total=100)	Wages (per employee, total=100)	Imports / GDP	Exports	Investment / GDP	S&T / GDP	Employment (total = 100)	Productivity (total=100)	Wages (per employee, total=100)	Imports / GDP	Exports	Investment / GDP	S&T / GDP	Employment (total = 100)	Productivity (total=100)	Wages (per employee, total=100)	Imports / GDP	Exports	Investment / GDP	S&T / GDP	Employment (total = 100)	Productivity (total=100)	Wages (per employee, total=100)	Imports / GDP	Exports	Investment / GDP	S&T / GDP
AGUASCALIENTES	1.75	120.30	92.87	54.33	121.85	4.66	0.66	1.04	123.19	89.57	60.22	122.97	7.39	1.06	0.01	665.29	131.31	1.90	4.76	11.83	0.00	0.70	110.55	97.36	47.70	127.55	5.14	0.03
BAJA CALIFORNIA	7.43	65.55	94.84	24.57	111.27	4.00	0.78	1.80	88.39	86.98	22.26	66.98	7.09	0.29	0.17	149.42	155.95	8.27	91.09	14.30	0.00	5.45	55.31	95.50	27.20	186.39	1.49	1.11
BAJA CALIFORNIA SUR	0.10	63.29	88.36	3.59	8.34	11.21	0.10	0.10	60.63	87.71	3.63	2.12	12.18	0.18	0.00	90.19	227.96	3.56	20.69	0.45	0.00	1.43	293.88	0.94	0.04	0.00	0.00	
CAMPECHE	0.28	35.30	59.26	28.93	104.25	11.57	0.02	0.10	52.87	78.08	6.37	43.17	4.82	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	24.78	88.60	87.75	102.31	20.19	0.00
CHIHUAHUA	6.03	102.13	89.60	122.66	217.68	15.22	0.28	2.49	115.32	71.28	132.56	196.34	7.69	0.38	0.58	188.46	105.52	29.68	56.04	8.47	0.00	2.97	72.20	82.53	149.27	311.62	27.15	0.21
CHIHUAHUA	0.15	228.71	89.66	3.21	30.66	13.03	0.03	0.11	242.92	96.06	2.10	11.24	15.79	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	142.82	30.99	14.62	4.62	3.54	0.19
COAHUILA	0.34	494.28	126.71	1.22	36.54	0.00	0.28	0.28	170.69	105.18	0.04	21.31	5.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	103.89	42.34	34.52	9.00	0.00
COLIMA	10.38	86.29	97.17	21.89	141.25	2.08	8.09	1.61	121.41	105.17	17.44	95.56	3.29	15.73	0.05	81.18	127.21	11.21	104.01	24.12	0.00	1.73	77.83	95.52	17.07	155.79	1.87	0.73
ESTADO FEDERAL	10.88	79.78	123.42	42.60	18.54	13.61	3.82	9.03	49.49	107.43	44.80	24.82	17.07	6.62	0.36	356.29	218.18	47.43	15.70	16.49	2.00	1.47	241.41	189.15	18.63	12.09	6.79	0.16
JALISCO	1.86	55.09	53.33	36.78	85.66	16.63	0.19	1.33	54.15	51.74	32.37	49.22	18.39	0.14	0.19	26.37	15.09	85.66	166.42	1.21	0.04	0.34	79.54	81.43	39.32	166.58	16.57	0.35
ESTADO DE MEXICO	4.54	101.26	83.03	99.35	194.01	13.60	0.54	3.65	94.55	88.24	107.03	219.56	12.15	0.66	0.14	43.74	78.06	76.41	15.73	32.60	0.03	0.78	72.69	58.54	76.12	128.60	22.54	0.41
GUANAJUATO	0.21	121.87	9.97	70.15	6.65	18.25	0.20	0.01	113.11	66.30	1.30	6.65	17.58	0.00	0.00	2273.51	117.46	0.00	-0.59	0.00	0.00	0.11	23.09	177.33	-2.99	-458.81	-22.40	0.00
GUERRERO	1.61	21.61	107.95	108.62	160.86	10.00	2.45	1.14	11.80	103.87	368.99	207.77	25.84	4.22	0.02	96.80	52.90	48.82	69.93	36.82	3.78	0.15	109.29	87.92	39.07	87.25	-7.78	0.42
HIDALGO	7.99	103.36	87.48	95.71	110.64	10.84	7.22	6.02	94.84	83.49	69.81	82.14	11.52	1.90	0.12	71.90	171.41	30.41	68.43	39.17	0.21	1.89	127.23	92.39	109.49	167.02	9.01	17.71
JALISCO	10.93	140.76	109.45	58.45	57.23	8.02	2.21	1.51	104.51	93.89	33.62	24.80	8.44	3.67	0.45	342.62	147.94	63.43	55.21	21.60	0.07	1.87	246.47	168.88	104.29	212.12	7.57	0.28
MICHUACAN	0.85	126.03	62.92	40.88	21.94	5.61	0.43	0.76	139.09	60.16	33.49	19.76	4.79	0.47	0.03	200.96	47.95	32.89	14.17	11.11	0.08	0.05	129.65	112.28	150.26	61.74	1.93	0.30
MORELOS	0.60	279.24	94.34	17.41	29.87	5.81	12.04	0.47	343.99	103.69	8.97	8.50	5.91	13.71	0.09	139.15	72.49	92.07	182.74	9.00	0.05	0.69	139.15	72.49	62.07	182.74	9.00	0.04
NAYARIT	0.31	99.46	116.01	13.61	16.22	1.47	0.12	0.12	101.29	117.40	0.33	3.09	10.39	1.59	0.01	111.55	106.76	0.04	157.62	10.64	0.00	0.00	-37.60	86.11	0.00	0.00	-1.51	0.00
QUEZARUO	8.75	97.87	115.63	74.11	120.13	24.62	10																					

Table 9 presents the information, but now for all Mexican states and Mexico City. First, the Northern Border and Center-Region states account for more than 2/3 of the BMF employment, while the Southern Region and Golf and Caribbean play a minor role in this data set. Second, the two main regions –the Northern Border and the Center-Region– present similar patterns in terms of their weight over employment, productivity and even wages, with some differences. The main differences, however, refer to the higher performance of the Northern Border states in contrast to the Center-Region: in terms of S&T coefficients, for example, the Northern Border is more than twice as high -6.86% vs. 2.66%-, and more than 3 times as high for BMF with no FDI (see map 3); the investment / GDP index calculated is also almost 30% higher in the Northern Border vs. the Center-Region. This is probably one of the most relevant results in terms of the North-South cleavage within Mexico and a substantial association between trade, export-orientation, investments and S&T, vs. Mexico’s Center, but also the rest of the country.

	Total	Northern Border	Southern Region	Pacific Region	Center-North Region	Center-Region	Golf and Caribbean
<b>All Big Manufacturing Firms</b>							
Employment (total=100)	100.00	35.79	1.29	9.97	14.17	33.51	5.26
Productivity (total=100)	100.00	88.15	150.15	101.78	103.53	102.74	137.99
Wages (per worker, total=100)	100.00	99.63	146.31	83.95	82.91	105.82	130.57
Imports / GDP	62.94	66.09	56.42	79.81	75.89	54.30	28.22
Exports / GDP	101.21	145.39	59.17	75.89	129.56	57.56	47.62
Investment / GDP	13.18	13.74	37.38	11.72	11.72	10.97	22.57
S&T / GDP	4.32	6.86	0.67	5.67	3.38	2.66	0.12
<b>Big Manufacturing Firms, no FDI</b>							
Employment (total=100)	35.90	8.80	0.62	4.23	5.72	14.36	2.18
Productivity (total=100)	90.98	93.18	149.12	97.66	96.99	76.21	134.23
Wages (per worker, total=100)	96.56	100.29	149.02	80.78	82.98	95.72	138.37
Imports / GDP	56.92	93.24	58.70	55.16	65.94	35.39	20.50
Exports / GDP	72.86	109.85	62.01	62.83	137.90	27.96	31.44
Investment / GDP	15.75	21.72	39.76	10.16	12.03	10.74	25.18
S&T / GDP	6.00	14.28	0.72	1.46	3.66	4.71	0.11
<b>Big Manufacturing Firms, FDI less than 50%</b>							
Employment (total=100)	3.48	1.51	0.00	0.17	0.54	1.14	0.12
Productivity (total=100)	219.54	176.55	1113.70	117.61	187.01	279.30	458.95
Wages (per worker, total=100)	129.55	131.21	103.98	141.81	61.84	157.64	127.76
Imports / GDP	54.39	41.47	6.87	29.31	83.92	60.10	41.91
Exports / GDP	54.08	69.26	10.64	47.10	48.68	48.45	28.33
Investment / GDP	12.34	14.12	0.93	22.21	11.25	10.80	11.78
S&T / GDP	0.51	0.51	0.00	0.47	0.04	0.74	0.00
<b>Big Manufacturing Firms, FDI more than 50%</b>							
Employment (total=100)	38.57	26.35	0.08	2.12	3.35	5.25	1.23
Productivity (total=100)	102.78	72.13	80.37	123.83	110.96	251.55	95.60
Wages (per worker, total=100)	102.51	98.05	143.11	84.86	83.35	111.20	124.38
Imports / GDP	72.59	50.62	32.00	146.32	97.67	78.21	52.90
Exports / GDP	148.00	180.82	20.70	163.22	132.39	99.38	121.48
Investment / GDP	9.91	8.13	2.62	8.83	11.11	11.32	17.08
S&T / GDP	2.81	2.57	0.00	16.74	3.59	0.39	0.21

Source: own elaboration based on INEGI.



Tables 10 and 11 present the main features of the autoparts-automobile and electronic chains, in particular:

1. The autoparts-automobile chain account for very low levels of S&T / GDP, of only 2.03% for the chain and compared with a 4.29% for all the sample of BMF. By far, branches with no FDI account for the highest coefficient of S&T, of 3.42%, while branches with a share of FDI over 50% only accounted for 1.33% (see table 10). The same chain accounts for very high exports / GDP –of 219%–, and in particular for those branches with a share of over 50% of FDI over its respective social capital. In both cases in which FDI play a role in social capital the investment / GDP coefficient is higher than for those branches without FDI. Very significant is also that 72% of total employment in the chain is represented by firms with a controlling stake by FDI.
2. In the electronic chain similar features are reflected: in contrast to the rest of the economy, the S&T /GDP coefficient is extremely high –of 14.64%–, but in particular for the non-FDI branches, with a coefficient of 39.93%, while it is only of 0.02% and 7.60% for branches with FDI levels below and above 50% of social capital.

Table 10  
Main Characteristics of Mexico's Big Manufacturing Firms in the Autoports and Automobile Chais by State (2003)

	All Big Manufacturing Firms						All Big Manufacturing Firms, no FDI						All Big Manufacturing Firms, FDI less than 50% of social capital						All Big Manufacturing Firms, FDI more than 50% of social capital									
	Employment (total = 100)	Productivity (total=100)	Wages (per employee, total=100)	Imports / GDP	Exports	Investments / GDP	S&T / GDP	Employment (total = 100)	Productivity (total=100)	Wages (per employee, total=100)	Imports / GDP	Exports	Investments / GDP	S&T / GDP	Employment (total = 100)	Productivity (total=100)	Wages (per employee, total=100)	Imports / GDP	Exports	Investments / GDP	S&T / GDP	Employment (total = 100)	Productivity (total=100)	Wages (per employee, total=100)	Imports / GDP	Exports	Investments / GDP	S&T / GDP
AGUASCALIENTES	2.52	172.84	169.96	87.99	161.14	5.28	0.42	1.21	269.58	202.58	176.07	89.33	3.44	0.49	0.48	53.17	179.19	15.55	163.65	5.18	0.00	0.83	72.19	117.04	111.15	72.76	16.06	0.18
BAJA CALIFORNIA	2.63	54.06	124.72	97.65	135.27	-14.31	0.00	1.14	38.49	89.53	127.94	9.14	1.26	0.00	0.00	--	--	--	--	--	--	1.50	65.88	151.43	136.91	138.53	-21.21	0.00
BAJA CALIFORNIA SUR	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--
CAMPESHE	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--
CHIHUAHUA	14.29	78.69	75.04	265.67	428.16	27.38	0.16	4.69	114.58	87.60	350.00	257.10	4.21	0.00	0.11	39.64	27.92	1119.66	1391.94	65.72	0.00	9.49	61.40	84.18	266.01	493.29	48.46	0.31
CHUBUTLA	0.02	90.20	92.30	19.67	31.92	0.00	1.33	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--	0.02	90.20	92.30	19.67	31.92	0.00	1.33
COAHUILA	0.28	32.54	29.54	72.33	0.00	0.37	0.00	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--	0.28	32.54	29.54	72.33	0.00	0.37	0.00
COLEMA	32.17	59.92	95.91	13.04	151.26	0.96	0.01	1.48	106.92	131.75	153.32	20.82	-0.58	0.01	0.07	-11.36	134.46	0.00	0.00	0.00	0.00	30.62	57.60	94.09	12.34	151.01	1.10	0.01
DISTRITO FEDERAL	2.12	-8.40	123.24	-696.82	-503.65	-60.54	-6.01	1.55	-18.38	122.30	-211.18	-371.35	-14.37	-2.79	0.15	33.32	108.92	146.83	84.19	1.56	0.07	0.42	13.81	133.85	187.43	438.07	114.64	4.71
DURANGO	0.46	82.09	86.45	14.44	150.64	31.41	1.74	0.31	35.90	43.37	46.55	6.82	4.84	3.81	0.00	--	--	--	--	--	--	0.16	83.53	170.14	20.79	237.55	53.60	0.01
ESTADO DE MEXICO	2.88	-135.32	81.90	114.11	275.50	-4.64	0.07	1.72	653.47	113.38	300.06	106.41	0.94	0.07	0.56	171.66	41.88	209.98	36.55	32.50	0.00	0.61	59.62	29.50	100.15	143.65	45.93	0.01
GUANAJUATO	0.00	20.93	26.28	0.00	0.00	0.00	0.00	0.00	20.93	26.28	0.00	0.00	0.00	0.00	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--
GUERRERO	0.03	47.60	68.33	0.00	0.00	0.00	0.12	0.03	47.60	68.33	0.00	0.00	0.00	0.02	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--
HALDAGO	1.94	69.65	84.94	317.88	171.09	12.14	0.07	0.59	23.23	51.33	128.87	72.96	32.88	0.21	0.02	38.82	0.00	0.00	0.00	0.14	0.00	1.33	90.63	100.97	347.39	176.77	9.84	0.06
JALISCO	7.55	128.44	128.45	230.35	306.60	-2.00	0.88	3.93	101.09	119.67	101.65	89.39	-0.78	1.98	1.11	146.37	199.93	279.61	276.63	3.94	0.04	2.50	167.86	137.14	345.91	511.20	-5.32	0.09
MICHOACAN	0.03	37.15	83.24	0.62	0.00	0.23	0.00	0.03	37.15	83.24	0.00	0.62	0.23	0.00	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--
MORELOS	0.68	219.44	177.34	174.36	133.99	0.39	71.07	0.02	58.19	83.00	202.77	33.03	11.17	8149.87	0.00	--	--	--	--	--	--	0.66	224.92	180.54	175.60	133.38	0.29	0.12
NAYARIT	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--
NEUVO LEON	7.85	93.25	90.33	74.36	146.34	18.72	1.56	2.43	166.46	118.91	105.43	40.37	21.81	0.26	0.24	119.75	182.68	174.41	153.98	-27.96	0.90	4.96	83.32	70.79	119.53	212.92	12.44	3.76
OAXACA	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--
PUEBLA	5.06	349.22	181.44	96.07	174.56	20.62	0.32	0.85	103.69	92.15	102.83	67.65	30.27	0.13	0.00	--	--	--	--	--	--	4.21	368.55	207.78	99.69	178.31	20.12	0.33
QUERETARO	2.74	148.64	126.80	83.73	126.36	10.59	13.82	1.85	149.24	132.96	126.91	63.41	13.12	0.53	0.05	114.30	151.26	64.77	0.00	-8.32	0.00	0.84	136.70	111.70	135.27	143.67	7.11	47.55
QUINTANA ROO	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--
SAN LUIS POTOSI	2.68	86.56	67.33	135.80	146.57	7.63	2.69	0.61	73.96	74.55	69.53	71.38	14.11	0.05	0.21	91.00	71.21	139.76	170.75	1.61	0.00	1.86	80.18	64.52	152.62	164.42	6.60	3.72
SINALOA	0.43	36.67	49.12	10.05	287.97	0.21	0.00	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--	0.43	36.67	49.12	10.05	287.97	0.21	0.00
SONORA	3.85	58.17	80.71	138.83	282.63	7.85	0.02	1.20	23.77	79.24	132.19	0.00	0.00	0.00	0.00	--	--	--	--	--	--	2.65	73.78	81.37	159.13	304.63	9.00	0.02
TABASCO	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--
TAMAULIPAS	8.68	48.85	80.20	11.49	134.33	1.82	0.49	1.31	42.28	79.86	134.14	0.93	0.69	1.32	0.00	--	--	--	--	--	--	7.37	50.02	80.26	13.08	134.36	1.99	0.37
TLAXCALA	0.33	66.98	49.52	92.77	91.13	8.53	0.04	0.25	43.90	65.06	1.49	80.37	15.92	0.07	0.00	--	--	--	--	--	--	0.08	140.52	0.00	105.11	180.35	1.18	0.00
VERACRUZ	0.02	12.76	43.15	23.97	61.16	8.13	0.00	0.02	12.76	43.15	61.16	23.97	8.13	0.00	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--
YUCATAN	0.02	10.05	31.77	0.00	0.00	-9.21	0.00	0.02	10.05	31.77	0.00	0.00	-9.21	0.00	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--
ZACATECAS	0.73	24.96	58.46	0.00	136.82	0.60	0.00	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--	0.73	24.96	58.46	0.00	136.82	0.60	0.00
Northern Border	69.47	65.84	89.27	93.59	222.89	10.24	0.34	12.44	101.30	86.72	218.30	126.54	9.37	0.15	0.41	77.74	135.29	327.44	318.59	33.54	0.80	56.61	57.96	89.50	78.64	223.72	10.35	0.41
Southern Region	0.28	32.44	29.51	71.93	0.00	0.37	0.00	0.00	20.93	26.29	0.00	0.00	0.00	0.00	0.00	--	--	--	--	--	--	0.28	32.44	29.54	72.13	0.00	0.37	0.00
Pacific Region	2.42	63.59	78.58	280.52	178.31	10.68	0.08	0.62	23.80	52.44	120.66	68.35	30.80	0.19	0.02	38.82	0.00	0.00	0.00	0.14	0.00	1.79	77.56	88.31	304.26	185.21	8.60	0.07
Center-North Region	12.01	197.36	106.09	104.32	213.95	6.31	2.77	5.69	317.26	130.75	242.30	101.84	3.64	0.25	1.30	120.64	101.84	154.09	49.85	19.86	0.00	5.02	81.56	79.27	126.00	144.51	12.84	14.94
Center-South Region	15.77	183.38	147.36	151.18	220.19	12.39	4.19	6.61	70.81	114.37	118.69	112.54	6.32	24.42	1.26	124.14	136.25	275.38	270.50	3.87	0.04	7.87	287.68	176.94	150.63	237.85	14.25	0.28
Gulf and Caribbean	0.04	11.20	36.59	11.57	29.51	-0.84	0.00	0.04	11.20	36.59	29.51	11.57	-0.84	0.00	0.00	--	--	--	--	--	--	0.00	--	--	--	--	--	--
<b>TOTAL</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>115.64</b>	<b>219.09</b>	<b>9.93</b>	<b>2.03</b>	<b>25.43</b>	<b>159.63</b>	<b>102.86</b>	<b>216.84</b>	<b>108.43</b>	<b>6.14</b>	<b>3.42</b>	<b>2.99</b>	<b>115.75</b>	<b>120.40</b>	<b>224.64</b>	<b>183.35</b>	<b>13.88</b>	<b>0.09</b>	<b>71.58</b>	<b>85.26</b>	<b>99.13</b>	<b>113.64</b>	<b>222.43</b>	<b>11.91</b>	<b>1.33</b>

Source: own calculations based on DISEI

Table 11  
Main Characteristics of Mexico's Big Manufacturing Firms in the Electronics Chain by State (2003)

	All Big Manufacturing Firms							All Big Manufacturing Firms, no FDI							All Big Manufacturing Firms, FDI less than 50% of social capital							All Big Manufacturing Firms, FDI more than 50% of social capital						
	Employment (total = 100)	Productivity (total=100)	Wages (per employee, total=100)	Imports / GDP	Exports / GDP	Investments / GDP	S&T / GDP	Employment (total = 100)	Productivity (total=100)	Wages (per employee, total=100)	Imports / GDP	Exports / GDP	Investments / GDP	S&T / GDP	Employment (total = 100)	Productivity (total=100)	Wages (per employee, total=100)	Imports / GDP	Exports / GDP	Investments / GDP	S&T / GDP	Employment (total = 100)	Productivity (total=100)	Wages (per employee, total=100)	Imports / GDP	Exports / GDP	Investments / GDP	S&T / GDP
AGUASCALIENTES	1.58	403.35	96.60	81.97	206.85	0.19	0.00	0.00	-14.39	44.26	0.00	0.00	0.00	0.00	0.00	---	---	---	---	---	---	1.58	403.73	96.65	81.97	206.84	---	0.00
BAJA CALIFORNIA	29.29	79.43	101.13	37.62	60.97	1.72	0.39	9.11	52.65	96.07	21.34	100.43	-2.36	0.05	0.32	62.91	146.38	0.07	133.37	1.20	0.00	19.86	91.99	102.73	42.31	49.81	470.68	0.49
BAJA CALIFORNIA SUR	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---
CAMPECHE	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---
CHIAPAS	1.10	56.25	117.63	22.32	0.31	2.52	0.00	0.13	14.41	26.20	377.71	0.90	40.20	0.00	0.01	-1.19	67.29	-405.41	0.00	-67.57	0.00	0.96	62.91	130.85	11.07	0.30	0.24	0.00
CHIHUAHUA	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---
COAHUILA	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---
COLIMA	20.70	141.48	105.46	43.63	87.53	1.43	38.10	4.30	177.75	116.48	88.00	178.88	0.11	71.36	0.00	---	---	---	---	---	18.40	131.96	103.10	27.94	15.23	203.26	28.34	
DISTRITO FEDERAL	1.48	59.53	99.60	95.04	122.76	4.58	0.47	2.59	45.85	101.87	73.14	43.87	6.18	0.91	0.23	15.92	92.40	4.05	0.00	17.58	0.45	0.65	128.74	93.10	129.81	219.29	59.98	0.00
DURANGO	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---
ESTADO DE MEXICO	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---
GUANAJUATO	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---
GUERRERO	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---
HIDALGO	11.68	110.13	66.85	591.18	701.98	-0.05	0.13	3.87	98.40	105.33	1135.25	1277.51	-17.75	0.10	0.00	---	---	---	---	---	7.81	115.93	47.80	362.61	460.19	112.53	0.34	
JALISCO	3.87	58.31	80.11	185.27	99.34	17.58	0.65	1.17	41.14	79.32	238.01	117.16	12.99	0.02	0.14	155.48	56.93	1.26	5.41	36.84	0.00	0.16	144.17	134.10	130.76	211.67	49.23	0.31
MICHOACAN	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---
MORELOS	0.01	33.27	125.28	0.00	0.00	-0.85	0.00	0.01	33.27	125.28	0.00	0.00	-0.85	0.00	0.00	---	---	---	---	---	0.00	---	---	---	---	---	---	---
NAYARIT	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---
NEUCHATEL	4.85	93.73	116.32	291.05	353.91	1.25	0.14	1.69	49.02	150.86	11.83	90.97	-2.76	0.68	0.83	70.83	116.94	6.06	134.13	1.36	0.00	2.03	140.45	87.23	431.48	476.06	760.95	0.01
OAXACA	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---
PUEBLA	0.00	16.88	77.09	0.00	6.88	3.88	0.00	0.00	16.88	77.09	0.00	6.88	3.88	0.00	0.00	---	---	---	---	---	0.00	---	---	---	---	---	---	---
QUERETARO	1.15	146.25	150.54	218.62	268.44	3.34	2.39	0.70	125.06	153.53	47.78	39.09	-4.90	4.50	0.01	308.20	270.38	513.11	2.63	2.91	0.00	0.44	176.53	147.23	407.09	396.88	93.56	0.11
QUINTANA ROO	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---
SAN LUIS POTOSI	0.50	25.07	61.34	7.75	7.88	7.79	0.92	0.50	25.07	61.34	7.75	7.88	7.79	0.92	0.00	---	---	---	---	---	0.00	---	---	---	---	---	---	---
SINALOA	0.15	30.36	107.31	188.07	0.27	2.03	0.00	0.15	23.01	102.07	220.79	0.00	1.08	0.00	0.00	---	---	---	---	---	0.00	---	---	---	---	---	---	---
SONORA	11.51	54.19	89.90	26.54	40.60	-0.25	53.14	4.38	34.13	96.67	42.52	161.50	-2.58	221.75	0.00	---	---	---	---	---	0.00	---	---	---	---	---	---	---
TABASCO	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---
TAMAULIPAS	10.10	107.01	133.46	12.85	2.51	1.41	0.05	0.05	33.32	124.46	0.00	0.00	0.16	0.00	0.12	71.28	27.11	0.00	110.11	0.00	0.13	9.92	107.84	134.83	12.98	1.63	---	0.05
TLASCALA	0.29	76.81	41.62	214.47	334.29	0.00	0.00	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.29	76.81	41.62	214.47	334.29	---	0.00
VERACRUZ	0.00	-15.31	44.26	0.00	0.00	0.00	0.00	0.00	-15.31	44.26	0.00	0.00	0.00	0.00	0.00	---	---	---	---	---	0.00	---	---	---	---	---	---	---
YUCATAN	0.17	38.60	8.79	49.75	4.43	16.49	0.88	0.04	-62.80	20.71	0.00	-3.81	-8.55	0.00	0.00	---	---	---	---	---	0.17	38.60	8.79	49.75	4.43	16.49	0.88	0.64
ZACATECAS	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---
Northern Border	77.25	96.42	105.98	48.86	77.51	1.37	19.57	19.67	75.29	102.33	61.85	146.34	0.77	59.30	1.29	68.15	115.10	4.17	131.58	1.20	0.01	56.29	104.44	107.04	47.52	59.37	236.60	9.85
Southern Region	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---	0.00	---	---	---	---	---	---
Pacific Region	12.01	107.33	65.00	589.87	701.61	0.84	0.13	4.62	95.58	101.47	1124.95	1270.33	-17.58	8.10	0.00	---	---	---	---	---	8.00	113.23	48.68	362.61	460.42	112.84	0.14	
Central-North Region	1.23	253.26	110.35	108.93	216.46	0.95	0.51	1.20	83.30	115.05	37.63	35.19	5.26	4.05	0.01	308.20	270.38	513.11	2.63	2.91	0.00	2.02	154.20	196.80	117.30	242.71	93.77	0.01
Central-South Region	72.09	5.00	6.50	173.25	163.22	28.33	0.29	5.84	42.87	89.61	158.37	81.72	9.49	0.40	63.79	0.06	0.34	1301.68	2796.18	1491.74	0.60	2.46	43.37	29.82	170.30	272.91	51.60	0.04
Gulf and Caribbean	0.38	18.16	9.08	49.89	4.44	16.55	0.88	0.04	-61.19	21.50	0.00	-3.78	-8.48	0.00	0.00	---	---	---	---	---	0.13	69.85	5.11	35.95	2.14	---	0.64	
TOTAL	100.00	100.00	100.00	128.03	171.04	1.56	14.64	30.77	71.91	100.68	266.54	328.42	-1.21	39.83	1.86	78.97	102.54	13.11	80.87	14.43	0.02	67.37	113.41	99.62	93.02	117.20	128.02	7.60

Source: own elaboration based on ENIG.

## Estimations on S&T and FDI

The model used is a crossed section specification, using manufacturer industry variables and working with economic branches ( $r$ ) and states ( $e$ ). Based on the prior data set –with 2670 observations of Big Manufacturing Firms (BMF)- for all states and respective branches for 2003, one basic model was applied. Several observations –with negative value-added and investments- were not included and the final sample was of 1,865 observations.

The goal of the cross-section model is to measure the impact of Science and Technology expenditures ( $ID$ ) on total investment ( $IV$ ), labor productivity ( $VAB/PO$ ), wages ( $W$ ), imports ( $M$ ) and exports ( $X$ ). The general specification of the model assumes a positive association with  $ID$ ,  $IV$ , labor productivity, wages, and trade.

$$\ln(ID_{r,e}) = \beta_0 + \beta_1 \ln(IV_{r,e}) + \beta_2 \ln((VA/PO)_{r,e}) + \beta_3 \ln(W_{r,e}) + \beta_4 \ln(M_{r,e}) + \beta_5 \ln(X_{r,e}) + u_{r,e}$$

Where  $r$  are branches and  $e$  the 32 states.

The used estimate method was the generalized square minimum, with White Heteroskedasticity-Consistent Standard Errors & Covariance matrix (Frees 2004; Greene 1998; Hsiao 2003; Cameron and Trivedi 2005; Woolridge 2002).

The estimate strategy consisted of applying different classification criteria with the objective to group the economic activities in order to be able to make inferences. Using that scheme, the general model was estimated in different sub-samples with several considerations. The same model was replicated for our full data set –and from an aggregated perspective-, but also specifically for each of the states and the two chains we have been highlighting, i.e. electronics and autoparts-automobiles. This data set was divided in those branches that had any kind of S&T expenditures in the states -686 branches- and the full data set, i.e. with and without S&T expenditures. We will have thus four kind of econometric results: a) aggregated results for the full set of BMF, b) by branch, c) by state, and for both value-added chains (electronics and autoparts-automobiles).

Table 12 presents the main aggregated results of Science and Technology expenditures (S&T) and its association with other variables discussed in the former chapter. The main results –and with a data sample of 2670 and 686 branches with and without S&T expenditures- are as follows:

- a) 75% of Mexico's BMF-branches do not present any kind of S&T expenditures. As a result of this performance –already discussed in earlier chapters with other data-, the

- models were run in two types: i. for the sample of branches with and without S&T expenditures and ii. Only for the sample of branches with S&T expenditures (see Table 12). As we shall see, differences among both samples are significant.
- b) For the sample of all Mexican BMF with and without S&T expenditures total investments, wages and imports are the main explanatory variables of S&T expenditures. Total investment presents the highest coefficient and is significant in practically all cases, with the exception of firms in which the FDI-share is under 50%. Four other issues stand out: i. Productivity and exports are not significant in practically none of the 4 cases presented in table 12, and ii. For the case of branches with a FDI-share under 50% only imports is a significant variable, iii. Productivity is not significant, but also presents a negative sign in three out of the 5 models, and iv. The cases of firms in which FDI has no share or has a share over 50% of social capital present almost identical results, with the only difference in wages with a coefficient of 0.31 and 0.17, respectively. The latter result is significant since export-orientation, import-dependency and the high association with investments are the main characteristics of S&T expenditures.
- c) For the much smaller sample of branches that only present S&T expenditures the results are substantially different. On the one hand, the significance of total investments fall, but the relevance of productivity increases: for the cases of all firms, for example, the coefficient is of 0.34 and the highest of all independent variables. For this specific sample, i.e. the firms with the highest S&T expenditures, there are also three other important features: i. wages become a much less important variable for understanding S&T, ii. Imports and exports –in contrast to only wages in the last model- are important for understanding S&T for BMF, and iii. The differences between firms and branches with no share of FDI and those with a share of FDI (and with a share above 50%) are more significant in this case: while firms with no FDI-share present a high association with productivity and wages, as well as imports and exports, those firms with a share of FDI present only an association with imports and exports. As discussed in other results (Dussel Peters et. al 2007), wages are not that relevant for explaining FDI and S&T in Mexico.

The second set of cross-section regressions included 32 regressions –with the same model-specification- for each Mexican state. The results, as imagined, vary widely, and in some cases a better specific model-specification has to be pursued. Nevertheless, and as presented in table 13, new relevant associations can be found. In the case of Mexico City, for example, total investment, wages and imports are the most relevant variables associated with S&T for all firms with and without S&T expenditures. When estimating the same model, but only for branches that actually pursued S&T expenditures, imports, exports, but also productivity and wages become additional important explanatory variables. These differences in the association of variables are similar to the national cases discussed before.

Finally, similar regressions were pursued for the autoparts-automobiles and electronics chains. In the former cases, and as a result of the existing concentration of this chain in Mexico –as already discussed-, the observations and degrees of freedom are problematic and the coefficients are not significant. In the case of electronics, however, the situation is different. As discussed in table 14, trade includes the most relevant explanatory variables for all firms. For only those firms with S&T expenditures productivity plays a more significant role.<sup>24</sup>

Table 12

**Determinants of Science and Technology for big manufacturing firms (BMF) /a**  
 (for all firms with and without Science and Technology expenditures)

Variables	Total firms	No share of FDI	With share of FDI	FDI-share under 50%	FDI-share above 50%
<b>Total Investment (IV)</b>	<b>0.30</b>	<b>0.23</b>	<b>0.23</b>	<b>0.14</b>	<b>0.25</b>
<i>t</i>	8.397	4.369	4.455	1.335	4.381
<i>Probability</i>	0.000	0.000	0.000	0.184	0.000
<b>Productivity (VAB/PO)</b>	<b>-0.13</b>	<b>-0.06</b>	<b>0.04</b>	<b>-0.04</b>	<b>0.12</b>
<i>t</i>	-1.908	-0.556	0.345	-0.226	0.853
<i>Probability</i>	0.057	0.579	0.730	0.821	0.394
<b>Wages (W)</b>	<b>0.24</b>	<b>0.31</b>	<b>0.16</b>	<b>0.08</b>	<b>0.17</b>
<i>t</i>	9.275	6.156	4.716	1.148	4.603
<i>Probability</i>	0.000	0.000	0.000	0.253	0.000
<b>Imports / GDP (IM)</b>	<b>0.12</b>	<b>0.12</b>	<b>0.12</b>	<b>0.14</b>	<b>0.11</b>
<i>t</i>	6.318	4.766	4.683	2.443	3.904
<i>Probability</i>	0.000	0.000	0.000	0.016	0.000
<b>Exports (X)</b>	<b>0.04</b>	<b>0.08</b>	<b>0.06</b>	<b>-0.01</b>	<b>0.08</b>
<i>t</i>	2.360	3.526	2.561	-0.204	2.734
<i>Probability</i>	0.018	0.000	0.011	0.839	0.007
<b>Basic Statistics</b>					
<b>R<sup>2</sup></b>	<b>0.25</b>	<b>0.30</b>	<b>0.20</b>	<b>0.11</b>	<b>0.23</b>
<b>R<sup>2</sup> adjusted.</b>	<b>0.24</b>	<b>0.30</b>	<b>0.19</b>	<b>0.09</b>	<b>0.22</b>

**Determinants of Science and Technology for big manufacturing firms (BMF)**  
 (for all firms with Science and Technology expenditures)

Variables	Total firms	No share of FDI	With share of FDI	FDI-share under 50%	FDI-share above 50%
<b>Total Investment (IV)</b>	<b>0.09</b>	<b>-0.09</b>	<b>0.33</b>	<b>0.59</b>	<b>0.24</b>
<i>t</i>	1.376	-1.006	3.631	3.839	2.345
<i>Probability</i>	0.169	0.315	0.000	0.001	0.020
<b>Productivity (VAB/PO)</b>	<b>0.34</b>	<b>0.45</b>	<b>0.11</b>	<b>-0.06</b>	<b>0.14</b>
<i>t</i>	3.604	3.413	0.757	-0.142	0.880
<i>Probability</i>	0.000	0.001	0.450	0.888	0.380
<b>Wages (W)</b>	<b>0.16</b>	<b>0.35</b>	<b>0.04</b>	<b>-0.02</b>	<b>0.07</b>
<i>t</i>	2.288	3.287	0.501	-0.098	0.761
<i>Probability</i>	0.022	0.001	0.617	0.923	0.448
<b>Imports / GDP (IM)</b>	<b>0.10</b>	<b>0.08</b>	<b>0.10</b>	<b>-0.03</b>	<b>0.13</b>
<i>t</i>	3.475	2.355	2.289	-0.212	2.891
<i>Probability</i>	0.001	0.019	0.023	0.834	0.004
<b>Exports (X)</b>	<b>0.09</b>	<b>0.09</b>	<b>0.06</b>	<b>0.08</b>	<b>0.05</b>
<i>t</i>	4.028	3.260	1.968	1.128	1.514
<i>Probability</i>	0.000	0.001	0.051	0.267	0.132
<b>Basic Statistics</b>					
<b>R<sup>2</sup></b>	<b>0.22</b>	<b>0.21</b>	<b>0.29</b>	<b>0.39</b>	<b>0.28</b>
<b>R<sup>2</sup> adjusted.</b>	<b>0.21</b>	<b>0.20</b>	<b>0.27</b>	<b>0.30</b>	<b>0.25</b>

/a The first value refers to the elasticity, while the second and third values refer to its t-statistic and its respective associated probability.  
 Source: Own elaboration.

Table 13

**Mexico City: Determinants of Science and Technology for big manufacturing firms (BMF) /a**  
(for all firms with and without Science and Technology expenditures)

Variables	Total firms	No share of FDI	With share of FDI	FDI-share under 50%	FDI-share above 50%
<b>Total Investment (IV)</b>	<b>0.61</b>	<b>-0.23</b>	<b>-8.69</b>	<b>0.38</b>	<b>0.80</b>
<i>t</i>	3.073	-0.688	-2.276	0.538	1.547
<i>Probability</i>	0.003	0.494	0.030	0.605	0.141
<b>Productivity (VAB/PO)</b>	<b>-0.45</b>	<b>-0.51</b>	<b>0.53</b>	<b>1.33</b>	<b>0.06</b>
<i>t</i>	-0.967	-0.710	1.453	0.737	0.053
<i>Probability</i>	0.336	0.481	0.157	0.482	0.959
<b>Wages (W)</b>	<b>0.35</b>	<b>1.96</b>	<b>0.63</b>	<b>0.33</b>	<b>0.16</b>
<i>t</i>	2.439	3.618	0.825	1.294	0.717
<i>Probability</i>	0.017	0.001	0.416	0.232	0.484
<b>Imports / GDP (IM)</b>	<b>0.19</b>	<b>0.22</b>	<b>0.23</b>	<b>-0.14</b>	<b>0.06</b>
<i>t</i>	1.776	1.978	1.848	-0.333	0.251
<i>Probability</i>	0.079	0.053	0.074	0.748	0.805
<b>Exports (X)</b>	<b>0.00</b>	<b>-0.17</b>	<b>0.03</b>	<b>0.24</b>	<b>0.04</b>
<i>t</i>	0.016	-1.652	0.158	0.779	0.216
<i>Probability</i>	0.987	0.104	0.875	0.458	0.832
<b>Basic Statistics</b>					
<b>R<sup>2</sup></b>	<b>0.41</b>	<b>0.51</b>	<b>0.00</b>	<b>0.41</b>	<b>0.43</b>
<b>R<sup>2</sup> adjusted.</b>	<b>0.38</b>	<b>0.47</b>	<b>0.38</b>	<b>0.04</b>	<b>0.25</b>

**Mexico City: Determinants of Science and Technology for big manufacturing firms (BMF)**

(for all firms with Science and Technology expenditures)

Variables	Total firms	No share of FDI	With share of FDI	FDI-share under 50%	FDI-share above 50%
<b>Total Investment (IV)</b>	<b>0.33</b>	<b>-0.36</b>	<b>0.88</b>	<b>0.89</b>	<b>0.00</b>
<i>t</i>	1.158	-1.124	3.149	1.833	0.000
<i>Probability</i>	0.252	0.268	0.020	0.318	0.000
<b>Productivity (VAB/PO)</b>	<b>0.26</b>	<b>0.94</b>	<b>-0.14</b>	<b>0.87</b>	<b>0.00</b>
<i>t</i>	0.694	3.101	-0.159	0.288	0.000
<i>Probability</i>	0.491	0.004	0.879	0.821	0.000
<b>Wages (W)</b>	<b>0.57</b>	<b>1.55</b>	<b>-0.41</b>	<b>-0.20</b>	<b>0.00</b>
<i>t</i>	1.616	4.027	-2.145	-0.109	0.000
<i>Probability</i>	0.112	0.000	0.076	0.931	0.000
<b>Imports / GDP (IM)</b>	<b>0.43</b>	<b>0.56</b>	<b>0.41</b>	<b>-0.33</b>	<b>0.00</b>
<i>t</i>	3.087	4.760	0.820	-0.131	0.000
<i>Probability</i>	0.003	0.000	0.444	0.917	0.000
<b>Exports (X)</b>	<b>-0.10</b>	<b>-0.23</b>	<b>0.06</b>	<b>0.25</b>	<b>0.00</b>
<i>t</i>	-1.451	-4.001	0.435	0.324	0.000
<i>Probability</i>	0.153	0.000	0.679	0.800	0.000
<b>Basic Statistics</b>					
<b>R<sup>2</sup></b>	<b>0.60</b>	<b>0.66</b>	<b>0.89</b>	<b>0.92</b>	<b>0.00</b>
<b>R<sup>2</sup> adjusted.</b>	<b>0.56</b>	<b>0.62</b>	<b>0.80</b>	<b>0.52</b>	<b>0.00</b>

/a The first value refers to the elasticity, while the second and third values refer to its t-statistic and its respective associated probability.  
Source: Own elaboration.

Table 14

**Electronics commodity chain: Determinants of Science and Technology for big manufacturing firms (BMF) (2003)/a**

(for all firms with and without Science and Technology expenditures)

Variables	Total firms	No share of FDI	With share of FDI	FDI-share under 50%	FDI-share above 50%
<b>Total Investment (IV)</b>	<b>1.05</b>	<b>4.63</b>	<b>0.00</b>	<b>2.52</b>	<b>0.00</b>
<i>t</i>	0.375	1.209	0.000	0.293	0.000
<i>Probability</i>	0.709	0.234	0.000	0.772	0.000
<b>Productivity (VAB/PO)</b>	<b>0.13</b>	<b>0.57</b>	<b>35.82</b>	<b>0.96</b>	<b>0.00</b>
<i>t</i>	0.613	2.105	15.106	1.781	0.000
<i>Probability</i>	0.542	0.042	0.042	0.084	0.000
<b>Wages (W)</b>	<b>-0.87</b>	<b>-2.11</b>	<b>1.26</b>	<b>-2.46</b>	<b>0.00</b>
<i>t</i>	-1.546	-2.432	13.310	-1.439	0.000
<i>Probability</i>	0.126	0.020	0.048	0.160	0.000
<b>Imports / GDP (IM)</b>	<b>0.36</b>	<b>0.32</b>	<b>-3.45</b>	<b>0.32</b>	<b>0.00</b>
<i>t</i>	2.724	2.468	-18.631	2.345	0.000
<i>Probability</i>	0.008	0.018	0.034	0.025	0.000
<b>Exports (X)</b>	<b>0.30</b>	<b>0.14</b>	<b>-3.05</b>	<b>-0.05</b>	<b>0.00</b>
<i>t</i>	2.682	0.844	-12.189	-0.154	0.000
<i>Probability</i>	0.009	0.404	0.052	0.878	0.000
<b>Basic Statistics</b>					
<b>R<sup>2</sup></b>	<b>0.00</b>	<b>0.00</b>	<b>0.47</b>	<b>0.00</b>	<b>0.00</b>
<b>R<sup>2</sup> adjusted.</b>	<b>0.19</b>	<b>0.32</b>	<b>0.00</b>	<b>0.31</b>	<b>0.00</b>

**Mexico City: Determinants of Science and Technology for big manufacturing firms (BMF)**

(for all firms with Science and Technology expenditures)

Variables	Total firms	No share of FDI	With share of FDI	FDI-share under 50%	FDI-share above 50%
<b>Total Investment (IV)</b>	<b>-1.15</b>	<b>-0.64</b>	<b>7.00</b>	<b>0.00</b>	<b>0.89</b>
<i>t</i>	-0.303	-1.500	0.928	0.000	2.114
<i>Probability</i>	0.764	0.158	0.371	0.000	0.056
<b>Productivity (VAB/PO)</b>	<b>-0.19</b>	<b>1.23</b>	<b>0.90</b>	<b>0.00</b>	<b>-2.39</b>
<i>t</i>	-0.541	2.578	2.269	0.000	-1.345
<i>Probability</i>	0.592	0.023	0.041	0.000	0.203
<b>Wages (W)</b>	<b>0.83</b>	<b>0.15</b>	<b>-2.44</b>	<b>0.00</b>	<b>0.17</b>
<i>t</i>	1.538	0.367	-1.509	0.000	0.483
<i>Probability</i>	0.134	0.720	0.155	0.000	0.638
<b>Imports / GDP (IM)</b>	<b>0.37</b>	<b>0.34</b>	<b>0.20</b>	<b>0.00</b>	<b>-0.28</b>
<i>t</i>	1.253	1.430	0.981	0.000	-1.177
<i>Probability</i>	0.219	0.176	0.345	0.000	0.262
<b>Exports (X)</b>	<b>0.19</b>	<b>0.10</b>	<b>-0.28</b>	<b>0.00</b>	<b>0.40</b>
<i>t</i>	0.975	0.635	-1.158	0.000	1.011
<i>Probability</i>	0.337	0.536	0.268	0.000	0.332
<b>Basic Statistics</b>					
<b>R<sup>2</sup></b>	<b>0.00</b>	<b>0.39</b>	<b>0.00</b>	<b>0.00</b>	<b>0.40</b>
<b>R<sup>2</sup> adjusted.</b>	<b>0.14</b>	<b>0.16</b>	<b>0.42</b>	<b>0.00</b>	<b>0.14</b>

/a The first value refers to the elasticity, while the second and third values refer to its t-statistic and its respective associated probability.

Source: Own elaboration.

## **Conclusions and Policy Recommendations**

Regardless of a multiplicity of analyses on the effects of FDI and causes for innovation processes, there is insufficient and limited research on the issue so far, specifically on the origin and destiny of FDI. The complexity of the topic, also considering methodological and statistical challenges, explain the lack of eloquence in this type of analysis, regardless of the relevance of FDI and innovation processes.

Clearly, the high annual FDI flows to Mexico represent an important potential that for the moment has not been sufficiently exploited; it could even be argued that FDI and its effects have increased the degree of socioeconomic and territorial polarization initiated in Mexico with the liberalization strategy in 1988. A strategic and long term proposal is needed with the objective to promote and attract FDI with the purpose of transferring knowledge, technology and added value in Mexico –a perspective of territorial endogeneity as advanced in this chapter- in the context of NAFTA and the growing competition with Central American countries, China and India, among others. Similarly, the attraction of strategic and high quality FDI requires a dynamic perspective, that is, processes and segments of value chains that nowadays could be of interest to Mexico but in a few years may not necessarily be. The strength of an institution in charge of this is critical.

The document also concludes on several topics relating FDI and innovation processes:

- Until 2008 the current Law on Foreign Direct Investments allows for a set of criteria for the evaluation of FDI-projects –including its technological contribution- which are not being implemented
- Until 2008 there is an overwhelming lack of evaluation of FDI projects and there are no coherent policies at the state-level that generate incentives for a cooperative behavior, resulting in a down-to-the-bottom-competition in many cases
- The lack of coordination is also reflected in state-level statistics with substantial differences with those offered by federal agencies
- R&D in Mexico accounts for falling levels since the 1990s and if compared to other nations internationally and in Latin America, also as a result of a small share of private R&D
- Different index of R&D and S&T reveal an increasing polarization process at the level of firms, branches and states in Mexico; from the latter perspective the Center-Region, but increasingly the North, are the main motors of these variables, while the states South of Mexico City play a secondary and diminishing role. The North-South cleavage has deepened substantially in the last 2 decades, and in particular considering R&D and S&T processes

Specifically regarding FDI and S&T processes, the document concludes that mainly two regions –the Northern Border and the Center-Region- have an important potential for integrating S&T and innovation processes through FDI-inflows; the share of the rest of the region on total FDI is almost negligible. Nevertheless, FDI specialization index reveals important branch-level differences and advantages among Mexico’s 31 states and Mexico City.

Chapter 4 establishes that, in general, branches with a FDI-share –both above and below 50% of their respective social capital- present significantly lower S&T coefficients. This rather surprising –and probably unexpected- result is supported at the branch and state-level, but also for the autoparts-automobile and electronic chain. Thus, branches without FDI account for higher S&T / GDP coefficient and employment shares over the total BMF sample, but with a lower trade –and in particular export- orientation.

These associations are also ratified through the econometric models since investment, wages and imports are the most significant explanatory variables of S&T. For the smaller sample of branches that effectively pursue S&T expenditures, however, the relevance of productivity increases, with an elasticity of 0.34. While imports and exports present a high statistical significance for almost all cases, wages in general are not significant for explaining S&T expenditures.

The former results and the rather small significance of FDI on S&T expenditures can in part be explained –and as discussed in the document- by its high association with imports and exports, which are highly dependent on processes of temporary imports to be reexported, i.e. by programs that generate incentives for massively importing parts and components to be reexported. These processes, however, in general create few linkages and upgrading processes, since R&D and S&T processes are pursued in other segments of the chains and in general not in Mexico.

In terms of policy proposals a few issues stand out.

On the one hand, the need of functionalizing FDI's potential in a long-term and systemic development framework, i.e. FDI can clearly allow for development and innovation processes –in terms of technology, employment, wages, and overall learning processes- only if it is part of a larger socioeconomic strategy with specific instruments parallel to FDI flows. The lack of such instruments and an overall perspective does not allow for integrating these processes in terms of the discussed concept of territorial endogeneity. The current lack of such a long-term strategy does neither allow for a coordination of state-level priorities, nor for an evaluation process beyond the growth of FDI-flows. The lack of using the present evaluation criteria of the Law on Foreign Investment is a good example of an existing and interesting policy framework that is useless with the lack of established priorities.

Second, several theoretical frameworks and the effects of globalization increasingly show that policies and instruments are more effective and useful from a territorial-sectorial perspective, i.e. acknowledging the territorial specificities of the respective sector. Given Mexico's richness in state-level experiences with clusters, FDI and innovation policies, in addition to detailed statistical information, state-level innovation policies are the most adequate level for implementing a battery of incentives for improving R&D and S&T.

Third, policies should address specifically the lack of a positive association between FDI, S&T and productivity links. This rather surprising result, in which BMF with no FDI present the highest levels of S&T, and in general with little association with high productivity (compared to the rest of BMF), invites to establish specific instruments to strengthen trade intensive-FDI activities in Mexico and in particular their backward and forward linkages with the rest of

Mexico's economy. Given the important share of states in the Northern Border and in the Center-Region, both could become the short-term priorities of such policies.

Fourth, and in order to overcome the increasing territorial polarization, the rest of the regions and state should be also the focus of these latter policies. In particular the states in the South, Pacific, Center-North and Gulf and Caribbean Regions have received few FDI-flows with even less innovation processes. An effective FDI-promotion to decrease FDI-concentration, in addition to the aforementioned backward and forward linkages-program are crucial. Otherwise, and based on Mexico's experience in the last 15 years, the North-South cleavage will deepen.

The existing information –at the branch and economic class level by origin- allows for a deep understanding of FDI in Mexico and for a “battery of instruments” to improve FDI-promotion. As discussed for the autoparts-automobile and electronic chains, these activities are highly concentrated in a few states within Mexico, which should be the focus of these specific innovation policies. Similar instruments should be coordinated at the federal and state levels for other clusters. The former policies –and the need of a strong FDI and innovation institution- are urgent, considering that Mexico has already received several hundred billion \$US since 1994 and the more uncertain future regarding FDI-inflows.

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## Endnotes

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<sup>2</sup> With the new law in 1993 only 10 out of 704 activities were reserved to the State, 5 to Mexican nationals, 13 require approval of the Foreign Investment National Commission (FINC) and in 18 activities foreigners could only invest up to 49%. In the rest of the activities -658 or 93.47% of total- FDI was open for 100% FDI stakes.

<sup>3</sup> For a full discussion, see: Dussel Peters et. al (2007) and Ibarra and Moreno-Brid (2004).

<sup>4</sup> Nevertheless, NAFTA kept regional requirements in sectors such as automobiles, among others.

<sup>5</sup> As a result and in real terms, many of the former restrictions to FDI could be solved. Dussel Peters et. al (2007) show that for 1994-2006 only two sectors –telephone services and air transport, both having formally the restriction in which foreign investments’ share should not be above 49%- accounted for 94.5% of neutral FDI.

<sup>6</sup> The Secretary of Economy has discussed recently to present a new law on foreign investment, and also including some of the topics listed below. However, and as a result of the discussion on the liberalization of the energy sector since 2007, the proposed law has so far not been presented to the Legislative and to the public.

<sup>7</sup> For details on each of the instruments, see: <http://www.economia.gob.mx/?P=5100>.

<sup>8</sup> The fiscal reform of 2007 has potentially granted the states in Mexico some new fiscal power, in particular in respect to the 2% payroll tax that applies at the state level. There is however until the end of 2008 not sufficient information to compare the use of this tax between states for specific strategic priorities, such as for attracting FDI, for example.

<sup>9</sup> According to personal interviews at the end of the 1990s with an important transnational corporation that finally established in Costa Rica, for example, some of the negotiators were promised by one Mexican state that they would not have to comply with the national labor law, among other topics. This resulted in important uncertainties for the transnational corporation and was one of the reasons for not investing in Mexico.

<sup>10</sup> FDI fell in the first half of 2008 –and compared to the first semester of 2007- by 20.4% and in Mexico City, the main recipient of FDI, by 43.6% (SE 2008/c). Under this scenario and substantial global turmoil, the topic should be a priority in Mexico’s socioeconomic agenda.

<sup>11</sup> An important exception of this environment is the Mexican Association of Secretaries of Economic Development (AMSDE) in Mexico, which increasingly started a discussion on these items together with federal agencies (see: <http://www.amsde.org.mx>).

<sup>12</sup> For a full discussion on this issue, including alternative methodologies, see: Dussel Peters et. al (2007:321-350.)

<sup>13</sup> For a full conceptual discussion, see: Dussel Peters et. al (2003, 2007); Görg and Strobl (2002); Padilla-Pérez (2008); Romo Murillo (2005).

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<sup>14</sup> The discussion on potential learning effects of processes, rather than products, is significant. There is a wide literature today that discusses for example innovation and technological levels (and upgrading) based on an aggregated typology of (exported) products –shoes are low-tech and laptops are high-tech- and strong policy recommendations for resource-based, low, medium and high-tech-products (Lall 2000). Such a product-based perspective, however, does not consider processes within segments of value-added chains and is too simplistic; even in the apparently most low-tech products there are off course high-tech processes and the proposed policy-implications are thus, in most of the cases, far too aggregated, and in many other wrong (Dussel Peters 2001).

<sup>15</sup> According to this regional distribution, Mexico's states are divided in 6 regions, i.e. i. Northern Border (Baja California, Baja California Sur, Coahuila, Chihuahua, Nuevo León, Sonora and Tamaulipas), ii. Southern Region (Chiapas, Guerrero and Oaxaca), iii. Pacific Region (Colima, Jalisco, Michoacán, Nayarit and Sinaloa), iv. Center-North Region (Aguascalientes, Durango, Guanajuato, Querétaro, San Luis Potosí and Zacatecas), v. Center Region (Mexico City, Hidalgo, State of Mexico, Morelos, Puebla and Tlaxcala), and vi. Golf and Caribbean Region (Campeche, Quintana Roo, Tabasco, Veracruz and Yucatán).

<sup>16</sup> Authors such as Botzman (1999) and Sánchez Daza (1996) show that the institutionalization of research in Mexico until the 1990s was very weak and highly centralized.

<sup>17</sup> Several important new regulations for the registration of FDI have occurred since the 1990s, in particular the requirement of only registering effectively realized FDI since 1994 –and in contrast to expected FDI registered in earlier periods-, as well as the unification of all temporary imports, including maquiladoras, under the item of accounts between companies and the disappearance of all temporary imports statistics since January of 2007 (Dussel Peters et. al 2007; SE 2008/c).

<sup>18</sup> It is expected that this performance will continue in 2008-2009, also as a result of the performance of US's economy. FDI fell by 20.5% in the first semester of 2008 in comparison to 2007.

<sup>19</sup> The respective chains were defined as follows, and based on Mexico's national accounting system: a) Electronics (sum of branches 2823, 2832, 3833 and 3850), automobiles (3841) and autoparts (3842).

<sup>20</sup> For a full discussion and results of the Economic Census of 2004, see: <http://www.inegi.org.mx/inegi/default.aspx?s=est&c=10213>.

<sup>21</sup> It would have been possible to obtain more detailed data and beyond the level of branches (for example economic classes). However, and as a result of confidentiality, INEGI would not provide data in those cases were a firm could be linked to its activities. This is the reason why branch-level data was sufficient for this project.

<sup>22</sup> Acquiring this data set was a result of several months of work, since until today FDI registration (CMAP94 or the Mexican Classification of Activities and Products) is not comparable with other registration forms of Mexican national statistics such as the more recent

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SCIAN (System of Industrial Classification of North America). This is a substantial limitation. We are extremely thankful to INEGI, which allowed in an intense discussion process, to reach these conclusion and have access to this data set.

<sup>23</sup> The Economic Census does not provide for exact data on trade, but rather on goods and services bought by foreigners, which is used as proxy variable for imports, while sales to foreigners are used as a proxy for exports.

<sup>24</sup> Future research will not only be able to compare this kind of analysis between 2003 and 2008, for example, but also to deepen this statistical and econometric analysis at a more profound level (economic classes).