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The Economic Geography of Foreign Direct Investment and Human Capital in Mexican Regions

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Declaration

I certify that the thesis I have presented for examination for the PhD degree of the London School of Economics and Political Science is solely my own work.

I declare that this thesis consists of 59,236 words.

Statement of conjoint work

The paper "Outward FDI from Mexican regions: Structural and policy determinants" is co-authored with Simona Iammarino and Lucia Piscitello. My contribution amounts to at least 60% of the total work.

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Abstract

Economies around the globe are increasingly interconnected. Foreign Direct Investment (FDI) has become one of the main drivers of economic interdependence among regions across the world. FDI as a flow of capital across international boundaries is bound to have distinctive effects on the human capital accumulation process in both home and host economies, with important consequences for economic development. The aim of this thesis is to improve our understanding on the geography of two interrelated economic phenomena for Mexican subnational regions: FDI and Human Capital.

Mexico has been an important recipient of inward FDI, but in the last two decades the services sector has been gaining importance over manufacturing, while the country has been increasingly sending flows of outward FDI to the rest of the world. Concurrently, wage inequalities persist, educational outcomes are lagging behind, and demand for skilled workers is decreasing. These changing trends and shifting balance have important implications for wages and the incentives to develop human capital at the local and regional scale in Mexico. Moreover, the aforementioned changes in FDI patterns, wages and human capital have occurred in a country where territorial disparities are still commonplace.

Against this background, these papers explore several relationships between FDI and three dimensions of human capital accumulation, namely; wages, educational attainment, and skills. The first paper examines the effect of inward FDI on the wage gap between skilled and unskilled workers. Departing from these findings, the second paper analyses the effect of higher wages offered by multinationals on youth educational choices. The third paper explores the regional determinants of the recent internationalisation of Mexican firms, with particular attention to skills, productivity and innovation. Finally, the fourth paper explores the effects of outward FDI on the relative demand for skilled and unskilled workers.

In order to empirically investigate the aforementioned relationships, I deploy a wide array of econometric techniques that allow me to provide quantitative estimates of the associations at hand. Particular attention is placed on endogeneity concerns that may lead to statistical biases on the evidence provided. By adopting a regional- and industry-level perspective, the present thesis hopes to shed some light on the effects of bidirectional FDI on various Human Capital dimensions. Policy implications drawn from the findings herein, are of paramount importance. Mexico has taken significant strides towards development; however, it still has a sizeable untapped economic potential. This and other empirical evidence should be duly considered if Mexico is to escape the middle-income trap.

Para Irma, Eduardo y Ana Paula,
mis tres pilares e inspiración en la vida

(To Irma, Eduardo and Ana Paula,
my three support pillars and inspiration in life.)

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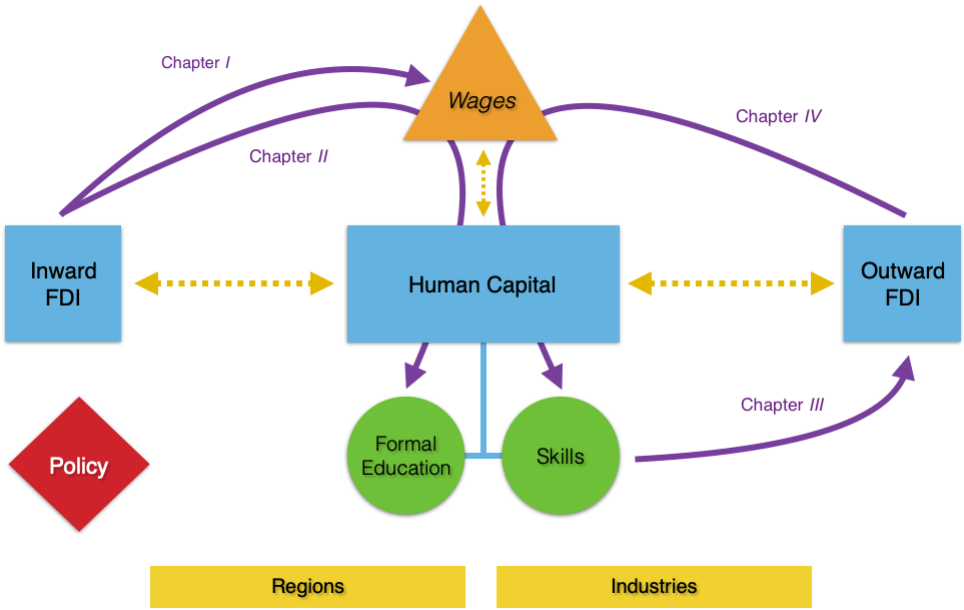
Introduction

1. Overview

Mexico has been an important recipient of inward Foreign Direct Investment (FDI), yet in the last two decades has been sending increasing flows of outward FDI to the rest of the world. These trends and shifting balance have important implications for wages and the incentives to develop human capital at the local and regional scale in Mexico. However, these topics have, so far, been understudied. The aim of this thesis is to improve our understanding on the geography of two interrelated economic phenomena for Mexican subnational regions: FDI and human capital. The broad research agenda is visually represented in Figure 1 below. The main themes of our study (represented by the blue boxes) are inward and outward FDI and their relationship with human capital.

Figure 1 – FDI and Human Capital: A Research Agenda



Source: Author's own elaboration

FDI is broadly defined as a cross-border investment requiring *direct* involvement and participation in international productive activities. These flows are compiled according to the direction of the investment for the reporting economy – either inward or outward. The study of FDI is largely divided into determinants and effects, both in the sending (home) and the receiving (host) location.

Human capital is a loosely defined concept. However, we focus on two of its main components (circles in the figure): formal education and skills. While the former is typically measured in years of education or school enrolments, the latter is broadly defined by the type of occupational tasks that workers perform. These two dimensions constitute a good proxy for a region's overall human capital stock.

The relationship between FDI and human capital is rooted on the premise that multinational enterprises (MNEs) are more intensive users of knowledge and technology when compared to domestically owned firms. They will also tend to pay higher wages for otherwise identical workers. Wages in turn, are tied to workers' productivity and play a role in the process of human capital accumulation and skill acquisition.

We primarily asses these relationships via the labour market (the triangle) which constitutes one of the main transmission mechanisms through which they operate. Consider, for instance, a Mexican firm that decides to invest abroad: this decision is likely to affect the local wages since it may decrease the demand for labour at home; in turn, this would have an impact on the rate of skills' acquisition of the labour force in the home region.

The solid unidirectional arrows represent each one of the papers comprised in the present thesis, and they link together the main themes here addressed;

- Chapter *I* examines the effect of inward FDI on average wages and the wage gap between skilled and unskilled workers in recipient municipalities and industries.
- Chapter *II* analyses the effect of new highly paid jobs by foreign firms –in different sectors– on youth educational choices in their region of residence.
- Chapter *III* investigates the regional determinants of the outward FDI by Mexican firms, with particular attention to skills, productivity and innovation.
- Chapter *IV* explores the effects of outward FDI originating in Mexican region-industries on the relative demand for skilled and unskilled workers.

These main four elements are linked together by dashed bidirectional arrows, suggesting a two-way relationship between them. For example, while inward FDI affects the accumulation of human capital by modifying relative wages, these variables will also play the role of locational determinants. Throughout the chapters of this thesis we empirically address the endogeneity of these associations by deploying a wide array of econometric techniques.

The yellow rectangles represent the units of analysis. By adopting a regional-industry approach we define the scope of FDI effects/determinants, while being able to capture the relevant

environment in which multinational firms –foreign and Mexican– operate. Whilst subnational regions have been conceived as an important source of competitive advantage in a highly interconnected world, their industry mix largely mediates the effects of FDI on regional outcomes.

Finally, a pervading element in the agenda is encapsulated in the policy diamond. Policy implications draw from the findings herein are of paramount importance. Mexico has a sizeable economic potential that has yet to be unleashed. This and other empirical evidence should be duly considered if Mexico is to take more significant strides toward development and escape the middle-income trap.

The theoretical background throughout the thesis is wide ranging. In particular, we borrow from different strands of literature: Economic Geography, Regional Economics, International Economics and International Business. The increasing complexity in the geography of contemporary economic phenomena, urgently calls for the cross-fertilisation among related fields of research, since one alone cannot provide an all-encompassing view of the interaction between FDI and Human Capital, and their role in shaping regional economic development, particularly with reference to emerging economies.

The remainder of this introduction is laid out as follows. Section 2 offers a general context on Mexico. In Section 3, we provide a bird's-eye view of the main conceptual building blocks that constitute this thesis, indicating our contributions to fill in the gaps. Section 4 contains the abstracts for the chapters that constitute this thesis. Section 5 outlines the main limitations. Finally, Section 6 puts forward some extensions and avenues of further research.

2. Mexico: A general context

The last two decades have witnessed significant changes in the patterns of Mexican FDI stocks. On the one hand, Mexico is still a net recipient of FDI: in 2015, the inward FDI stock reached 500 billion dollars, representing 44 percent of the GDP (UNCTAD, 2017). Furthermore, sectoral changes have occurred in recent years, with FDI in services gaining predominance – averaging 50 percent – over manufacturing – 42 percent – in the accumulated FDI stock (Ministry for Economics, 2016). On the other hand, outward FDI stocks have been rising steadily since the year 2000, increasing from roughly 8 billion US dollars to around 150 billion in 2015. Meanwhile the importance of OFDI stocks relative to the country's GDP reached 12 percent — from 1.2 percent in the span of 15 years (UNCTAD, 2017).

Since the outset of liberalisation in the early 1980s, Mexico experienced increases in wage inequality, as wages for skilled workers grew faster than for the less skilled (Cragg & Epelbaum, 1996). An economy-wide increase in the skill premium and the uneven distribution of skill endowments across states contributed to the divergence in regional incomes (Aguayo-Téllez, 2006). There is no evidence of a reduction in the wage gap between skilled and unskilled labour in Mexico after NAFTA in 1994, which if anything, has remained unchanged (Esquivel & Rodríguez-López, 2003).

As far as the quality of the labour force is concerned, despite educational improvements, workers still have generally low educational levels and skills. School enrolments and educational attainment continue to lag behind, and still remain below the international trend line. Only 37 percent of the adults have attained upper secondary education, while only 62 percent of 16-year-olds were enrolled in school (OECD, 2014). Access to education is still an issue to be addressed.

Regarding the skill composition of employment, the share of skilled workers has considerably declined, whereas that of unskilled has increased. Initial increases in the high-skill premium led to a rising supply of these type of workers (Montes Rojas, 2006). However, Mexico's North American trade and investment partners are more high-skill intensive: increasing integration with these countries might have caused a labour demand shift towards low skilled workers (Robertson, 2004).

The aforementioned changes in FDI patterns, wages and human capital have occurred in a country where territorial disparities are still commonplace. Distinct groups of regions can be identified; whist more diversified regions show higher labour productivity and wages, another group heavily relies on a few locally important activities and exhibit low productivity and wages (Unger et al., 2014). The uneven distribution of factors of production has an influence in the patterns of economic activity; subnational effects of FDI are likely to be more stringent in emerging economies, such as Mexico (Bernard et al., 2010).

Although many countries in Latin America, Mexico included, reached the middle-income band as early as the 1960s and 1970s, a great majority have remained there ever since (Agénor et al., 2012). Sustaining growth through the middle-income band requires significant reforms to the institutions of economic policy-making and political processes (Agénor & Canuto, 2015). In order to compete in the global economy while improving welfare, Latin American countries must develop value-added and knowledge-intensive activities to generate broad-based upgrading and productivity growth (Paus, 2011).

In sum, Mexico still greatly relies on inward FDI (IFDI) with gaining predominance of the service sectors, and steadily rising outward FDI (OFDI). Concurrently, wage inequalities persist, educational outcomes are lagging behind, and demand for skilled workers is not increasing. Against this background this thesis sets out to investigate the Mexican case, by exploring the economic geography of FDI and Human Capital in Mexican subnational regions and industries.

3. Bird's-eye view of background literature: filling the gaps

A) MNEs' superior performance

The question of why multinational enterprises (MNEs) are better performers than their uninational counterparts has long been superseded. The superior economic performance of the former versus the latter has been amply attested; particularly in areas such as firm size, wages, productivity, export propensity and technology, foreign-owned firms outperform domestic enterprises, not only when their country of origin is a developed economy, but also when it is a developing one (for a comprehensive review see Bellak, 2004). Therefore, performance gaps can be attributed to multinationality per se. Theoretically, it is a widely accepted premise that MNEs possess some kind of firm-specific advantage, and are therefore typically expected to have higher marginal labour productivity when compared to domestic firms (e.g. Caves, 1974; Markusen, 2002). These advantages will enable MNEs to overcome the 'liability of foreignness' by importing organisational capabilities of their parent enterprises (Zaheer, 1995).

The fact that MNEs intrinsically differ from domestically-owned enterprises makes research questions on this regard relevant, both theoretically and empirically. Moreover, for countries like Mexico undergoing restructuring in FDI flows and stocks, it is of central interest for policy-making to counter the negative effects and foster the positive consequences in the host and home economies.

B) MNEs and FDI defined

For the purposes of this thesis, it is important to define MNEs and their FDI activities. MNEs are defined as incorporated or unincorporated[1] firms that comprise parent companies, located in the home country, and their foreign affiliates located in the host economy (Ietto-Gillies, 2012; UNCTAD, 2006). *Parent companies* are enterprises which control assets of other entities in at least one country other than its home country, usually by owning an equity stake of 10 percent or more of the shares or voting power. A *foreign affiliate* is an incorporated or unincorporated enterprise in the host country in which another entity directly owns between 10 and more than a half of the shareholder's voting power[2].

FDI is one of the main economic activities of MNEs and it requires *direct* involvement and participation in international productive activities. FDI is commonly defined as a cross-border investment involving medium and long-term strategic relationships and control by a parent company (a multinational enterprise) over affiliate enterprises located overseas (OECD, 2008; UNCTAD, 2006). The 'long lasting' interest of such relationships involves not only direct participation in the management of the enterprise but allows the investor to gain access to the host economy of the investment. The objectives of direct investment differ from those of portfolio investment whereby investors do not generally expect to influence the management of the enterprise (OECD, 2008).

FDI can be measured both in flows and in stocks (OECD, 2008; UNCTAD, 2018). Flows comprise capital – equity, reinvested earnings and intra-company loans — provided by a foreign direct investor to an enterprise, or capital received from an investing enterprise by a foreign direct investor. Under the directional principle, the direct investment flows are compiled according to the direction of the investment for the reporting economy − either inward or outward. In other words, all flows originating from MNEs in an economy are considered outward investment and all flows for foreign affiliates resident in that economy are considered inward investment (UNCTAD, 2017).

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[1] An *incorporated* business is one whose main feature is having liability protection, additional tax deductions and ability to raise capital through sale of shares of the company. An *unincorporated* firm refers to one that does not possess a separate legal identity from its owner(s) (Ietto-Gillies, 2012).

[2] According to UNCTAD (2006), *foreign affiliates* include subsidiaries, associates and branches. A *subsidiary* is an incorporated firm in the host country in which another entity directly owns more than 50% of the shareholders' voting power. An *associate* is an incorporated enterprise in the host country in which an investor owns a total of at least 10 percent, but not more than half, of the shareholders' voting power. A *branch* is a wholly or partly owned unincorporated enterprise in the host country.

FDI stocks are estimated by either accumulating FDI flows over a period of time or adding flows to an FDI stock that has been obtained for a particular year from national official sources or the IMF data series on assets and liabilities of direct investment. They reflect the prices at the time of investment (UNCTAD, 2018). Flow figures tend to exhibit year-on-year volatility, since individual investments can represent substantial percentages of the total flow in any one year. Temporal trends are best observed via stock figures.

The core focus of this thesis is the cross-border direct investment activities of MNEs. The first two chapters study inward FDI, whereas the last two are devoted to outward FDI.

C) Effects of FDI

The activities of MNEs in all their modalities and manifestations produce a variety of effects. Understanding the boundaries and dimensions of multinational activities is not only crucial for the conceptualisation of research questions, but also for the interpretation of the empirical results (Ietto-Gillies, 2012). While Chapters *I* and *II* are dedicated to inward FDI effects in host regions, Chapter *IV* explores Outward FDI effects on home regions. We briefly discuss the boundaries of these effects.

Effects on what?

FDI is likely to affect both firms and workers. For example, FDI can have an impact on firms' productivity (e.g. Driffield et al., 2002), affect the level of innovation activities (e.g. Crescenzi et al., 2015) or change the skill composition within the firm (e.g. Castellani et al., 2008). It can also impact worker's wages (e.g. Feenstra & Hanson, 1997) or their productivity (e.g. Piscitello & Rabbiosi, 2005). Moreover, FDI can also affect workers and firms differently depending on the industry in which they operate (e.g. Feliciano & Lipsey, 2006).

The evidence on Mexico has been largely concerned with the effects of inward FDI in manufacturing industries. However, FDI in the services sector has significantly increased in the last twenty years, and its effects have not been sufficiently attested yet. Furthermore, our focus of study is largely centred on groups of workers' outcomes in terms of wages (Chapter *I*), education outcomes (Chapter *II*) and skills (Chapter *IV*), while considering the relevant sectors and industries.

Effects at what level?

FDI effects may operate at the *micro*, *meso* or *macro* level. Theoretical assumptions usually underpin the levels at which these effects might operate. Often, the boundaries between these effects are blurry. At the *micro* level, studies consider the effects using firm data (e.g. Cozza et al., 2015), employee data (e.g. Figini & Görg, 1999) or even firm-employee matched data (e.g. Hummels et al., 2014). At the other extreme is the *macro* level, which usually considers country-level, thus very aggregate, effects of FDI (e.g. Beugelsdijk et al., 2008). In between these two is the *meso* level, which captures the heterogeneity of FDI effects across subnational regions within a country (e.g. Monastiriotis & Jordaan, 2010). Since FDI effects may include spillover elements and externalities, the aggregation or disaggregation from one level to another is not linear (Iammarino & McCann, 2013; Ietto-Gillies, 2012).

While the literature has been more thorough in exploring the *micro* level (firms or workers) and country level effects of FDI, there is a systematic lack of studies at the subnational regional level. In emerging countries with significant territorial inequalities, the regional level is meaningful inasmuch as FDI is bound to have spatially differentiated effects. Throughout the thesis we adopt a regional level of aggregation.

Effects where?

What is the effect of MNEs in host economies? Inward FDI affects the composition of markets and influences the economic activity in the host economies. These effects can be transmitted through three main channels; product market effects, factor market effects and spillover effects (Barba Navaretti & Venables, 2004; Lipsey, 2002). Perhaps the most important benefits that accrue from FDI are a variety of externalities, which may be technological and knowledge spillovers or pecuniary externalities (extensive reviews are Blomström & Kokko, 1998; Görg & Greenaway, 2004; Smeets, 2008). While the former arise when FDI introduces a benefit or a cost that is not directly transmitted through a market, the latter operate through changes in the market prices.

The FDI labour market effects in host economies deserve more careful consideration, especially in the context of emerging countries, since they directly affect workers' wages, income and ultimately welfare. The first two chapters of the thesis focus precisely on two FDI labour market effects. Whilst, Chapter *I* explores the pecuniary externalities arising from increases in inward FDI on the average wages and skilled-unskilled wage gap in host region-industries, Chapter *II* analyses these market-driven effects on educational choices of young individuals.

What is the effect of MNEs in home economies? Outward FDI implies that some of the economic activity production and employment takes place abroad instead of at home. Four main issues have been stated to matter for home economies (Barba Navaretti & Venables, 2004; Lipsey, 2002): overall output and employment levels, compositions of the factors of production (skills), technological upgrade, and productivity spillovers. To certain extent, these effects depend on whether home and foreign activities are substitutes and complements. Predictions on OFDI home effects on skill composition are linked to the motivation of the investment (Agarwal, 1997). These are mostly based on the observation of MNEs from developed countries, which are bound to be different from their emerging country counterparts (see subsection on FDI determinants below). In general, however, the impact of OFDI has received comparably less attention in the literature, and very little research exists at the subnational level of the region (e.g. Iammarino, 2018).

The home effects have received significantly more attention in developed countries, since these economies used to be the main the source of FDI. Rising participation of emerging and developing economies in the global investment flows justify further exploration of the home effects when MNEs originate in emerging countries. Moreover, the literature on FDI effects on the home region is rather thin, for developed and emerging economies alike. Chapter *IV* explores an externality in the labour market arising from changes in the demand for different types of workers when regions-industries are the source of OFDI.

D) Determinants of FDI

Chapter *III* focuses on the determinants of FDI originating in Mexican subnational regions. In trying to explain the determinants of MNE investment activities at the firm level, perhaps the most influential framework is the 'OLI eclectic paradigm of international production' as it offers a flexible framework that reconciles major theoretical strands — economics, international business and management, innovation and technology studies — that have sought to explain the various aspects of the multinational phenomenon (Dunning, 1977, 1988, 2001). MNEs are envisaged as the result of three main advantages; (O) ownership, (L) location and (I) internationalisation.[3] While the first and last are firm-specific, the second is particular to geographical locations; the simultaneous combination of the aforementioned provide the necessary and sufficient conditions for the existence of MNEs (Iammarino & McCann, 2013). At the macro level, the International Economics literature has envisaged FDI cross-border

[3] A comprehensive account and discussion can be found in Iammarino and McCann (2013).

flows arising from industry-specific trade-offs between scale economies and market access, and between scale of integration and factor costs differentials, across different locations (Barba Navaretti & Venables, 2004; Markusen, 2002; Markusen & Venables, 1998). These investment flows can also be driven by exogenous factors affect firm's FDI decisions, such as exchange rates, taxes and to a more limited extent, tariffs (see Blonigen, 2005 for a review).

On the regional determinants.

Notwithstanding, these frameworks have not yet fully incorporated specific geographies in the concepts of international production. Geography is conceived as an 'international geography' rather than as a 'subnational space' (McCann & Mudambi, 2004). The treatment of space is highly stylised and at a macro level: typically countries or macro-regions (Cantwell & Iammarino, 2000). Integrating firms' organisational issues with the characteristics of the subnational regions is crucial for the understanding of MNEs and their spatial environment (Beugelsdijk et al., 2010). Moreover, Multinational enterprises have become critical for the global connectivity of a city-region, and these in turn have been seen as increasingly driving national economies (McCann & Acs, 2011).

Despite these recognitions, the evidence on the geography of internationalisation at the regional sub-national level is surprisingly sparse. By considering the subnational level, Chapter *III* contributes to the largely absent evidence on regional determinants of OFDI with emphasis on emerging market MNEs.

E) FDI from emerging markets

The rise of MNEs from emerging economies (EMNEs) as players in the geography of global investment, and the accelerating pace of their participation in global value chains, have urged a deeper understanding of their internationalisation behaviours and the influence of their home economies (see, for a review, Cuervo-Cazurra, 2011). Mainstream international business perspectives have been criticised on the grounds that they derive primarily from research on large MNEs from advanced countries, presuming that firms only internationalise on the basis of *competitive advantages*. However, the possibility that firms from emerging or developing economies could become multinationals to seek for assets in order to address *relative disadvantages* has been given considerably less attention, with the main focus being the BRICS (Child & Rodrigues, 2005; Luo & Tung, 2007; Mathews, 2002a, 2006; Wesson, 1999).

We contribute to the literature on FDI in emerging countries in the context of changing global economic landscape. Chapter *III* combines the perspective of investment from emerging economies with that of the regional determinants of OFDI. Chapter *IV* incorporates the emerging economy perspective from a different angle, inasmuch as the motivation of OFDI will have differentiated effects in the sending region.

F) The regional scale

Given that the world's economy has never been more interdependent, differences across regions within countries are often greater than differences between countries (OCDE, 2009). The notion of regional competitiveness has taken a place in the forefront of the academic and policy-making arenas since Porter's (1990) influential publication. Regions have come to be seen as an important resource of competitive advantage in a highly interconnected world where interregional variety is a common feature (Boschma, 2004). The idea of regions as a source of advantages is rooted in the conception of space as 'territory' and as a generator of static and dynamic advantages (Capello, 2007). Space is diversified-relational; it is diversified inasmuch as the distribution of economic activities across space is uneven and development comes about selectively where a critical mass of production gives rise to increasing returns; its relational in that economic and social relations that arise locally enable operation of market mechanisms, efficient production and rapid innovation (Capello, 2007). To the extent that firms' performance depend on region-specific intangible assets embodied in a localised knowledge and competence base rooted in a particular institutional setting, it makes sense to speak about regions as sources of competitiveness (Boschma, 2004). Now more than ever regions are competing to attract and retain advanced functions and tasks based on their local assets such as human capital, know-how or entrepreneurship (Capello & Ponce Dentinho, 2012).

A main contribution of this thesis is on regions and FDI: with increasingly interconnected regions, which in turn are as sources of both competitiveness and within-country inequality, the relationship between global investment and regional outcomes becomes progressively more intertwined (McCann & Acs, 2011).

G) The region-industry

The economic geography literature has dealt with the question of whether a specific regional industrial structure enhances knowledge diffusion, innovation and ultimately competitive advantages (e.g. Delgado et al., 2010; Porter, 1990). Specifically, whether firms learn more from

local firms in the same industry – i.e. regional specialisation – or from local firms in other industries – i.e. regional diversification. The extent to which a particular sectoral structure influences innovative activities, also depends on the spatial characteristics of the geographical area, i.e. whether it is an urban area, a local district or a non-urban area (Capello, 2002). By combining the region and industry dimensions, a 'region-industry' can be defined as the ensemble of firms operating in the same industrial sector, which is constituted by interdependent sectors that belong to the same industrial *filière* and are collocated in the same geographical region (Elia et al., 2009; Mariotti et al., 2003).

Throughout this thesis, the main unit of analysis is the region-industry. By adopting this as the prime unit of analysis we aim to account for regional and industrial heterogeneity in the effects – direct and indirect — and determinants of FDI.

H) Regional human capital

There is currently no general consensus on the definition of human capital. Broadly understood, human capital could mean "any knowledge, skills and competencies embodied in individuals or their social relations that increase an individual's productivity" (Faggian et al., 2019). However, the importance of human capital as a catalyst for prosperity has been a major tenet of economic growth theories. A vast body of literature has suggested that human capital is the main driver of growth, because it generates increasing returns at a local scale and hence induces divergence in economic growth rates across countries (Aghion & Howitt, 1998; Lucas, 1988; Romer, 1990). The existence of geographically bounded increasing returns external to the firm allows this group of models to account for regional divergence and consider regions as engines of growth. However, at the regional level, the relationship is not so straightforward: regions are very different from nations as they do not have proper boundaries and labour is potentially very mobile between regions within the same country. The introduction of human capital can therefore imply increasing divergence at the regional level, because while more advanced regions benefit from a range of positive externalities depressed regions will progressively suffer from outflows of skills (Faggian et al., 2019). Notwithstanding, human capital alone does not warrant increasing regional growth, since the extent of the increasing returns depend on its interaction with other intangible and un-imitable assets that are territory-specific (Capello et al., 2011). Along this lines, it has also been posited that the alignment between the local stage of economic development and the quality of human capital is a necessary condition for the latter to spur regional growth (e.g. von Tunzelmann, 2009).

The regional dimension of human capital is of paramount importance since it may lead to increasing territorial disparities. By underlying the importance on this dimension, we contribute to the literature on Mexican development: our findings suggest that both IFDI and OFDI at the regional level might lead regional divergence in the process of human capital accumulation. Chapter *II* suggests that FDI-induced jobs and wages for unskilled workers could worsen youth educational attainment; Chapter *IV* advances that OFDI to High-income countries may lead to regional skill-downgrading.

I) Human capital and FDI

The rising importance of human capital as an input for growth is due to the intensification of the rate and pace of the "knowledge-based economy" (Cooke & Leydesdorff, 2006). Furthermore, the composition of FDI has significantly changed worldwide, with the majority of global FDI originating and going into services, rather than manufacturing (UNCTAD, 2017). The possibility that FDI may contribute to widening wage inequalities, has brought a relatively unexplored link with human capital to the fore (Blomström & Kokko, 2002). Since physical and human capital are complements, a more educated labour force leads to higher investment in physical capital and higher wages for workers with different skill sets (Acemoglu & Angrist, 2000). While FDI may have an effect on human capital development it also plays a role as a determinant for MNEs (e.g. Noorbakhsh et al., 2001).

The relationship between FDI and human capital development is of particular relevance. Is FDI benefiting only high-skilled workers or increasing opportunities for workers at all income levels? We contribute to the literature on FDI in Mexico by exploring this in depth across the four chapters; Chapters *I* and *II* highlight the positive and negative effects of IFDI on wages and human capital, Chapter *III* considers the level of local skills as one determinant of OFDI, and Chapter *IV* emphasises on a potential skill-downgrading effect of OFDI.

J) Local labour markets

Spatial heterogeneity in economic outcomes within a country is a common feature around the world. Local labour markets are characterised by differences in wages, productivity and innovation (Moretti, 2010). Localised employment shocks will have differentiated effects across types of workers with different skill levels. For example, MNE's presence is likely to raise wages for skilled workers at the expense of the unskilled (Markusen & Venables, 1998). These employment shocks tend to be region- and industry-specific and are persistent over time (T. E.

Clark, 1998). Local labour markets have also been considered as a mechanism for the transmission of knowledge ever since Marshall (1890). Much work has been done in this realm for a long time now. However, for the most part the precondition for knowledge diffusion was mostly physical proximity (e.g. Audretsch & Feldman, 1996). Regional economists have emphasised instead that relational capital[4] as the underlying mechanism for knowledge spillovers, considering that it constitutes the basis of collective learning which can be understood as a dynamic and cumulative process of knowledge production which stems from local interaction mechanism (Camagni, 1995; Capello, 1999). It has been argued that local labour markets are an important channel for knowledge transmission, hence public policies should be designed to improve the quality of the labour force and foster mobility of highly skilled employees (Capello & Faggian, 2005). For example, a worker trained on-the-job by an MNE might leave to work for a domestic firm bringing the acquired knowledge with her (Fosfuri et al., 2001)

Having highlighted the importance of labour markets and its relationship with the dynamics of human capital and FDI via employment shocks and the transmission of knowledge, this thesis contributes in the following ways: Chapter *I* brings attention to the labour market effects of IFDI in terms of increasing the wage gap between skilled and unskilled workers. Chapter *II* highlights evidence on how IFDI-led changes in the labour markets can affect educational choices. Lastly, Chapter *IV* proffers that OFDI can lead to skill-downgrading via the labour markets.

4. Chapter abstracts

This thesis comprises four chapters, their abstracts are included below. The main original findings are highlighted in *italics*.

Chapter I: Heterogeneous inward FDI and the wage gap in Mexican municipalities

Foreign firm entry is likely to affect wages. A wide body of literature has considered the effects of Foreign Direct Investment (FDI) on local labour markets. In general, inward FDI has been associated with increases in local wages. However, the evidence on the overall effect of FDI on

[4] Relational capital can be understood as "the set of all relationships – market, power and cooperation – established between firms, institutions and people that stem from a sense of belonging […]" (Capello & Faggian, 2005: 77).

regional average wages, the wage gap between skilled and unskilled labour, and inter-industry heterogeneity, is sparse. We address these questions for Mexican subnational regions and industries. Our time frame includes a decade-long period from 1998 to 2008, that has witnessed increasing FDI and sectoral change, while wage gaps between skilled and unskilled workers have either risen or remained unaltered. The endogeneity problem of this relationship is indisputable, as wages are both a locational determinant of FDI inflows and are also affected by it. Nonetheless, scant empirical work has sought to identify the causal effect of FDI on wages particularly across space. This paper combines difference-in-difference and propensity score matching techniques to identify the effect of FDI on average wages and the wage gap between types of workers, once observable characteristics of industries and regions have been accounted for. *Results herein suggest that FDI is associated with higher wages mostly for skilled workers –but often for the unskilled as well— and with a widening gap between them. Both of the latter effects are found to be heterogeneous between industries and even within industries in different locations, and they tend to either strengthen or wane when the initial or incremental effects are considered.* Policy implications are drawn regarding the role of FDI in shaping human capital accumulation, wage inequality and economic development at the local level.

Chapter II: Inward FDI and youth educational choices in Mexican municipalities

Inward Foreign Direct Investment (IFDI) has been often considered to play a prominent role in the development of human capital in the host economy. By providing attractive employment opportunities for skilled workers, via the adjustment of the relative returns to education, foreign presence may incentivise students to acquire further formal education; thus, contributing to human capital development in the host region. However, if foreign firms increase the demand of unskilled workers, the effect of foreign presence on educational attainment can act in the opposite direction if the IFDI-induced returns to education do not compensate the opportunity cost of schooling, pushing youths to dropout of secondary education. The IFDI labour market effects may be magnified in the context of large inequalities in access to education. This paper combines data on educational attainment of young cohorts spanning over a period of 20 years with IFDI employment and wage data. To investigate this relationship for the Mexican case, we construct several datasets to measure the effect of new foreign jobs and foreign wage premia on the enrolment rates and years of education of young cohorts that were 15 years old at the time of foreign jobs arrival in their municipality of residence. *The results suggest that new highly-paid foreign unskilled jobs have negative effects on a cohort's subsequent enrolment rates and individual probability of*

school attendance, both for services and manufacturing. Contrarily, the effects of foreign wage premium for skilled workers, might lead to positive educational outcomes. The labour market effects of foreign entry are long lasting and result in lower educational attainment years later. Losses accruing from low investment in human capital not only affect individuals but societies as well.

Chapter III: Outward FDI from Mexican Regions: Structural and Policy Determinants

The geography of world investors has hugely changed in the past two decades and enterprises from emerging economies have played an increasing role. Despite this changing landscape, relatively little research has been done on the regional determinants of outward FDI (OFDI), in particular, in the context of emerging economies. Mexico provides an interesting setting to conduct this research because outward FDI is a relatively recent phenomenon, with increasing importance for the country and its relative position in the Latin American macro-region. This paper explores the factors driving the internationalisation of Mexican subnational regions through OFDI, considering both regional structural determinants and public financial incentives aimed at supporting domestic firms' activities abroad. Furthermore, we investigate whether these effects differ according to the destination of the investment. By examining a panel dataset of 32 Mexican subnational regions and eight macro-sectors observed over the period from 2006 to 2017, we estimate the effects of determinants of active internationalisation along three dimensions (i) the propensity to internationalise, (ii) the extensive margin of OFDI and (iii) the intensive margin of internationalisation. *The obtained results point to the fact that the effects of some OFDI determinants are not necessarily in line with those from developed economies. We find heterogenous effects of local determinants across OFDI destinations. Furthermore, Mexican region-sectors seem to be driven to invest in high-income countries to boost their competitiveness in the globalised economy, especially when it comes to the sourcing of innovative activities and skills.* Implications concern the tailoring of public policies to encourage internationalisation and the understanding of MNE strategies in their spatial context.

Chapter IV: Outward FDI and skill downgrading in Mexican regions

Domestic firms increasingly invest abroad. The relocation of economic activity is bound to have effects in the skill composition at home, with the potential consequences being either positive or negative. Outward Foreign Direct Investment (OFDI) employment effects are closely related to the motives driving firms' internationalisation strategies and have been mainly studied for developed economies. Despite the recent surge of emerging country multinational enterprises

(EMNEs) in the global investment landscape, very few studies have enquired on the OFDI skill composition in emerging home economies, particularly at the region-industry level. EMNEs motives to engage in OFDI might differ to those of their developed country counterparts, hence the home effects are likely to diverge from the extant theoretical and empirical literature. Mexico is of particular interest in the Latin American region, since the country has recently embarked in active outward-oriented investment strategies. We investigate the extent to which changes in Mexican OFDI lead to skill downgrading or upgrading in the relevant local labour markets and whether the effects on labour demand for different skills vary according to the country of OFDI destination. The sample period we used, from 2007 to 2017, includes the transformation of a significant number of Mexican firms that have engaged in a process of internationalisation by establishing affiliates abroad. *The results from the analysis suggest that the level of development of the destination country has different effects on the composition of home employment: OFDI to high-income economies is associated with skill downgrading in the relevant region-industry, whereas investment towards middle-income economies has no significant effect.* Implications relate to the potential technology transfers from affiliates abroad and the improvement of local learning capabilities at the regional level.

5. Limitations

Like any research, the papers in this thesis are not immune to limitations. Although each chapter acknowledges them, we broadly outline some here.

Missing data. Our main source of inward FDI at the subnational level is the Economic Census data collected by the *Instituto Nacional de Geografía y Estadística* (INEGI). Due to the confidentiality principle disaggregated data is concealed if there are three or less firms operating at the administrative unit-industry level. Nonetheless, the number of missing observations is low, thus posing no severe problems for the analyses. Regarding the outward FDI data, it is sourced from ORBIS Historical Ownership database (Bureau van Dijk) due to the absence of this variable in Mexican sources. The issue here is the coverage and representativeness of the data at the regional level. Aggregate data was reassuringly cross-checked with International Trade Centre Market Analysis Tools. We also use a higher administrative level to avoid losing information, which obviously comes at a cost in terms of the identification of local labour markets.

Proxies. In all chapters we use proxies for FDI, as none of them capture the actual flows or stocks of investment. Whilst Inward FDI is an average of firms' foreign ownership on total assets, Outward FDI is measured in terms of the number of Mexican-owned affiliates abroad.

Level of aggregation. We use two different levels of aggregation depending on data availability; municipalities (2,457) and states (32). Although both allow us to capture subnational variation, constructing travel-to-work areas will significantly improve estimates by tracking the actual spatial extent of labour markets.

Workers skill groups. We are aware that the skill/unskilled dichotomous categorisation of worker skills is not necessarily capturing the knowledge intensity of job tasks. With better data, research could focus on more meaningful occupational tasks. Unfortunately, this is not available in the Economic Censuses.

Entry mode. With our data for Mexico, we are not able to tease out different FDI entry modes. There is growing evidence that effects and determinants of FDI, differ across greenfield and brownfield investments. The lack of data on this regard is widespread, but particularly stringent for Mexico.

Econometric estimations. A number of econometric models are deployed in order to investigate the relationships at hand. To the best of our ability we address threats to internal validity (omitted variable bias and reverse causality) of our estimates in each standalone paper. Two comments remain:

Internal consistency. Broadly speaking, Chapter *I* could be considered as the reduced form of Chapter *II*: while the former estimates the effects of IFDI on wages, the latter estimates the effects of foreign wages on educational choices. However, the econometric methods differ since they were chosen to address internal biases within each research framework. Finally, the first uses average wages, whereas the second uses foreign wages relative to domestic wages.

Partial equilibrium. Chapters *III* and *IV* are closely related, while the former considers the effect of the share of skilled labour, among others, as a determinant of OFDI, the latter concerns the effects of OFDI on the demand for skills. It is important to note that they are both envisaged in a partial equilibrium framework and we do not attempt to estimate general equilibrium effects. Finally, inasmuch as the identification strategies are credible within each paper, this should not be a concern.

6. Going forward

The findings in the thesis motivate and justify future research in several directions. We categorise them as extensions and further research avenues. Finally, we put forward a future research agenda.

A) Extensions

Period of analysis. More extensive data collection would be desirable, and analyses could be expanded to incorporate the latest wave of economic census (2018) which is yet to be released.

Wage spillovers. In Chapter *I*, we estimate the effect of FDI on average wages. However, one could directly estimate the effects of foreign entry on wages payed by domestic firms, to test for wage and productivity spillovers.

Gender gap. Efforts should be made to estimate differentiated effects of FDI on women's wages (Chapter *I*) and educational outcomes (Chapter *II*), since this group of the population faces significant disadvantages especially in deprived contexts.

Internal migration. Migration across regions within the country could potentially influence the estimated effects. Unfortunately, this issue is not properly addressed in these papers due to lack of publicly available data. To tackle this issue, data should be released by the statistical institute.

Origin-destination sector. In Chapters *III and IV*, we only consider the sector of origin of OFDI, again constrained by missing data in the ORBIS database. Increasing data collection will allow us to consider the effects of the sector of destination.

B) Further research

Productivity spillovers. While the effects of inward FDI have received considerable attention since the liberalisation of the economy, the recent sectoral changes warrant further explorations on its spillover effects by disentangling the mechanisms of these externalities on firms' productivity and technology transfer.

Human capital development. We only explored the effects of FDI on formal education. However, there is evidence that MNEs can influence the local training and vocational systems (TVET) in the host economies. In emerging economies, TVET systems may play a significant role in responding to changes in the demand for skills.

OFDI. Outward FDI in Mexico is a relatively recent phenomenon, as such, there is not enough evidence on its home effects in the sending region. Further research should be conducted to

evaluate whether increasing OFDI leads to productivity gains and technology transfers from the affiliates abroad and higher regional output.

Micro analysis. All our analyses are conducted at the region-industry level providing a meaningful unit of analysis for the evaluation of FDI effects and determinants. Nonetheless, conditional on data availability, firm or worker level analyses could further improve our understanding of these relationships at the micro level.

Qualitative analysis. All our statistical findings suggest average effects for regions and industries. In general, it is crucial to increase the qualitative evidence for the Mexican case. In particular for OFDI, it is important in order to grasp a better understanding of individual firms' internationalisation strategies.

Policy. Our findings warrant the generation of additional substantive evidence regarding FDI and human capital. The policy implications arising from our results are relatively general; regarding the educational, industrial and internationalisation policy realms. The analyses conducted represent a significant progress in our knowledge of the heterogeneity in FDI impacts and determinants at a regional scale. Despite the generality of the policy recommendations, they allow for a far more informed policy debate than hitherto.

C) A future research agenda

The contributions of this thesis can be summarised into two broad areas. One the one hand, this research sheds some light on the heterogeneous effects of inward FDI on wage inequality and educational attainment across municipalities and industries. On the other, it provides evidence on the effect of outward FDI on the relative demand for skills in the sending region, while offering insights on the home regional determinants of the recent trends of Mexican internationalisation. Although contributing to the extant literature, my doctoral work has also opened some compelling further research opportunities. Building on the contributions of this doctoral thesis, my future research agenda will focus mainly on OFDI from Mexican regions. The foreign investment by Mexican firms is a relatively recent phenomenon, thus remains understudied. In particular, questions regarding both home and host knowledge related activities as drivers of internationalisation, the extent of regional productivity gains accrued from participating in Global Value Chains through outward FDI, and the role of Information and Communication Technologies (ICT) in facilitating OFDI.

Very little attention has been paid to the OFDI home determinants and effects when the investing firms are from emerging or less advanced economies (Knoerich, 2017). This void is

much at odds with the relatively recent expansion of cross-border investments spurring from emerging economies and principally led by the BRICS (e.g. Holtbrügge & Kreppel, 2012; Mathews, 2002; Padilla-Pérez & Gomes Nogueira, 2015, 2016; Sauvant, 2005) in unison with the increasing importance and complexity of emerging country multinationals (EMNEs) in the global investment landscape (Goldstein & Pusterla, 2010) and their participation in global value chains (Giuliani et al., 2005), as well as the increasing role of ICT in facilitating OFDI and its contribution to competitiveness (Guerrieri & Meliciani, 2005). EMNEs represent a very unique case since the motives for internationalisation are likely to differ from that of their developed country counterparts (Wright et al., 2005).

Furthermore, mainstream frameworks studying the investment activities of multinational enterprises have not yet fully incorporated specific geographies in the concepts of international production. Geography is conceived as an 'international geography' rather than a 'subnational space' (McCann & Mudambi, 2004). The treatment of space is highly stylised and at a macro level: typically countries or macro-regions (Cantwell & Iammarino, 2000). Integrating firms' organisational issues with the characteristics of the subnational regions is crucial for the understanding of MNEs and their spatial environment (Beugelsdijk et al., 2010). Moreover, MNEs have become critical for the global connectivity of a city-region, and these in turn have been seen as increasingly driving national economies (McCann & Acs, 2011). Despite these recognitions, the evidence on the geography of internationalisation at the regional sub-national level is surprisingly sparse. I put forward three future research proposals as follows.

What are the regional home and host determinants driving different internationalisation patterns? EMNEs seeking to overcome their competitive disadvantages at home, may attempt tapping into more advanced technologies in the host regions (Amighini et al., 2010; Jindra et al., 2016; Mathews, 2002a) since the investing firms may be able to source foreign knowledge, which in turn might boost productivity (Fosfuri & Motta, 1999). Furthermore, it has also been argued that the home subnational region may be of particular significance in determining heterogeneous responses of firms to internationalisation (Bannò et al., 2015; Hitt et al., 2000; Iammarino & McCann, 2013; Masciarelli et al., 2010). Regarding the determinants of OFDI most evidence usually focuses only on one end, either the destination or origin of the investment (P. Li & Bathelt, 2018). Taking a comprehensive perspective on multinational corporate linkages helps us identify which region types and knowledge bodies are connected with each other and why (Cantwell & Zaman, 2018; Chung & Yeaple, 2008; Kafouros et al., 2012). The proposed research will aim to analyse both ends simultaneously by considering both home and host knowledge-related determinants of regional OFDI, while accounting for sector heterogeneity.

Does GVC participation through OFDI enhance regional productivity at home? Participating in a GVC has become a widespread strategy to enhance competitiveness, especially for emerging economies (Giuliani et al., 2005). Furthermore, the participation of EMNEs in GVC has become increasingly common as a channel for technological catch-up (Amighini et al., 2010; Pietrobelli & Rabellotti, 2011), since investing firms may be able to source foreign knowledge, which in turn might boost firm's productivity (Fosfuri & Motta, 1999). A broad literature using both industry and firm-level data has uncovered that participating in GVCs can stimulate productivity growth through a myriad of channels (Criscuolo & Timmis, 2017). However, productivity gains from OFDI may not be able to compensate for the aggregate loss in terms of value added or the exit of local firms along the value chain, resulting from the relocation of domestic production abroad (Castellani & Zanfei, 2006). This proposed research aims to understand the extent to which regional productivity dynamics are associated with internationalisation, and in particular with foreign investments by Mexican enterprises to different host locations and activities along the value chain.

What is the effect of ICT in facilitating GVC participation through OFDI? The rapid progress in Information and Communication Technologies (ICT) and the rising role of the service sector make intangible investments a key element of global competition in the 'knowledge-based economy' (Jona-Lasinio et al., 2019). ICT have facilitated the diffusion of knowledge across regions by lowering transport and communication costs (Foss & Pedersen, 2004), whilst making previously distant technological combinations possible (Cantwell & Santangelo, 2002). Today, cities and clusters cannot rely exclusively on local knowledge sources, but they need to combine "local buzz" (Storper & Venables, 2004) with "global pipelines" (Bathelt et al., 2004). Moreover, there is increasing evidence on the existence of a complementary relationship between intangible capital intensity and GVC participation (Jona-lasinio & Meliciani, 2019). In order to remain competitive, it is necessary for cities to combine non-local sources of knowledge with local knowledge sources (Cantwell & Zaman, 2018). The proposed research will aim to explore the extent to which the development of ICT enables or deters the participation of Mexican firms in GVC through different internationalisation strategies reflected in the location destination choices of their OFDI.

1. Chapter I: Heterogeneous inward FDI and the wage gap in Mexican municipalities

1.1. Introduction

Foreign firm entry is likely to affect local wages. A wide body of literature has considered the effects of Foreign Direct Investment (FDI) on local labour markets. In general, inward FDI (IFDI)[5] has been associated with increases in local wages. However, the evidence on the overall effect of IFDI on average wages, the wage gap between skilled and unskilled labour, and inter-industry wage differentials is at best mixed (e.g. Aitken et al., 1996; Driffield & Girma, 2003; Feenstra & Hanson, 1997; Feliciano & Lipsey, 2006; Figlio & Blonigen, 2000). To understand the association between IFDI and changes in wages in the host economy, it is important to highlight how foreign and domestic firms intrinsically differ. There is little doubt that multinational enterprises (MNEs) possess some firm-specific advantage that confers them a superior level of technology and knowledge, and therefore they are typically expected to have higher marginal labour productivity when compared to domestic firms (Dunning, 2001; Markusen, 2002); it is almost a stylised fact that foreign firms pay higher wages than their domestic counterparts in the host economy (Caves, 1974; Lipsey & Sjöholm, 2004; Markusen, 2002). Therefore, the remaining questions pertain to the overall effects of FDI on the labour market.

This paper addresses two of these outstanding issues. First, increasing IFDI may results in higher average wages in those industries and regions in which they operate (Feliciano & Lipsey, 2006). A second issue that has dominated the debate surrounding FDI, is the association between foreign presence and the widening of the wage gap between skilled and unskilled workers (Feenstra & Hanson, 1997; Taylor & Driffield, 2005). Generally speaking, the localised average effects of MNE activity, in the form of FDI, will depend on the industry and the technological and organisational context in which the investment takes place (Ietto-Gillies, 2012; Lipsey, 2002). We address these questions for Mexican subnational regions and industries.

Mexico constitutes a good case to study the effects of FDI in three ways. First, not only has the country become one of the largest recipients of FDI inflows worldwide (ranking 10th in 2013),

[5] FDI and IFDI are used interchangeably to refer to inward FDI in the host economy.

but the value of inward FDI stock as percentage of GDP rose from 7.8 percent in 1990 to over 30 percent in 2013 (UNCTAD, 2014). Second, the early 2000s have witnessed important changes in the sectoral composition of aggregate inward FDI. While the manufacturing sector continues to concentrate a sizeable share of FDI inflows – 42 percent — the services sector has gained importance – 50 percent — in the total accumulated FDI in 2010 (Ministry for Economics, 2014). Thirdly, territorial disparities are very marked across the country. On the one hand, the distribution of foreign investment has been extremely uneven; only five states out of 32 (excluding Mexico City) concentrate 64 percent of the accumulated FDI stock in 2010. On the other hand, wage gaps between skilled and unskilled vary significantly across regions and they are negatively correlated with regional skill abundance (Bernard et al., 2010). The uneven distribution of factors of production has an influence in the patterns of economic activity; subnational effects of FDI are likely to be more stringent in emerging economies, like Mexico, experiencing substantial inward FDI, large initial territorial disparities and significant variation in regional relative wages.

Therefore, attempting to unravel the true effects of foreign presence on the local labour markets in a country with sizable disparities seems relevant for policy-making purposes. Firstly, many local governments exert disproportionate fiscal efforts to attract foreign companies, oftentimes justified by the allegedly positive potential spillovers of MNEs; however, the impact on skills, income distribution and wages is commonly seen as secondary to the number of jobs created by foreign firms (Driffield & Taylor, 2000). Some authors have argued that such inequalities are transitory because the skilled wage premium diminishes as more workers move to become skilled over time (Galor & Tsiddon, 1997). However, evidence has been put forward that in the context of large disparities in access to education, the economic opportunities will mainly be captured by the skilled and educated workers, thus increasing the income gap (Rodríguez-Pose & Tselios, 2009). Finally, the effects of FDI have been shown to differ across industries, largely depending on the knowledge intensity of the main activities, and across territories (Caves, 1974; Markusen, 2002), therefore wage effects will be heterogeneous across industries and even within the same industry in different locations.

Against this background, it seems pertinent to explore heterogeneous effects of FDI on average wages across economic sectors and subsectors at the municipality level, and assess whether FDI may reduce, enhance or perpetuate the wage gap between different types of workers. The contribution of this paper is twofold. First, while there are a few papers studying the relationship between FDI and wages in Mexico at the firm level based on industrial survey data, to our knowledge this is the first study to address the question at the municipality-industry-level

exploiting census data. Furthermore, most of these papers focus on early periods of FDI. Our time frame includes a decade long period from 1998 to 2008, that has witnessed times of increasing foreign presence and sectoral change, while wage gaps between skilled and unskilled workers have either risen or remained unaltered. This level of geographical-industrial disaggregation offers a territorial approach to economic development, inasmuch as it considers a finer administrative boundary, which is more likely to capture the differences in regional capabilities (Pike et al., 2006). Moreover, by means of various subsamples, we are able to estimate average wage effects for the most important subsectors in the Mexican economy. Second, the use of non-experimental techniques in this field of study is scant; we implement a selection on observables and difference-in-difference estimation method as the identification strategy for the effect of FDI on wage differentials between skilled and unskilled workers, accounting for industry heterogeneity. The results obtained are in line with evidence suggesting that FDI is associated with higher wages mostly for skilled workers –oftentimes for the unskilled too— and with a widening gap between them. However, the effects of FDI vary significantly when more detailed level of industrial aggregation is used, and they tend to either strengthen or wane when the initial or incremental effects are considered.

The rest of the paper is laid out as follows. Section 1.2 offers a discussion of the theory of multinational activity and wages and provides some of the existing evidence on foreign wage premium and wage inequalities in Mexico. The geography of FDI and wages in the Mexican case is described in Section 1.3. The quasi-experimental setting and the empirical strategy is outlined in Section 1.4, along with the identification issues. The subsequent Section 1.5 describes the data and construction of the variables and subsamples and provides evidence towards the credibility of the propensity score matching estimates. Section 1.6 reports and discusses the difference-in-difference matching estimates of FDI on wages for different sectors, both for skilled and unskilled wages. The last Section 1.7 draws final remarks and further avenues of research.

1.2. Background literature

1.2.1. Theory

Foreign firms' entry and presence has labour market effects in the host locations. In this paper we address two main questions. The first question concerns the overall impact of foreign firm's activity, i.e. whether increasing FDI causes average wages to be higher in the regions and industries where they operate (e.g. Feliciano & Lipsey, 2006). A positive effect could be a

combination of higher foreign and domestic wages, but could also arise in the absence of domestic wage spillovers (Lipsey, 2004). Second, we ask whether the presence of foreign firms might also have an effect on wage inequality between skilled and unskilled labour. FDI has been associated with increases in the wage gap between workers with different skill levels (Feenstra & Hanson, 1997; Markusen & Venables, 1997). When seeking to understand the association between inward FDI and changes in average wages (including foreign and domestic), and wage inequality between skilled and unskilled labour in a given location and industry, it is paramount to highlight how foreign and domestic firms intrinsically differ.

Theoretically, it is a widely accepted premise that MNEs possess some kind of firm-specific advantage, and are therefore typically expected to have higher marginal labour productivity when compared to domestic firms (e.g. Caves 1974; Markusen 2002). This can also be attributed to technological advantages that generate productivity differences between foreign and domestic firms and consequently differences in profitability (Dunning, 2001). In as much as labour productivity is tied to workers' wages, MNEs are expected to have different labour demand schedules when compared to domestic firms. As it has been extensively documented, MNEs pay, on average, higher wages than domestic enterprises, thus they are typically associated with a foreign wage premium (e.g. Lipsey, 2004). The explanation of the foreign wage premium is grounded on the determinants of multinational activity. While it is not the purpose to study the determinants of FDI and multinational activity, it is worthwhile mentioning what types of firm-specific advantages confer MNEs a competitive edge over established firms.[6]

Having ownership of specific assets both tangible or intangible —including superior levels of technological knowledge, reputation or market power— confers the multinational firm an advantage vis-à-vis its domestic competitors and compensates for the adversity of operating away from home (Caves, 1974; Hymer, 1972; Markusen, 2002). Furthermore, internalisation advantages allow MNEs to compare the costs and benefits of organising transactions internally within the firm as opposed to conducting them externally in arm's-length market transactions (Buckley & Casson, 1976). Foreign firms might be inclined to pay higher wages to reduce labour turnover and prevent proprietary technological knowledge from leaking to domestic firms via

[6] In studying the competitive advantages of MNEs, the "OLI eclectic paradigm of international production offers a flexible framework that reconciles major theoretical strands —economics, business and management— that seek to explain the various aspects of the multinational phenomenon (Dunning, 1977, 1988, 2001). A comprehensive account and discussion can be found in Iammarino and McCann (2013). MNEs are envisaged as the result of three main advantages; ownership, internationalisation and location. While the first two are firm-specific, the third is particular to geographical locations; however, the simultaneous combination of the aforementioned provide the necessary and sufficient conditions for the existence of MNEs (Iammarino & McCann, 2013). On macroeconomic determinants of FDI flows see a review in Blonigen (2005).

worker mobility (Lipsey & Sjöholm, 2004). Even when MNEs are expected to introduce a foreign-wage premium into host locations, the effects could be insignificant since there might be a selection into high-wage industries or locations (Lipsey, 2004).

Foreign presence has direct and indirect effects on local labour markets (Ietto-Gillies, 2012).[7] The overall average wage effects depend on whether or not MNEs introduce a foreign-wage premium (direct effect) and on the reaction of domestic firms in the region-industry following inward FDI (indirect). Even in the absence of a foreign-wage premium, MNE presence may have an effect on domestic firm's wages. The direction of this wage 'spillover' depends on the extent to which domestically-owned firms are able to assimilate the technology that accompanies FDI (Blomström & Kokko, 1998), but in particular, on the technology gap between domestic and foreign firms (Kokko, 1994). It may me positive if established firms increase their productivity and their wages as a result (e.g. Driffield & Taylor, 2000), or negative if domestic firms are undercut and forced to compete on the basis of cost-cutting and lower wages (Aitken & Harrison, 1999; Ietto-Gillies, 2012). Whether or not MNE's higher wages spill over to domestic firms, a higher degree of foreign ownership could affect the average level of wages in the location or industry in which they operate; either by raising the demand for labour, or through the higher wages paid by the foreign-owned firms themselves (Lipsey, 2004). If foreign firms offer higher wages, and labour markets are segmented by industry and location, and increase in foreign presence would raise average wages but not necessarily those of domestic firms (Feliciano & Lipsey, 2006). A nil effect on the average wages is also possible if MNEs are able to poach the best workers or acquire domestic firms with the best workers, there would be no changes on the aggregate accrued to foreign presence (Driffield & Girma, 2003). Generally speaking, the localised average –direct and indirect— effects of multinational activity, in the form of FDI, will depend on the industry and technological and organisational context in which the investment takes place (Ietto-Gillies, 2012).

An increase in the degree of FDI in a local labour market, holding everything else constant, will raise overall productivity and increase the labour demand for a given supply of productive factors, thus introducing a wage differential in the location (Lipsey, 2004; Lipsey & Sjöholm, 2004). Because MNEs introduce superior levels of technology in the host economy, they play

[7] The literature on FDI spillovers is vast. A review on the nature of MNE-induced spillovers and the extent to which domestic firms benefit from them is out of the scope of this paper (see reviews in Blomström & Kokko, 1998; Görg & Greenaway, 2004; Smeets, 2008). It must be stressed that these spillovers are largely unintended since MNEs will try to capture the full returns of their investment, hence domestic firms will only benefit if some sort of indirect technology transfer takes place. These channels through which spillovers might boost productivity in the host location: imitation, skills acquisition, competition and exports (Görg & Greenaway, 2004)

and important role in explaining changes in the wage gap between skilled and unskilled workers (Figini & Görg, 1999; Markusen & Venables, 1997). Typically foreign presence is predicted to raise wages for the skilled at the expense of the unskilled, although the effect on the latter might result ambiguous (Markusen & Venables, 1998). Hence, the accumulation of foreign presence is usually associated with an expansion of the demand for skilled labour, and therefore a widening wage differential between skilled and unskilled workers in the location (Bandick & Hansson, 2009; Feenstra & Hanson, 1997; Waldkirch, 2010). What is more, if this demand for skilled labour is further transmitted to the domestic sector, the wage gap between skilled and unskilled labour will be widened even further at the expense of unskilled workers (Driffield & Taylor, 2000).

It is important to mention that in this paper we address wage inequality between worker types within a region-industry. However, FDI-induced wages effects might also have an effect on territorial inequalities. MNEs will tend to favour certain regions depending on the particular function of the production chain, resulting in a geographically fragmented MNE network, both across and within countries (Defever, 2006). It has been long noted by the literature on multinational activity that FDI effects can be overall detrimental, in the sense that increasing flows may preserve or even reinforce existing subnational inequalities within countries (Hymer, 1972). In particular, the uneven distribution of factors of production is likely to have an influence in the patterns of economic activity (Bernard et al., 2010); subnational effects of FDI are likely to be more stringent in economies experiencing substantial inward FDI, large initial territorial disparities along with significant variation in regional relative wages.

1.2.2. Evidence

Whilst the evidence on the foreign wage premium is fairly robust,[8] the evidence regarding the overall effects of FDI on average wages and wage inequality is sparse and far from conclusive; results have been found to be contingent on numerous region- and industry-specific factors as well as labour market structures (Lipsey, 2004). Moreover, the type of investment and entry mode will also determine the outcomes in the local labour markets if the new FDI generates

[8] Evidence on the foreign wage premium is vast both for developed and developing countries. In general, it suggests that foreign firms indeed pay higher wages than their domestic or smaller counterparts. To some extent, the differential can be explained by the industry composition of FDI, skewed toward relatively high-wage industry sectors. However, the differential exists within industries, in most industries, and in most countries (Lipsey, 2004). For evidence in developed countries see, for instance, the cases of USA (Aitken et al., 1996; Doms & Jensen, 1998; Feliciano & Lipsey, 2006), the UK (Girma & Görg, 2007; Taylor & Driffield, 2005), Portugal (Almeida, 2007), and Ireland (Figini & Görg, 1999). For evidence in developing countries see, for example, the cases of Brazil (Arbache, 2004), Indonesia (Lipsey & Sjöholm, 2004), Venezuela (Aitken et al., 1996), and East Asian countries (Te Velde & Morrissey, 2004).

new employment capacity or not (Ietto-Gillies, 2012). The direct effect of multinational entry, may be positive if foreign companies pay higher wages, but can be cancelled out by a negative indirect effect if domestic companies have to compete on the basis of wage reductions (Ietto-Gillies, 2012; UNCTAD, 1994). For example, Feliciano and Lipsey (2006) found that FDI had no significant effect on overall USA industry wage levels, including foreign and domestic firms, for manufacturing and retail trade. However, in other non-manufacturing low-skilled industries, FDI average wage effects were found positive and significant. In a more localised study Figlio and Blonigen (2000) reported that, in South Carolina, additional foreign ownership in manufacturing, lead to increases in wages for all workers within the same industry and county. Furthermore, skilled and unskilled workers may be affected differently due to the nature of MNEs, generally increasing inequality at the expense of less skilled labour. IFDI was found to substantially raise wage differentials in Thailand, while the effects on the wage gap were found to be less clear or insignificant in Singapore, Hong Kong, the Philippines and Korea (Te Velde & Morrissey, 2004)

In the particular case of Mexico, evidence is at best mixed. Feenstra and Hanson (1997) show that FDI in the *maquiladora*[9] industry had an inequality-enhancing effect, during the early period between 1975 and 1988, as skilled workers experienced wage increases across states, while unskilled workers had only a slight wage growth. In a similar vein, Aitken et al. (1996) show that FDI is associated with overall higher wages during a similar time period (1984-1990), both for skilled and unskilled workers, with a larger effect on the latter, suggesting too that FDI enhances wage inequality. They do not find evidence of wage spillovers to domestic firms. Although, Villarreal and Sakamoto (2011) also find FDI to be associated with higher overall regional wages, they do find evidence of positive wage spillovers, as domestic firms increased their wages in labour markets with higher MNE presence during the period 1992-2001. Conversely, Waldkirch (2010) finds no positive effect of FDI on average wages in Mexican industrial sectors. Moreover, the results for that period of study (1994-2004) show that there was either a negative or no FDI effect at all, on both skilled and unskilled wages. A potential explanation is that *maquiladora* investment is not necessarily skill-intensive, therefore further increases in capital flows do not increase skilled labour demand but instead rises the demand for unskilled labour. It has been put forward that, in economies characterized by labour market segmentation and high labour

[9] In 1971, the Mexican government launched the programme that enabled the establishment of *maquiladoras* under the framework of the earlier *Programa de Industrialización de la Frontera* (1965). Under the former decree, the territories along the Northern border were constituted as a platform for the export of manufactured goods assembled in the country with raw material and components imported duty free in plants largely owned by foreign capital (Lopez Villafañe, 2004).

mobility costs, FDI might increase wage inequality even without bringing in skill-biased technology (Zhao, 2001).

The existing empirical literature has usually attempted to measure this relationship by estimating firm level wage equations (e.g. Aitken et al., 1996), or by looking at the average regional wages (e.g. Feliciano & Lipsey, 2006). Inasmuch as wages are a broad measure of human capital and skills, estimates of the FDI effects will have an upward bias if foreign presence is higher in municipalities with higher initial wages. Even when controlling for observable and time-invariant unobservable factors of municipalities, these estimates are likely to be biased because there are other time-varying characteristics that are possibly correlated with wages, making the exogeneity assumption less credible (Girma & Görg, 2007). Despite the large number of empirical studies assessing this relationship, few attempts have been made to deal with the selection bias that threatens the validity of the estimates of FDI effects on wages. In trying to disentangle the conundrum of FDI and wages, we implement in this paper a quasi-experimental approach to ask whether average wages and wage differentials, once we have accounted for observable characteristics of industries and regions, can be solely attributed to foreign presence.

The latter is what we set out to do in the remainder of this paper. The main goal is to identify heterogeneous FDI average wage effects across different manufacturing and services subsectors, for different skill groups of workers and the temporal persistence of the effects. The bottom line is to assess whether different types of FDI have wage inequality enhancing or reducing effects at the subnational level and between skilled and unskilled employees.

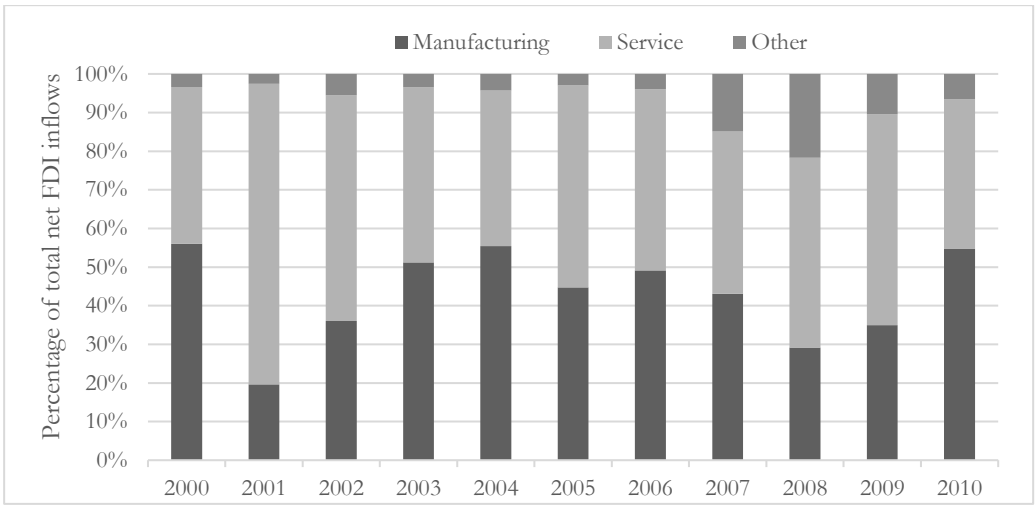
1.3. The geography of Mexican inward FDI and wages

Mexico has become one of the largest recipients of FDI inflows. In 2013, it ranked 10th world-wide, and 6th among developing and transition economies (UNCTAD, 2014). Total FDI inflows into Mexican territory exhibit a generally increasing trend, averaging 25 billion US dollars annually between 2000 and 2010 (Ministry of Economics, 2014)[10]. The national sectoral composition of inward FDI is shown in Figure 2. While the manufacturing sector concentrated the bulk of foreign investment during the 1980s and 1990s, its importance is, on average, diminishing relative to the share of investment in the services sector. While for some individual years, FDI in manufacturing still concentrates more than half of the total FDI inflows, the share

[10] Flow figures tend to exhibit year-on-year volatility, since individual investments can represent substantial percentages of the total flow in any one year. Trends are probably better observed via stock figures. However, national composition of FDI is only available for annual flows.

of manufacturing dropped to 42 percent, compared to 50 percent of the services sector, in the total accumulated FDI at the end of the period from 2000 to 2010.

Figure 2 – Sectoral composition of inward FDI in Mexico, 2000 – 2010.



Source: Author's own elaboration with data from the Ministry for Economics, *Secretaría de Economía, Gobierno de México* (2014)

The period of study has witnessed important changes in the sectoral composition of aggregate inward FDI. These recent trends are worth exploring since FDI wage effects are likely to be heterogenous across industrial sectors. Further disaggregation of subsectors reveals a more detailed picture of the distribution of FDI in Mexico as depicted in Table 1.

Table 1 – Yearly and accumulated FDI inflows into Mexico by subsector: 2000-2010.

	2000	2005	2010	Σ 2000-2010
TOTAL FDI	**18,298.0**	**24,668.9**	**23,027.4**	**262,174.0**
Manufacturing	**56.0**	**44.8**	**54.7**	**42.0**
Chemical	7.6	2.5	2.2	5.0
Electronics	11.4	4.9	8.2	6.5
Automobile	9.8	9.3	6.7	7.8
Food and beverages	8.2	9.9	30.8	10.2
Services	**40.6**	**52.3**	**38.8**	**50.2**
Real State & Finance	26.7	15.2	15.7	27.3
Media & Business Support	-3.3	15.0	3.8	10.3
Tourism	2.8	4.7	3.5	2.9
Other	**3.4**	**2.9**	**6.5**	**7.7**

Note: First row figures are total FDI inflows in million US Dollars; the rest of the rows show figures in percentages relative to the total FDI. The first three columns show total FDI inflows and shares for selected years, while the fourth column shows the accumulated value of FDI and shares in the relevant period. Source: Author's own elaboration with data from Ministry for Economics, *Secretaría de Economía, Gobierno de México* (2014)

The accumulated total FDI inflows, from 2000 to 2010 are shown in the fourth column. According to these figures the top FDI-recipient manufacturing industries in terms of their relative importance were food & beverages (10.2), automobile (7.8), electronics (6.5) and chemical (5.0). On their own, the top FDI-recipient services were real estate & finance (27.3), media and business support (10.3) and tourism (2.9). Because of these differences in importance in the national economy, the heterogeneity of FDI effects on wages is explored for these subsectors individually at the subnational region level.

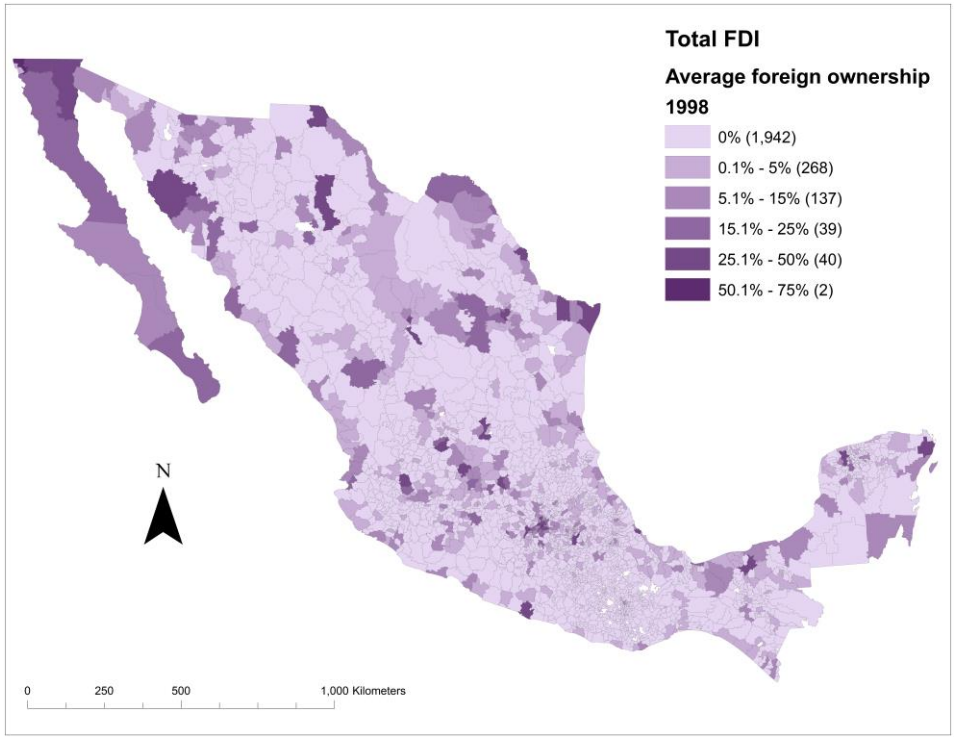
Despite its noticeable importance at the country level, the territorial concentration of foreign investment has been extremely uneven. To give a first indication, only five states (excluding Mexico City), Nuevo Leon, Mexico, Chihuahua, Baja California and Jalisco concentrate 64 percent of the accumulated stock of inward FDI in the period of 2000-2010. Concentration of foreign assets is more evident at the municipality[11] level as depicted Figure 3. The map displays in darker shades those administrative regions with higher average foreign ownership (percentage of foreign owned total assets) and in lighter those with lower or no foreign investment.

In 1998, total FDI was concentrated in 20 percent of the 2,457 municipalities scattered across the Mexican territory, with the highest density in Northern regions, some Central areas, the vicinity of Mexico City, Southern oil-producer municipalities and tourist destinations. At the turn of a decade, the spatial concentration remains relatively unchanged. However, there are significant increases in the number of municipalities with higher percentages of foreign ownership, especially around the 5 and 25 percent threshold.

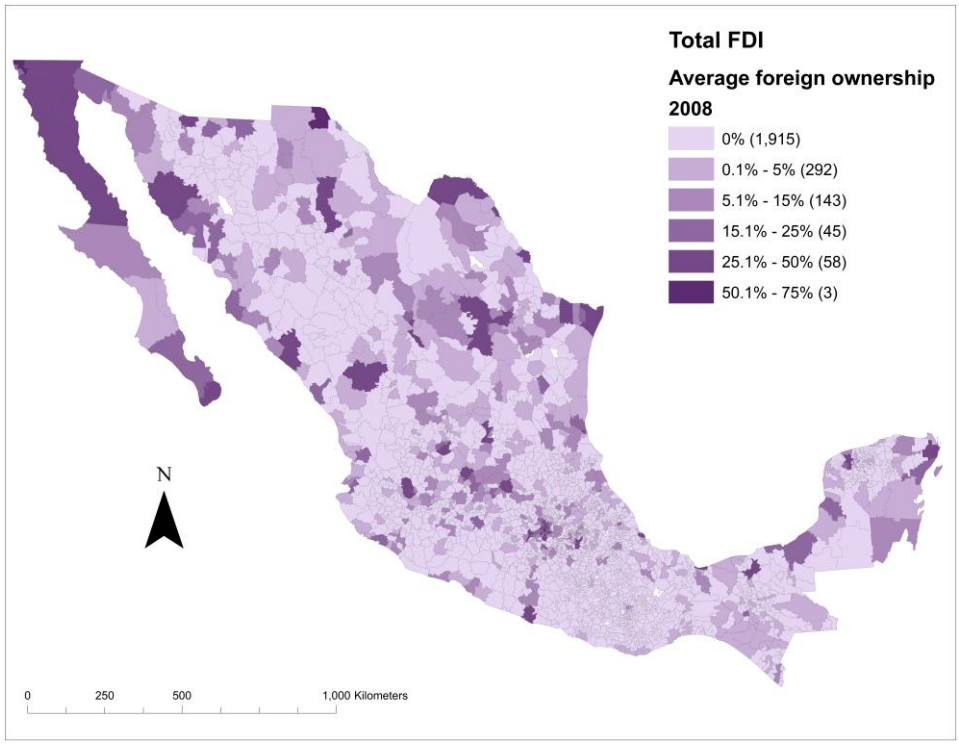
The spatial distribution of manufacturing and services FDI individually exhibit quite distinct patterns (see maps in Figure A1 and Figure A2 in the Appendix). While FDI in manufacturing concentrates in the Northern and Central traditionally industrial regions, foreign investment in the services sector tends to be located around big and medium sized cities and tourist destinations. Moreover, although average foreign ownership tends to be significantly higher in the manufacturing sector than in services, FDI in the former remained concentrated at the end of the decade in and around traditional manufacturing hot-spots. Conversely, FDI in the service sector was more sparsely distributed across the territory at the end of 2008.

[11] This administrative unit represents the third level of government, after the state and federal administrations. It is the equivalent of US counties. There are 2,457 *municipios* in Mexico. Population sizes range from 100 to 1.8 million inhabitants. The smallest *municipio* is 4.3 km^2, while the largest occupies 52 km^2. Slightly over 80 percent of the country's population resides in 47 percent of the total municipalities.

Figure 3 – Total FDI in Mexico: Average foreign ownership by municipality, 1998-2008



(a) Levels 1998



(b) Levels 2008

Source: Author's own elaboration with data from Economic Census, *Censos Economicos* (INEGI, 1999, 2009)

The skilled-unskilled wage gap is also unevenly distributed across the country. The maps in Figure 4 plots the spatial extent of the relative average wages computed as the ratio of skilled to unskilled wages; the higher the ratio the wider the wage inequality. In 1998, wage disparities did

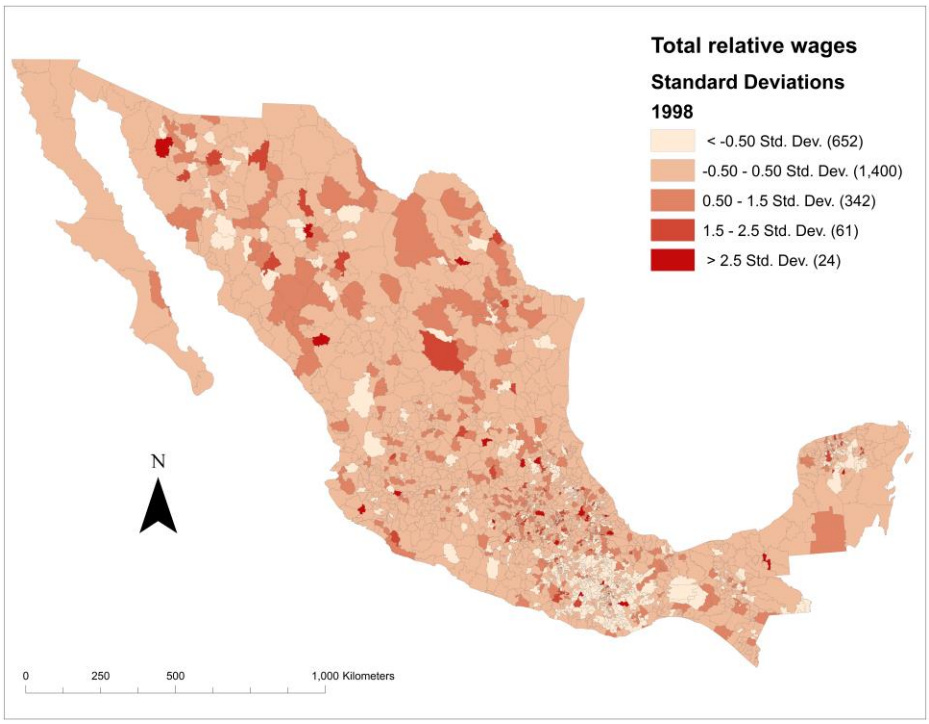
not seem to follow a clear pattern as darker shades are scattered up and down the territory. However, there is an unusual concentration in the Southern regions; poorer regions are typically more unequal than richer ones. It is worth noting as well that some Northern municipalities, often industrialised, also exhibit high wage inequalities. At the turn of the decade, the map for 2008 shows that the overall dispersion of relative wages decreased. However, a closer inspection reveals that this was only due to a few outliers that saw their wage gap shrink. In fact, there were more municipalities above 1.5 standard deviations. Wage inequalities seem to have risen from North to South.

These wage inequality trends are more evident when breaking down wages by sector with markedly different patterns. The distribution of relative wages between skilled and unskilled workers in the manufacturing sector was quite extreme in 1998 (maps in Figure A3 in the Appendix). It seems that ten years later, despite an overall compression around the mean, the distribution of wage gap remained virtually the same, with some Northern border and South-eastern municipalities increasing the wage gap between types of workers.

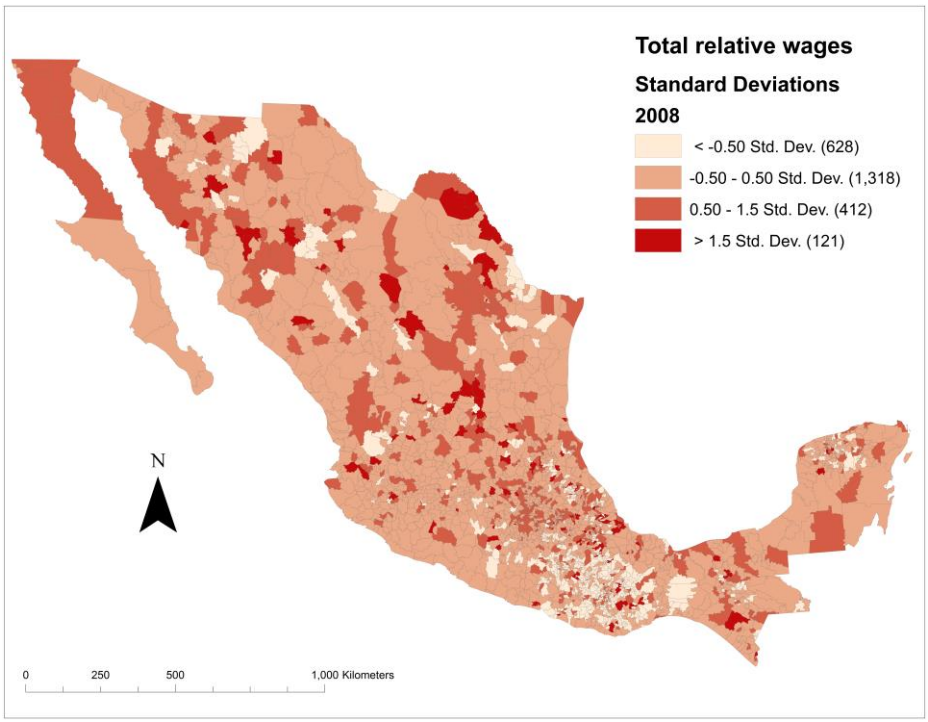
Wage differentials in the services sector offer a completely different story (see maps in Figure A4 in the Appendix). At the beginning of the period the distribution of relative wages was rather compact, with only a few municipalities having large inequalities. However, in 2008 the dispersion of relative wages significantly increased. No discernible geographical pattern arises, but it seems that the largest wage inequalities in the services sector are prevalent in municipalities with medium-sized cities and tourist destinations.

In a broad sense, since the outset of liberalisation in the early 1980s, Mexico experienced initial increases in wage inequality, as wages for skilled workers grew faster than for the less skilled workers (Cragg & Epelbaum, 1996). An economy-wide increase in the skill premium and the uneven distribution of skill endowments across states contributed to the divergence in regional incomes (Aguayo-Téllez, 2006). However, the increasing divergence came to a halt after the enactment of NAFTA in 1994 (Airola & Juhn, 2008). If anything, Mexico's wage inequality has remained unchanged after the trade agreement, and there is no evidence of a reduction in the wage gap between skilled and unskilled labour in Mexico after 1994 (Esquivel & Rodríguez-López, 2003).

Figure 4 – Relative wages in Mexico: Average relative wages by municipality, 1998-2008



(a) Levels 1998



(b) Levels 2008

Note: The variable plotted is the average relative wages as the ratio of skilled to unskilled wages for all sectors.
Source: Author's own elaboration with data from Economic Census, *Censos Economicos* (INEGI, 1999, 2009)

Moreover, it has been suggested that the main source of inequality in Mexico is rising wages of skilled workers rather than declining real wages of the unskilled (Graham & Wada, 2000). Our time frame comprises a later period from 1998 to 2008. At a time of increasing foreign presence and sectoral change, the wage gaps between skilled and unskilled workers have risen or remained unchanged at best. Two general trends have been described in this section that lay the ground for the analysis. First, territorial wage differentials are a common feature of the Mexican economy. Moreover, within-municipality wage gaps between skilled and unskilled workers seem to differ across sectors. Second, FDI continues to flow unevenly across the country. Importantly, the period of study is witness to considerable changes in the sectoral composition of FDI and consequently the spatial distribution of FDI. It is therefore worthwhile to assess the heterogeneous effects of FDI on average wages across economic sectors and subsectors at the municipality level, and whether it may reduce or enhance the wage gap between different types of workers. This paper discusses the likely impacts of FDI on these labour market effects.

1.4. Empirical strategy

The purpose of this paper is to address the question of whether inward FDI across different industries is associated with higher average wages and widening differentials between skilled and unskilled workers in FDI-recipient municipalities. The most salient and problematic feature of the FDI-wage relationship is its reverse causality. It is empirically difficult to disentangle the location determinants of FDI from its effects on the local economy (Ietto-Gillies, 2012). On one hand, there is no doubt that FDI has an effect on the local labour market of the host economy, via the demand of labour. On the other hand, initial wages may play an important role as locational determinants of multinational activity by being a proxy for skills. On this account, disentangling the endogenous relationship is the main challenge of any quasi-experimental approach attempting to identify the effects of FDI on wages.

Essentially, a positive association between FDI and wages might be obscuring a selectivity bias driven by foreign firms' investment decisions. Broadly speaking, high wages could be either the result of selective FDI flowing into regions with higher skills and human capital reflected in higher wages (Almeida, 2007); foreign firms operating in industries with higher skill requirements and higher wages (Harris & Robinson, 2002; Lipsey & Sjöholm, 2004); established exporting industries (Villarreal & Sakamoto, 2011); or simply traditional marshallian externalities in the form of specialised labour pool and local suppliers. The aforementioned scenarios constitute the reverse causality problem of wages and FDI. It is common sense that a simple

OLS or even fixed effects estimators would suffer from selection bias. To this end, we use a selection on observables empirical strategy, in the spirit of Girma and Görg (2007), to identify the effect of FDI on wages in Mexican subnational regions and industries.

To measure the causal effect of FDI on wages, let $FDI_{it} \in \{0,1\}$ be the treatment variable indicating whether municipality i received foreign direct investment in a given industry in time t or not. Bearing in mind that the treatment units are groups of municipalities for different industries, we omit the industry subscript in the interest of clarity. The treatment effect of FDI on wages in municipality i is simply the difference $w^1_{it+\delta} - w^0_{it+\delta}$. In the period following FDI inflows, $t + \delta$, the first term is the observed wages in municipality i under foreign presence, while the second term is the observed wages in the same municipality without foreign presence. The fact that for a given municipality we can only observe either $w^1_{it+\delta}$ or $w^0_{it+\delta}$ in time $t + \delta$, constitutes the fundamental problem of causal inference that all non-experimental empirical strategies are faced with.

Attempting to estimate the average treatment effect on both FDI-recipient and non-recipient municipalities, will tend to overestimate the effect of FDI because, on average, treated municipalities might have higher observed wages. Therefore, a more sensible estimate is the effect of FDI on wages for FDI-recipient municipalities only, because it puts more weight on those that are more likely to be treated. The estimand of interest herein is the average treatment effect on the treated (ATET), which is defined as the expected value of the difference in wages for those municipalities that received FDI in t:

$$E\{w^1_{it+\delta} - w^0_{it+\delta} \mid FDI_{it} = 1\} = E\{w^1_{it+\delta} \mid FDI_{it} = 1\} - E\{w^0_{it+\delta} \mid FDI_{it} = 1\} \qquad (1)$$

To solve the problem of unobservability described above, the missing outcome $w^0_{it+\delta}$ can be replaced by the observed wages for a set of potential comparison municipalities that did not experience any foreign capital inflows. However, for this counterfactual to be valid, it is necessary that the control units have the same pre-treatment characteristics (Dehejia & Wahba, 2002). Specifically, it is assumed that, conditional on some observable characteristics $X_{it-\delta}$ of the municipalities, FDI flows are not determined by unobservable factors. For the units to be comparable, wages in the potential comparison municipalities need to fulfil the following condition:

$$w^0_{it+\delta} \perp\!\!\!\perp FDI_t \mid X_{it-\delta} \qquad (2)$$

This assumption rules out selection bias by ensuring that no variables that are correlated with FDI are omitted and it is less restrictive than the assumption needed to estimate the average

treatment effect.[12] Nonetheless, any reliable inference drawn on the effect of foreign presence on wages crucially depends on the construction of a valid comparison group. Matching on observable characteristics allows pairing each FDI-recipient region to one non-FDI-recipient region that is similar along some predetermined observable characteristics.

The increasing appeal of these techniques is that they require an explicit statement of conditional independence assumption, like the one given by (2), for the estimates to have a causal flavour (Angrist & Pischke, 2008). Nonetheless, one limitation of this methods is that matching municipalities on a vector of covariates X_i requires a sufficiently rich comparison group to ensure that no cell containing a treated municipality is without a control; as the number of covariates increases, the difficulty of finding exact matches rises exponentially (Dehejia & Wahba, 2002). An alternative method is the propensity score matching, which reduces this multidimensionality problem by instead matching on one scalar only, namely, the conditional probability of receiving the treatment (Rosenbaum & Rubin, 1983). In this particular observational setting, the conditional probability of receiving FDI is a function of pre-treatment characteristics:

$$Pr(FDI_{it} = 1|X_{it-\delta}) = F[X_{it-\delta}] \quad (3)$$

The choice of covariates $X_{it-\delta}$ is motivated by the literature on the locational determinants driving FDI decisions of firms seeking to establish operations abroad, which in turn, affects the probability of foreign investment flowing into a given host region. These factors are often associated to advantages offered by the host economy. Multinationals may be willing to invest abroad in order to gain access to specific advantages such as inputs, intermediates, services or other tangible or intangible assets that might not be present or are more expensive in the home economy (for an overview, see Iammarino & McCann, 2013). Locational advantages determine the geographical extent of multinational activity by combining different forms of integration with market and industry structure. In a broad sense, they can be understood as industry-specific trade-offs; between scale economies and market access, and between scale of integration and factor costs differentials on the other (Barba Navaretti & Venables, 2004). Therefore, pre-treatment covariates are factors influencing firms' investment decisions and hence they are correlated with FDI flows and wages. The selection and construction of the variables is presented more in detail in Section 1.5. To account for industry heterogeneity, we estimate the

[12] Such assumption additionally requires that the potential wages in treated municipalities are also independent of the conditional treatment.

FDI effects by sector and subsectors separately. Both pre-treatment covariates and outcome wages are measured at the municipality-level by industry.

The propensity score estimator may be a good approximation of the causal effect of FDI on wages if, conditional on the probability of receiving FDI, potential wages are independent of the incidence of foreign ownership. If the assumption of selection on observables (2) holds, then it follows:

$$w_{it+\delta}^{0} \perp\!\!\!\perp P(FDI_{it}|X_{it-\delta}) \tag{4}$$

Instead of controlling for all the factors $X_{it-\delta}$ affecting the probability of inward FDI, the propensity score allows to control only for the probability of treatment itself $P(FDI_{it}|X_{it-\delta})$. Hence, the estimand of the ATET is given by

$$E\{w_{it}^{1} - w_{it}^{0} \mid FDI_{it} = 1\} = \frac{1}{P(FDI_{it}=1)} E\left[\frac{(FDI_{it} - p(X_{it-\delta}))\boldsymbol{w_{it}}}{1-p(X_{it-\delta})}\right] \tag{5}$$

Matching on the propensity score is equivalent to weighting the comparison municipalities when estimating the ATET, provided that they have a similar conditional probability of being treated as the treated units, and according to the matching technique. For (5) to yield a consistent estimate, a consistent estimator of the propensity score is needed (Angrist & Pischke, 2008). In this application, the conditional probability (3) is estimated using a logit model. The matching procedure is described in Section 1.5 along with the balance tests. Furthermore, the estimation of (5) requires that there is a positive probability of either being treated $FDI_{it} = 1$ or not $FDI_{it} = 0$,

$$0 < P(FDI_{it} = 1|X_{it-\delta}) < 1 \tag{6}$$

The latter is the common support assumption and it implies that a match can be found for all treated municipalities providing the basis of the comparison (Smith & Todd, 2005).

Finally, since data on wages before and after FDI are available for both control and treated municipalities, propensity score matching can be combined with the difference-in-difference technique (Heckman et al., 1997). Such combination represents a considerable improvement on the identification of the causal effect because, in addition to controlling for selection on observables through matching on the conditional probability, it further eliminates time-invariant unobserved differences in wages between municipality groups by using the difference in wages before and after FDI (Blundell & Costa Dias, 2000). Furthermore, unobserved heterogeneity across industries is also accounted for. The identification assumption (4) is now stated in terms of the before-after evolution of wages instead of levels,

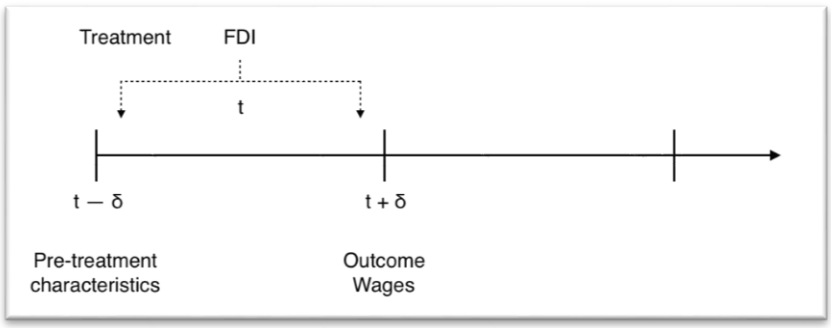
$$w^0_{it+\delta} - w^0_{it-\delta} \perp\!\!\!\perp P(FDI_{it}|X_{it-\delta}) \quad (7)$$

This is the equivalent of the parallel trend assumption and implies that the control municipalities have evolved in the same way as the treated would have done in the absence of FDI inflows. Therefore, $\Delta w_i = w_{it+\delta} - w_{it-\delta}$ can be plugged in the sample analog of (5) instead of w_i,

$$ATET = \frac{1}{N_1}\sum_{i=1}^{N} \boldsymbol{\Delta w_i} \cdot \frac{FDI_{it} - \hat{p}(X_{it-\delta})}{1 - \hat{p}(X_{it-\delta})} \quad (8)$$

which constitutes the difference-in-difference propensity score matching estimator of the average treatment effect on recipient municipalities of FDI on wages that we are interested in estimating. The treatment is represented diagrammatically in Figure 5. Matching on pre-treatment covariates is done in period $t - \delta$. Inward FDI takes place any year during period δ, while the outcomes, i.e. wages are measured in the period following the treatment $t + \delta$. The treatment is repeated for different municipality groups in two time periods δ_1: 1998-2003 and δ_2: 2003-2008. The wage effects of FDI are estimated for treated municipalities in different sectors and subsectors.

Figure 5 – Diagram: Temporal definition of treatment: FDI on wages



Source: Author's own elaboration

1.4.1. Hypothesis

Based on the theoretical literature and existing evidence we formulate for our empirical model the following testable hypothesis on the average wage effects, by industry, on FDI-recipient municipalities in Mexico.

> *H1. FDI and average wages.* An increasing degree in foreign presence in a given industry, is associated with higher wages, both for skilled and unskilled labour, in the host municipalities. This positive effect could be due to some combination of foreign wage premia and domestic wage spillovers.

H2. FDI and wage gap. Increases in foreign presence in a given industry, may enhance the wage gap between skilled and unskilled labour in host municipalities. This effect could be due to (i) skilled wages increasing more than unskilled wages, or (ii) skilled wages increasing while unskilled decrease or remain unchanged.

H3. FDI temporal effects. Initial wage effects will tend to be larger than cumulative effects. Initial foreign entry in a given industry is likely to have strong effects on wages due to the introduction of a foreign wage premium. These effects will tend to wane with incremental FDI as both MNEs' and domestic firms' wages adjust in time.

1.5. Data and balancing of covariates

To address the questions at hand we use data for Mexican municipalities from the Economic and Population Censuses, both collected by the National Institute for Statistics (INEGI). The data related to foreign ownership can only be obtained under certain confidentiality principles[13] and by request. The rest of the variables can be obtained from INEGI's website[14]. The dataset consists of aggregated data at the municipality level by three-digit industrial subsector according to the North American Industrial Classification System (NAICS, 2013). Economic Census data is available in five-year intervals for 1998, 2003 and 2008.[15]

The analysis encompasses several subsamples of the dataset to allow for heterogeneous effects of FDI. The first division corresponds to the industrial scope. Estimations of the effect of FDI on average wages are carried out for the entire pool of industrial sectors, then separately for the manufacturing sector and for the service sector. Further analysis is carried out by disaggregating the latter sectors into their top recipient subsectors; food and beverages, automobile, electronics, chemical, finance and real estate, business and media and tourism (see Table A2 in the Appendix for further detail on industries and sectors). The second division comprises the different wage groups. Foreign ownership effects are evaluated separately on two different wage groups; skilled and unskilled workers. Lastly, the third division corresponds to the temporal and dynamic dimensions of FDI's effects on wages. To this end, we define two treatment variables explained below to estimate both the initial and incremental effect of foreign presence on local wages.

[13] Wherever there are three or less economic units in the industry-municipality observation, data is concealed due to a principle of confidentiality.

[14] https://www.inegi.org.mx/anterior/accesomicrodatos/ (Last accessed: December 2016)

[15] Economic Census data refers to the fiscal year before the information is collected (INEGI, 1999, 2004, 2009)

The outcome variables are built as the logarithmic forms of average real skilled wages and average real unskilled wages, with 1998 being the base year. Average wages are calculated as total remunerations relative to total employment in the relevant wage group. The difference in wages is given by $\Delta w_i = w_{it+\delta} - w_{it-\delta}$. In other words, it is the change in wages between the pre-treatment period, $t - \delta$, and post-treatment period $t + \delta$. According to the data source, groups of skilled and unskilled workers are defined in terms of production and non-production employment. It is acknowledged that these have been regarded as coarse categories for skill sets; unfortunately, these are the only data available from the economic census. Nonetheless there is some support in the literature suggesting production and non-production groups are closely related to the knowledge intensity of the job activities (Berman et al., 1994; Slaughter, 2000).

The variable of interest, FDI, is the average of firms' percentage of foreign ownership of total assets in each industrial category and municipality. The variable is collected by asking individual firms what percentage of their total assets is owned by foreign capital, then it is averaged at the subsector-municipality-year level. We test differences in the temporal effects of FDI by defining two dichotomous treatment variables. First, we construct a treatment variable that captures the initial effect of FDI on wages: $FDI^{\rightarrow} = 1$ if the municipality goes from no foreign presence to a positive share of foreign ownership between $t - \delta$ and $t + \delta$; conversely, $FDI^{\rightarrow} = 0$ if the municipality has no foreign presence during the same period. We also define a second treatment variable, that measures the incremental effect of FDI on wages for municipalities with existing foreign presence: $FDI^{\rightrightarrows} = 1$ if there is a strictly positive change in foreign presence between $t - \delta$ and $t + \delta$; inversely, $FDI^{\rightrightarrows} = 0$ if there is no change or a negative change in foreign presence. We evaluate these treatment effects on two groups of municipalities; the first group δ_1 for the period from 1998 to 2003, the second δ_2 from 2003 to 2008. The number of treated and untreated municipalities varies depending on the subsample considered.

The pre-treatment covariates[16] in $t - \delta$ are both related to FDI and wages, therefore they are used to match treated and control municipalities and rule out any pre-existing differences along these characteristics, by conditioning the probability of receiving positive FDI inflows. Foreign companies tend to have superior productivity, technology levels or input requirements (Harris & Robinson, 2002). To address the latter, we include labour productivity measured as the log of value added per worker; local labour force as the percentage of the population aged 15 to 29 years; and infrastructure and development as captured by the development index.[17]

[16] Descriptive statistics for all pre-treatment covariates are provided in Table A1 the Appendix by FDI presence in the pre-treatment period.

[17] It is a composite index of life expectancy, literacy rates and income per capita (INEGI)

Furthermore, large firms have been largely known to pay higher wages. To account for any size effect we include capital stock in the log form of total fixed assets (Hollister, 2004). At the same time, FDI might be flowing into regions hosting certain industries with higher skill requirements (Lipsey & Sjöholm, 2004), hence exhibiting higher levels of human capital; average years of education is included on this account. Moreover, to control for the fact that FDI might choose to locate in regions with established exporting industries (Villarreal & Sakamoto, 2011), the share of exports, as the ratio of foreign sales to total sales, is included. Finally, because FDI might be flowing into regions with either higher skills and human capital reflected in higher wages (Almeida, 2007), we control for the initial average skilled and unskilled wages in their logarithmic form.

The propensity score estimator may yield a good approximation of the causal effect of FDI on wages if, conditional on the probability of receiving FDI, potential wages are independent of the incidence of foreign capital. As it was mentioned in Section 1.4, the propensity score is a convenient measure of "closeness", because it reduces the multidimensionality to a single scalar, namely the probability of being treated. For the identification assumption to hold, the pre-treatment covariates should be balanced across groups of municipalities in the data (Rosenbaum & Rubin, 1983). We provide below some tests suggested by the literature so as to rest assured that the matching is balanced enough to provide consistent estimators.

Before turning to the balancing tests, we briefly discuss two main issues that arise regarding the matching procedure (Dehejia & Wahba, 2002). First, regarding the selection of the matching technique, k-nearest neighbours is the most straightforward method to estimate the ATET because it matches each treated unit to the k controls that have the closest propensity score.[18] We choose to run the matching for the two nearest neighbours. The second issue is related to the first and it considers whether to match with or without replacement.[19] Due to the large heterogeneity across Mexican municipalities, finding a "close enough" control unit might be difficult. For this reason, we choose to match with replacement, in order to reduce bias by

[18] The choice of k entails a trade-off between bias and precision. Selecting a high number of neighbours, k, introduces bias in the estimate because by definition the subsequent matches are further away of the treated unit than the first match (Stuart, 2010). However, choosing $k > 1$ reduces the variance due to larger matched sample and because the propensity scores are averaged by the k closest matches.

[19] Matching with replacement leads to bias reduction since it reduces the distance in the propensity score between the control units and the treated, even if the comparison municipalities have been matched more than once (Dehejia & Wahba, 2002). Conversely, matching without replacement will increase bias because treatment units are forced to match with comparisons that are not necessarily the most similar in terms of the propensity score.

allowing any control region to be matched more than once to the nearest FDI-recipient municipality; of course, this comes with a loss in the precision of the estimates.[20]

Balance checks for pre-treatment covariates are conducted for all subsamples for which we estimated a propensity score in the results section. For all of them, we are able to verify that no pre-existing differences across treated and control municipalities existed before FDI flows and satisfy ourselves that differences are not significant. Balancing test results are presented in Table 2 for the most general sample and all industries, comprising 128 municipalities that received initial FDI inflows ($FDI^{\rightarrow} = 1$) between 1998 and 2003 for the first time and 1,628 potential comparison municipalities.

Table 2 – Balancing tests from matched data for all industries.

Variable	Means		%	% Bias	T-test		Variance
	Treated	Control	Bias	reduction	t-stat.	P-val.	Ratio
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Labour productivity	3.5847	3.6466	-7.9	92.1	-0.52	0.603	0.35
Capital	11.313	11.402	-5.3	97.1	-0.52	0.604	0.64
Exports	.04487	.02228	25.9	44.0	1.84	0.066	1.15
Average schooling	6.218	6.1586	5.1	94.8	0.41	0.680	0.71
Population aged 15 to 29	.27443	.27514	-2.9	96.2	-0.29	0.774	1.03
Development index	.80721	.80447	3.9	94.9	0.40	0.687	1.02
Skilled wages	3.4208	3.571	-12.6	91.4	-1.82	0.070	0.97
Unskilled wages	2.7914	2.8086	-2.5	97.5	-0.33	0.742	0.40

Note: Matching is shown for the pool of all industries, $FDI^{\rightarrow}$ treatment variable, and group 1 (1998-2003). There are 128 treated municipalities and a pool of 1,628 comparison municipalities, yielding a sample size of 1,756 observations. Pre-treatment covariates in 1998.

The tests include standardised bias, difference in means t-tests, and variance ratios between the raw and the matched data for all pre-treatment covariates in X_{it-1}. The first balancing test requires to consider the means for the pre-treatment covariates across treatment and control groups. The standardised differences or bias for all $X_{it-\delta}$ is defined as the difference in means between the sample of FDI-recipient municipalities and the matched comparison group, scaled by the average variances of the variable in both groups (Smith & Todd, 2005).

At first glance, the means for the matched sample, shown in the first two columns of Table 2, appear to be fairly balanced across groups. This is summarised by the standardised bias reported in column (3). For most of the covariates this value is smaller than ± 10 percent. Meaning that for the matched sample, the differences in means across groups are relatively small. All of the

[20] It should be noted that because some control units have been matched more than once, they are no longer independent and inference becomes more complex (Stuart, 2010).

biases appear to be fairly smaller than 20 percent and the mean bias is 15 percent.[21] The only notable exception is exports with a bias of 25 percent. However, this should not be surprising for a sample including a pool of manufacturing and services sectors, since exporting firms tend to dominate the manufacturing sector. In fact, the standardised bias in exports is closer to zero in the subsamples for manufacturing and individual industrial subsectors.

The appropriateness of the balancing is further confirmed in column (4) which displays the bias reduction in terms of the improvement from the raw to the matched sample. After matching on observables, almost all the pre-treatment covariates present a bias reduction above 90 percent, which increases our confidence in the matching procedure. Again, the exception being exports with a bias reduction of 44 percent. Lastly, columns (5) and (6) report the results of the t-test between FDI and non-FDI municipalities to gauge whether significant differences exist. At the 1 percent level of significance, we fail to reject the null hypotheses of mean equality. There are no significant differences across groups of municipalities in terms of the pre-treatment covariates.

In column (7), the variance ratios give indication about the similarity across groups in terms of the spread of each distribution. The closer to one, the more similarly dispersed the distributions for treated and control municipalities are. For most of the covariates, this ratio is closer to one. However, for labour productivity and skilled wages it seems that the variance for the control group is larger than that of the treated municipalities. This again should not be startling. Finding exact matches for FDI-recipient municipalities in the Mexican context might prove difficult due to large disparities across sub-regions, hence the resulting matched comparison group of non-FDI municipalities is bound to have larger variance. Put differently, FDI-municipalities will tend to be more similar to one another, therefore having smaller dispersion around the mean. The standardised bias and variance ratios (columns 3 and 7 in Table 2) balancing tests are visually summarised in Figure A5 in the Appendix.

Finally, with respect to the second identification assumption (Equation 6), common support needs to hold in the data for the estimates of the ATET to be consistent. This condition requires that there is substantial overlap between the distribution of propensity scores of comparison and treatment groups: without this the comparison points may result inappropriate (Heckman et al., 1997). In the subsequent analysis, the common support assumption is imposed, and the analysis restricted to the control municipalities that fall within the distribution of the treated

[21] It should be noted that only a bias greater than 20 percent can be considered large and hence problematic (Rosenbaum & Rubin, 1985).

units, therefore focusing on the ATET. The evident caveat is the external validity of the results due to the locality of the estimates.

1.6. Results and discussion

Once the balance on the covariates has been ensured for the conditional propensity score, the estimates of the ATET of FDI on wages for treated municipalities (equation 8) are given in Table 3 for the initial effect and in Table 4 for the incremental effect. As described in the empirical approach above, these estimates not only control for selection on observables through matching on the conditional probability, but they further eliminate time-invariant unobserved differences in wages between municipality groups by using the difference in wages before and after FDI. Insofar as the identification assumptions hold in the dataset, the coefficients can be interpreted, with some caution, as the causal effects of FDI on wages in treated municipalities. Since these are expressed in logarithmic form, they can be read as a percentage change in the relevant average wages.

Table 3 contains a number of estimates of the initial effect of $FDI^{\rightarrow}$ on regional wages. The treatment is meant to capture the initial shock of FDI on wages for those recipient municipalities with no previous foreign presence in period $t - \delta$. In general, when all industries are considered, we find evidence in favour of hypothesis *H1*. In other words, in the period following the entry of new foreign investments, regional average wages tend to be significantly higher in treated municipalities had they not received FDI at all. Although skilled wages are significantly higher in both groups, unskilled wages significantly rose only in one and remained unaffected in the other. Regarding hypothesis *H2,* we find evidence in support of initial FDI shocks being associated with a widening of the wage gap. For example, in group 1, while skilled wages increased in 32.3 percent, there was no significant increase in unskilled wages. Considering that mean skilled wages are almost 22.5 percent higher than unskilled in the pre-treatment period (from Table 2), FDI further broadens the initial average wage gap in treated municipalities to 55 percent. A similar pattern is found for group 2, with the slight difference that unskilled wages rose 11.5 percent, that is still markedly lower than the increase of 45 percent in skilled wages. It should be noted that for groups 1 and 2, treated municipalities are not the same, so the effects of FDI on wages correspond to different sets of locations and should not be thought of as a temporal trend.

Table 3 – Estimates of the initial effect of FDI on wages in recipient municipalities

	Skilled wages (1)	Unskilled wages (2)	
	DID PS Matching Estimate (AI Robust Standard Errors)		N (T=1)
All industries			
Group δ_1	.323 (.090) **	.045 (.045)	1,756 (128)
Group δ_2	.450 (.102) ***	.115 (.045) **	1,766 (75)
Manufacturing			
Group δ_1	.779 (.170) ***	-.016 (.070)	1,449 (89)
Group δ_2	.617 (.135) ***	.198 (.059) ***	1,452 (58)
Automobile			
Group δ_1	.601 (.257) **	.255 (.065) ***	56 (12)
Group δ_2	.680 (.673)	.049 (.113)	44 (7)
Electronics◊			
Group δ_1	-	-	-
Group δ_2	-	-	-
Chemical			
Group δ_1	1.450 (.637) **	.511 (.326)	81 (10)
Group δ_2	.085 (.297)	-.212 (.180)	81 (14)
Food & Beverages			
Group δ_1	.417 (.193) **	.038 (.066)	1,487 (50)
Group δ_2	1.089 (.315) ***	.360 (.073) ***	1,507 (21)
Services			
Group δ_1	.276 (.118) **	.205 (.071) ***	1,435 (69)
Group δ_2	.575 (.152) ***	.194 (.066) ***	1,535 (59)
Real Estate & Finance			
Group δ_1	-.038 (.209)	.043 (.207)	402 (40)
Group δ_2	.329 (.164) **	.103 (.091)	490 (23)
Business & Media			
Group δ_1	.362 (.151) **	.285 (.201)	828 (60)
Group δ_2	1.255 (.342) ***	.440 (.156) ***	990 (23)
Tourism			
Group δ_1	.508 (.140) ***	.160 (.081) **	1,284 (52)
Group δ_2	.235 (.176)	.060 (.064)	1,308 (50)

*** 1% , ** 5%, * 10% level of significance. N = Sample size. T = Treated municipalities on common support.
Note: Treatment municipalities are not the same for each period of study. Group δ_1 corresponds to treatment and control municipalities in the period 1998-2003, while Group δ_2 are municipalities in the following period 2003-2008.
◊The coefficients for the Electronics industry could not be estimated due to a violation of the common support assumption, i.e., not enough control units.

All in all, foreign entry is confirmed to be associated with an initial increase of average wages and a widening of the pre-existing gap between skilled and unskilled workers, much in line with previous studies (Cragg & Epelbaum, 1996; Feenstra & Hanson, 1997). These estimated coefficients, however, consider FDI in all industries, thus hiding a great deal of inter-industry heterogeneity in FDI effects. The latter is confirmed below when the sample is broken down into manufacturing and service sectors and their respective top subsectors.

The first set of results concerns the effect of FDI in manufacturing. Again, manufacturing FDI is associated with higher average wages for both groups of workers, but more persistently for skilled workers. For example, in group 1, skilled wages rose significantly in 77.9 percent after initial FDI inflows, while unskilled labour did not experience any significant change. Given an initial wage differential of 16 percent at the beginning of period 1, manufacturing FDI is markedly associated with an increase in the wage gap of 106 percent at the expense of unskilled labour (see Table A3 in the Appendix). Nonetheless, these higher average wages might still be driven by particular industries, after all the manufacturing sector encompasses a wide range of economic activities with different levels of technology and knowledge intensity, that rely more or less on particular worker skills. Thus far, the subsamples are still too broad in scope and hence concealing the nuances of numerous economic activities; we further breakdown the sample in order to identify the inter-industry heterogeneity of manufacturing FDI effects.[22]

For the automobile industry in the first group, both skilled and unskilled wages are estimated to be 60.1 percent and 25.5 percent higher in treated municipalities respectively. However, for the treated municipalities in group 2, there are no significant wage effects for neither group of workers. Despite its relative importance to the national manufacturing sector, these results might suggest that FDI in the automobile industry locates different stages of the production chain, with varying degrees of skill requirements, in different regions. For instance, manufacturing of suspension components might be less skill intensive than manufacturing of the automobile itself, and hence the latter is more likely to be associated with higher average wages. In the chemical subsector, unskilled workers did not experience any significant foreign wage premium, while skilled wages in treated municipalities only significantly rose in more than 100 percent for group 1. As far as the food & beverages industry is concerned, there is consistent evidence of higher wages for skilled workers in both groups. At the same time, unskilled workers in this subsector saw their wages increased, on average, by 36 percent at the end of the period for the second group. The lack of consistency in the estimates of average wage effects in different manufacturing industries only confirms the wide heterogeneity of FDI effects on wages even within the same industry in different locations.

The second set of results involve the effect of services FDI on local wages. On the aggregate, the services sector exhibits consistently significant initial higher average wages, both for skilled and unskilled workers. In group 1, wages for skilled workers was 27.6 percent higher and that

[22] The initial effect on wages in the electronics industry could not be estimated due to a small number of control municipalities which resulted in a violation of the treatment overlap assumption.

for unskilled workers came to 20.5 percent. FDI in this sector seems to be also associated with a widening of the wage gap between worker groups, in the pre-treatment period the skilled wages were only 23.2 percent higher than unskilled and this wage gap increased to only 30.6 percent (from Table A4 in the Appendix). To further explore the inter-industry heterogeneity of the services sector we break down the sample into its main components.

For the real estate & finance subsector, whereas skilled wages were estimated to be 32.9 percent higher following FDI inflows only in group 2, unskilled wages did not experience any significant wage effects in neither period. This probably suggests that this industry requires, on average, less unskilled labour force. As far as the business & media subsector is concerned, the effect of initial foreign presence seems to be positive and significant for both skilled and unskilled workers in both groups (the only exception being the lack of a significant unskilled wage effect in group 1). For group 2, whereas skilled wages were estimated to be 125 percent higher, unskilled wages rose as high as 44 percent, resulting in further widening of the wage gap. Higher average wages for both groups of workers should not come as a surprise since industries within this subsector are wide-ranging in terms of their skills requirements; from cleaning support to scientific and technical assistance for businesses (Table A2 in the Appendix). The tourism subsector represents another special case due to the very different nature of the economic activities that it encompasses. These range from passenger transportation, entertainment, to food, drinks and accommodation services. While all wages across the subsector were significantly higher following FDI inflows in group 1, there were no significant wage effects for group 2 on the sector as a whole. Taken all together, the aforementioned estimated coefficients for different services subsectors, might suggest that even though services are more knowledge-intensive and rely more on skilled rather than unskilled workers, FDI might also increase average unskilled wages. Even with the Mexican economy slowly transitioning towards the services sector (50 percent of the accumulated FDI stock between 2000-2010, see Table 1), many of the services still concentrated higher shares of low skill activities.

Up until now, the discussed estimates correspond to the initial effect of FDI on wages, that is, on recipient municipalities that saw an increase in foreign presence from zero to strictly positive. We now turn to the incremental effect that $FDI^{\rightrightarrows}$ may have on average wages and wage differentials. In other words, whether increasing foreign investment is associated with further higher average wages and changes in the wage gap in recipient municipalities that already have an established foreign presence in the pre-treatment period. Results are presented in Table 4. Overall, it seems that incremental foreign ownership is associated with smaller increases in average wages across specifications compared to those of initial FDI. The coefficients for all

industries and the aggregated manufacturing and services sectors largely exhibit the same patter as their counterparts in Table 3 but with lower magnitudes. This constitutes evidence in favour of hypothesis *H3*, suggesting that subsequent arrival of MNEs is associated with lower increases in wages when compared to initial FDI shocks.

Table 4 – Estimates of the incremental effect of FDI on wages of recipient municipalities

	Skilled wages (1)	Unskilled wages (2)	
	DID PS Matching Estimate (AI Robust Standard Errors)		N (T=1)
All industries			
Group δ_1	.178 (.046) ***	.024 (.022)	2,168 (341)
Group δ_2	.220 (.056) ***	.099 (.027) ***	2,226 (291)
Manufacturing			
Group δ_1	.323 (.071) ***	.0005 (.033)	1,702 (215)
Group δ_2	.455 (.086) ***	.091 (.041) **	1,747 (141)
Automobile			
Group δ_1	.200 (.155)	.088 (.118)	114 (30)
Group δ_2	.138 (.309)	.120 (.081)	110 (20)
Electronics			
Group δ_1	.072 (.105)	-.089 (.094)	66 (28)
Group δ_2	-.258 (.184)	.291 (.094) ***	62 (26)
Chemical			
Group δ_1	.295 (.106) ***	.064 (.108)	186 (59)
Group δ_2	.183 (.100) *	.024 (.066)	182 (48)
Food & Beverages			
Group δ_1	.244 (.106) **	-.016 (.047)	1,602 (82)
Group δ_2	.330 (.145) **	.071 (.071)	1,648 (59)
Services			
Group δ_1	.252 (.080) ***	.073 (.042) *	1,601 (163)
Group δ_2	.294 (.034) ***	.066 (.046)	1,731 (151)
Real Estate & Finance			
Group δ_1	.162 (.110)	.008 (.076)	475 (100)
Group δ_2	.168 (.069) **	.009 (.033)	600 (70)
Business & Media			
Group δ_1	.306 (.090) ***	.166 (.070) **	944 (102)
Group δ_2	.434 (.157) ***	.017 (.123)	1,123 (80)
Tourism			
Group δ_1	.353 (.129) ***	.148 (.121)	1,360 (95)
Group δ_2	.186 (.042) ***	.036 (.051)	1,428 (100)

*** 1% , ** 5%, * 10% level of significance. N = Sample size. T = Treated municipalities on common support. Note: Treatment municipalities are not the same for each period of study. Group δ_1 corresponds to treatment and control municipalities in the period 1998-2003, while Group δ_2 are municipalities in the following period 2003-2008.

However, estimates on some individual subsectors display distinct results. For instance, incremental FDI inflows into the automobile industry are not significantly associated with higher average wages for neither group of workers. Put differently, after an initial increase in

average wages, possibly driven by foreign wage premia introduced by newly arriving MNEs in the local labour market, wages do not significantly escalate further with subsequent entry of MNEs in the industry. As far as the electronics industry is concerned, the only positive and significant wage effect is found in group 2 for the unskilled workers that experienced an average increase of 29.1 percent. No evidence is found of higher wages for skilled workers in this industry, possibly implying that the activities being offshored into the country might still largely concentrate in low skill-intensive stages of the value chain. Contrarily, incremental FDI in both the chemical and food & beverage industries is associated with increasing average wages for skilled workers in both groups, suggesting the presence of skill-intensive activities.

Regarding hypothesis *H2*, the cumulative effect of FDI in manufacturing seems to increase wage inequality in the chemical and food & beverage subsectors, by increasing average skilled wages while unskilled wages did not have a significant change. Conversely, incremental FDI might contribute to narrowing the wage gap in the electronics industry by increasing only the average unskilled wages, while leaving skilled wages unchanged. Finally turning to services subsectors, while FDI in all subsectors is associated with increases in average wages for skilled workers in all but one group of recipient municipalities, only FDI in business & media was associated with higher wages for unskilled labour. Overall, incremental effects of services FDI on wages seem to widen the gap between types of workers; wage gains are only captured by the skilled.

In sum, the results herein highlight four general trends for inward FDI wage effects in Mexican municipalities for the entire period of study. First, we find sufficient evidence in favour of hypothesis *H1*. By large FDI is associated with higher average wages, both skilled and unskilled, in FDI-recipient municipalities and industries following capital inflows. This goes in line with previous findings for Mexico (Aitken et al., 1996; Villarreal & Sakamoto, 2011). Nonetheless, in some instances the FDI effects are found to be statistically insignificant, in the same vain as Waldkirch (2010). While we find consistent evidence in support of hypothesis *H1*, that increasing FDI is associated with higher average wages in the host region-industries, we are not able to distinguish between the foreign wage premium and domestic wage spillovers. Second, FDI is consistently found to be associated with increases in the wage gap between skilled and unskilled workers. This evidence favours hypothesis *H2*. Similar results were found by Aitken et al. (1996) and Feenstra and Hanson (1997). In most cases, even when unskilled wages increase as well, pre-existing wage inequalities seem to be reinforced by considerably higher increases in skilled wages. The widening of the wage differential between types of workers seem to be stronger for FDI in the manufacturing than in the services sector, as suggested by the literature

on developed countries (Taylor & Driffield, 2005). However, incremental FDI in the service sector appear to have deeper inequality-enhancing effects. This may possibly be attributed to rising inward flows of FDI in the services sector. Finally, as it has been attested in the literature increasing FDI flows may preserve or even reinforce existing subnational inequalities within countries (Kottaridi, 2005).

Third, at the subsector level, evidence is found in support of hypothesis *H3*. The effects of FDI on local wages seem to be larger for initial incoming flows of foreign investment than for incremental inflows. This finding is in accordance with the evidence that FDI effects on wages are more substantial after initial shocks and they tend to wane with subsequent MNE entry (Girma & Görg, 2007). Nonetheless, in some industries and services in particular, incremental FDI continues to be persistently associated with higher wages, especially for skilled workers. Fourth, the evident differences in the results reported in Table 3 and Table 4 confirm the heterogeneity of FDI wage effects across the Mexican territory. The industry-specific wage effects seem to capture underlying technology and knowledge intensity in different economic activities that have distinct skill requirements (M. Wang, 2011). Effects are found to greatly differ, not only between industries, but within the same industry in different locations. What is more, the pattern of the estimates, or lack thereof, suggests that indeed the effects of FDI are the result of a very complex interaction between MNEs and the territories and industries in which they operate (Dunning, 2000a).

1.7. Conclusions

This paper contributes to the scant evidence on FDI wage effects in Mexico expressly acknowledging sector and regional heterogeneity. We consider a decade long period –from 1998 to 2008— that has witnessed times of increasing foreign presence and sectoral change, along rising or unaltered wage gaps between skilled and unskilled workers. Additionally, we implement a combination of non-experimental econometric techniques to address endogeneity issues. The difference-in-difference propensity score matching estimates measure the average wage effect of FDI on recipient municipalities in the period following investment inflows. They will be unbiased provided that, conditional on initial pre-treatment characteristics of municipalities, FDI is independent of wages in control municipalities. We acknowledge, nonetheless, the well-known limitations of this group of methods which relate to the many decisions undertaken by the researcher in modelling the propensity scores, choosing the matching techniques and making inference. Even though this matching estimates lack of asymptotic efficiency, there will

often be a precision gain in finite samples (Angrist & Pischke, 2008). Inasmuch as the evidence on the balancing of covariates we advance is credible, our estimates of the effects of FDI on wages may allow us to draw some implications for the Mexican case. The possibility that FDI is contributing to widening wage inequalities has revealed an important but relatively unexplored links with human capital and policy (Blomström & Kokko, 2002); we put forward two broad implications surrounding these issues and the scope for policy.

The first one is related to the evidence that foreign investment is generally associated with higher average wages, mainly for skilled workers but for unskilled workers as well. Measuring the effect of FDI on average wages allows to draw the first implication for the role of FDI on the transfer of knowledge and human capital formation (Aitken et al., 1996). Perhaps the most important mechanism is via the labour demand. MNEs provide attractive employment opportunities to high skilled graduates (Blomström & Kokko, 2002). Evidence herein suggest that FDI is positively associated with higher average skilled wages, both in manufacturing and services and in most of the subsectors considered. Insofar as FDI raises demand for skilled labour, in turn raising the returns to higher education, it could arguably contribute to the region's development path through skills upgrading and human capital formation (Iammarino & McCann, 2013). However, MNEs also hire unskilled labour. What is more, *maquiladoras* in manufacturing or call centres in business services will rely more on low-skilled labour that on highly skilled workers (Waldkirch, 2010). It might very well be the case that the new relatively higher unskilled wages might offset the returns to higher education, pushing vulnerable youths out of school, thereupon dropping the level of educational attainment (Asali et al., 2016; Atkin, 2012). The results strongly suggest that FDI in different industries provides different incentives to invest in education since they require different types of skills according to the underlying knowledge intensity of the main economic activity. We observe significantly higher unskilled wages in a number of subsectors; in automobile and electronics, but also in business services and tourism. For example, consider the arrival of a foreign-owned automobile assembly plant (a hotel or a call centre), that introduces a wage premium for unskilled labour at a given location, then individuals with the minimum educational level required might choose to drop out of school and get a highly paid unskilled job. If FDI has this effect, it might further widen income inequality while lowering the long-run educational attainment in a given region.

The second broad implication stemming from the obtained results relates to the increasing wage gap between different types of workers. The results also suggest that FDI is generally associated with an increasing wage inequality, not only at the most aggregated level but also within more detailed industrial categories. Furthermore, FDI in manufacturing industries appears to have

more severe initial effects on the widening of the wage gap, as opposed to services which seems to have more persistent incremental wage gap effects. Industrial policy at the municipal level is often, if not always, focused on attracting FDI. The sizeable efforts of local governments are commonly justified by the allegedly positive potential spillovers of multinational activity, but in particular employment generation. Unfortunately the redistributive effects are usually relegated to second order considerations (Driffield & Taylor, 2000). Some authors argue that such inequalities serve as incentives to invest in both physical and human capital, encouraging competition within the economy, and that they will eventually disappear as more workers move to become skilled over time (Galor, 2000; Galor & Tsiddon, 1997). Nonetheless, the equalising effect is highly dependent on the level of access to education. Improved access to tertiary education may increase the earning opportunities of the lower end of the income distribution which might lead to a reduction in wage inequality (Checchi, 2000). However, in the context of large disparities in access to education, the economic opportunities will mainly be captured by the skilled and educated workers, thus increasing the income gap (Rodríguez-Pose & Tselios, 2009).

In the absence of redistributive policies, unskilled workers will continue to lose in terms of welfare as their wages further erode. Restricting trade and investment is definitely not the answer, since both generate overall gains for society (Slaughter, 1998). Two policy realms are identified to tackle wage inequalities in Mexican municipalities. First, initially large disparities in the access to education, are likely to prevent unskilled workers from entering the formal education system to acquire additional skills. Hence, the opportunities provided by MNE presence, will lean in favour of skilled workers, while unskilled labour will continue to lag behind, and wage disparities will prevail. Current education policies are justified on the basis of at least modest externalities, however, physical and human capital are complements therefore a more educated labour forces leads to greater investment and higher wages (Acemoglu & Angrist, 2000). Educational policies in Mexico should aim at expanding access to education (Atkin, 2016). For instance, expanding compulsory schooling[23], conditional cash transfers to keep youths in school or raising the age of earliest employment, might all lead to higher educational attainment of the work force and will enable the poorest to access to higher life-long earnings. Policies that solely focus on the expansion of the upper end of the educational

[23] The educational reform of 2012 included upper secondary education as mandatory, elevating from 9 to 12 the years of compulsory schooling (Political Constitution of the United Mexican States, amended 2012).

distribution, without considering labour market and education institutions, may be ineffective as a way to reduce the wage gap (Cortez, 2001).

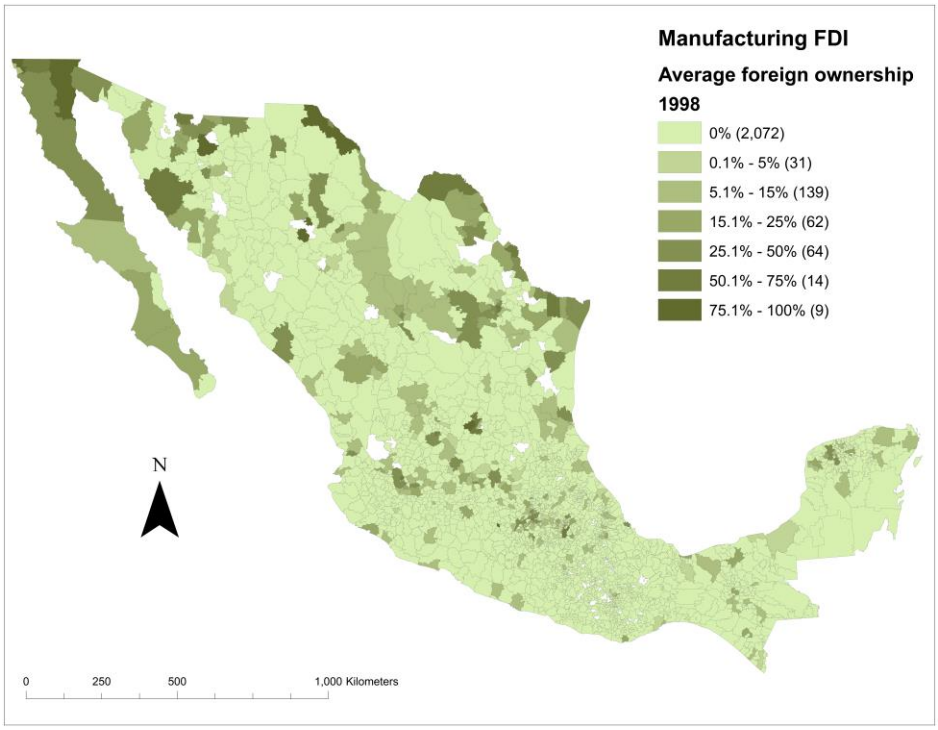
Second, as suggested by the overall pattern of the estimates, not all FDI embodies higher wages. This affirms that the potential positive gains from foreign activities are not equal across industries or even within the same industry in different locations. For instance, FDI in the electronics industry is found to be associated with very different effects in two regions in Mexico (Iammarino et al., 2008): MNE presence does not guarantee the technology transfer, since its assimilation largely depends on the absorptive capacity of local firms. Therefore, heterogeneity of FDI effects should be taken into account in the industrial policy design process. Mexican local governments must maximise the benefits of their limited resources and target those industries and firms that offer the highest potential spillovers with the promotion of indigenous linkage capability being at the forefront of industrial policies (Paus & Gallagher, 2006). Now more than ever regions are competing to attract and retain advanced functions and tasks based on their local assets such as human capital, know-how or entrepreneurship (Capello & Ponce Dentinho, 2012). However, as put by Pietrobelli and Rabellotti (2004), the major shortcoming of the current policy approach in most Latin American countries is the lack of an integrated vision of local small and medium sized firm development and upgrading. For example, a 'rule of origin' that requires a higher percentage of intermediated inputs to be purchased locally, might go a long way in fostering economic and social upgrading (Villanueva, 2017).

Further research is required in some respects. The first obvious extension of this research framework would be investigating the extent of FDI-induced wage effects on domestically-owned firms, by teasing out the direct effects embodied in foreign wage premia from the indirect spillovers in the domestic sector's wages. Second, FDI effects in Mexico may not only depend on receiving industry or location specific characteristics, but also on the sources of FDI (Waldkirch et al., 2009). North American investors are likely to have different investment strategies than their European or Asian counterparts, hence FDI wage effects should vary across FDI sources.[24] The last natural further research avenue should be to explore the mechanisms through which individuals respond to changes in foreign-induced wage incentives and make decisions concerning their investment not only in formal education (Checchi et al., 2007) but in training and vocational education too (Miyamoto, 2003); and ultimately the subsequent impact on the accumulation on human capital. This relationship is explored in Chapter *II*.

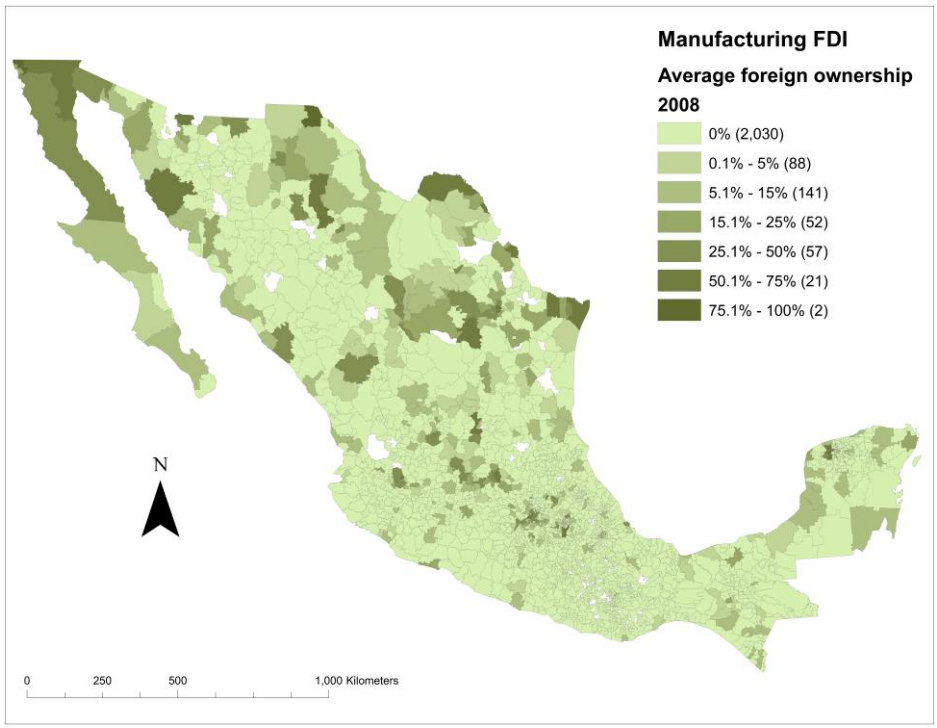
[24] North American FDI accounts for 52.6 percent of the total accumulated inward FDI (2000-2013); the European Union represents 16.3 percent; finally selected Asian economies (Japan, Korea, Singapore and Taiwan) account for 3 percent.

1.8. Appendix

Figure A1 – Manufacturing FDI: Average foreign ownership by municipality, 1998-2008



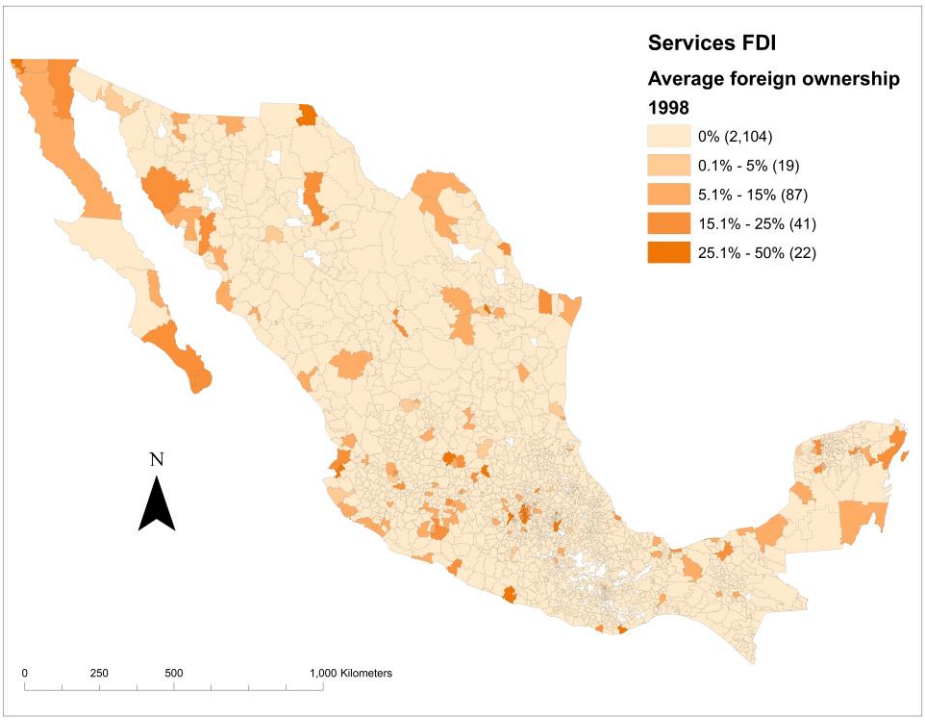
(a)Levels 1998



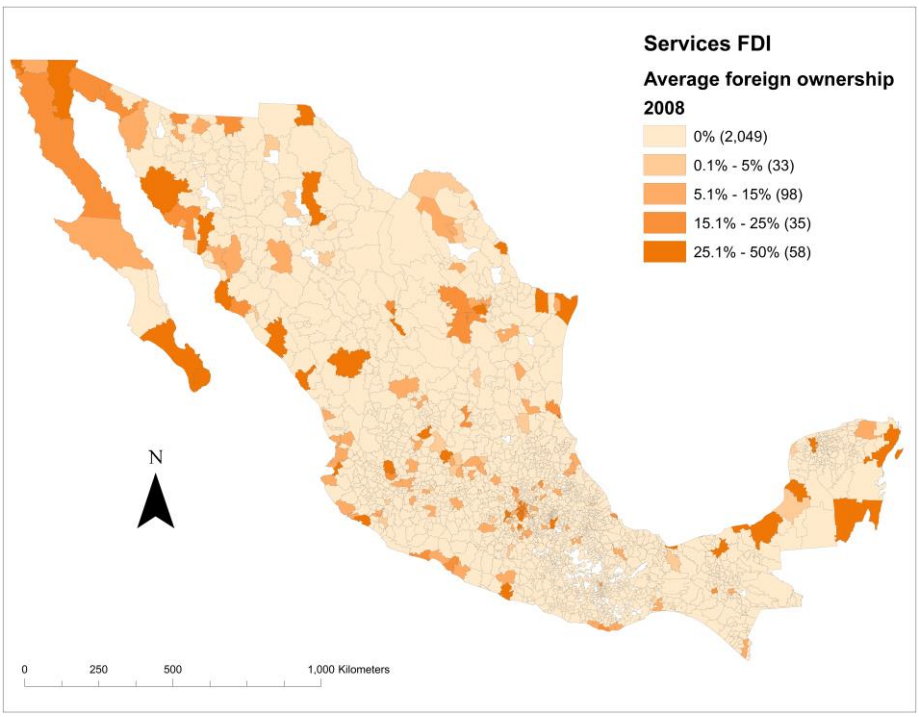
(b) Levels 2008

Source: Author's own elaboration with data from INEGI Censos Economicos (1999, 2009)

Figure A2 – Services FDI: Average foreign ownership by municipality, 1998-2008



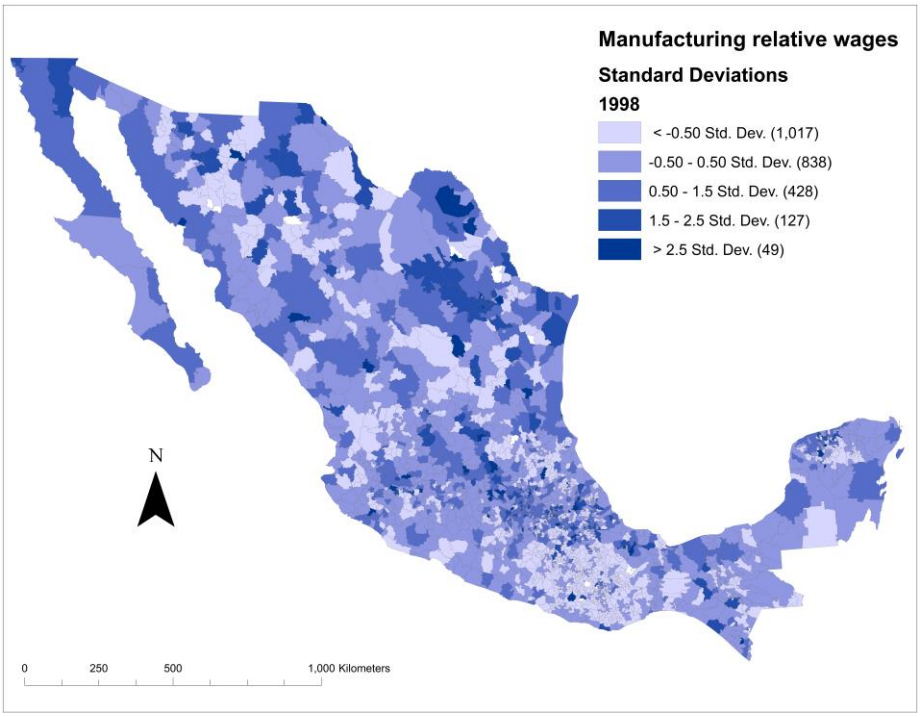
(a) Levels 1998



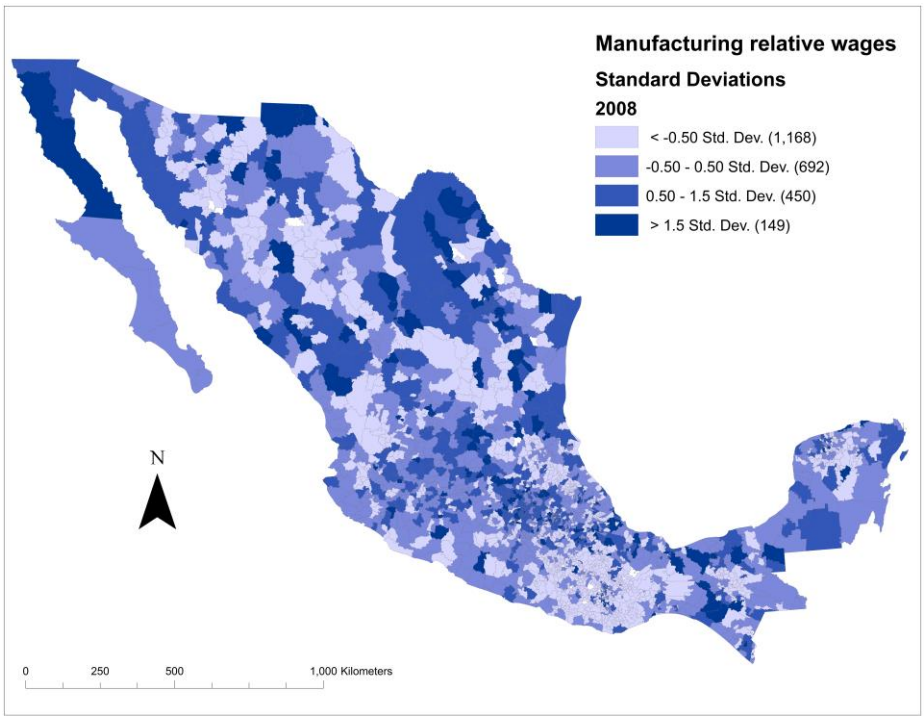
(b) Levels 2008

Source: Author's own elaboration with data from INEGI Censos Economicos (1999, 2009)

Figure A3 – Relative wages in manufacturing: Average relative wages by municipality, 1998-2008



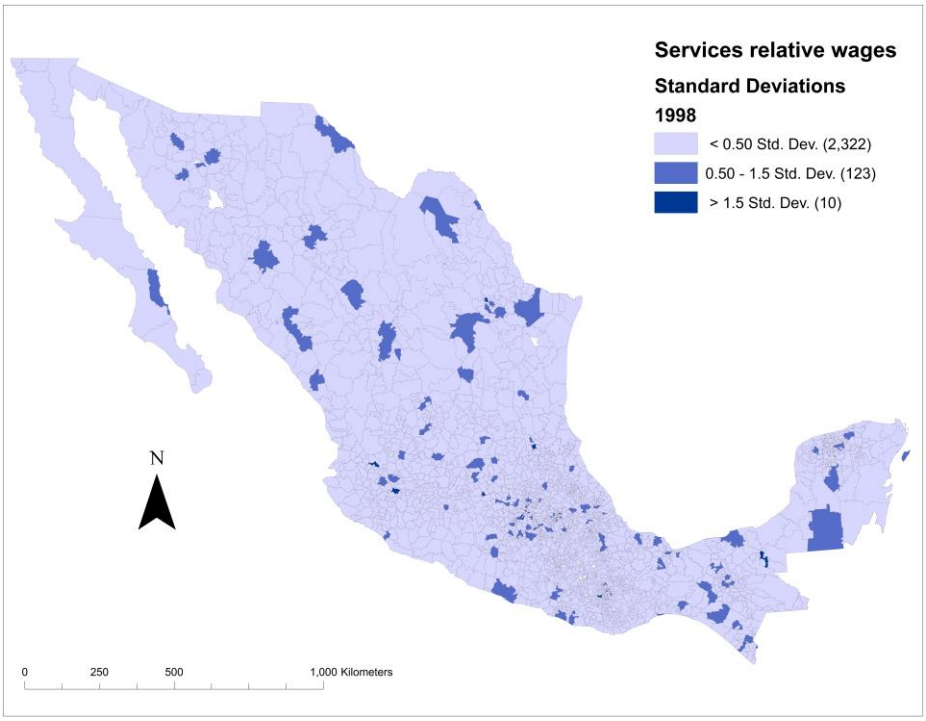
(a) Levels 1998



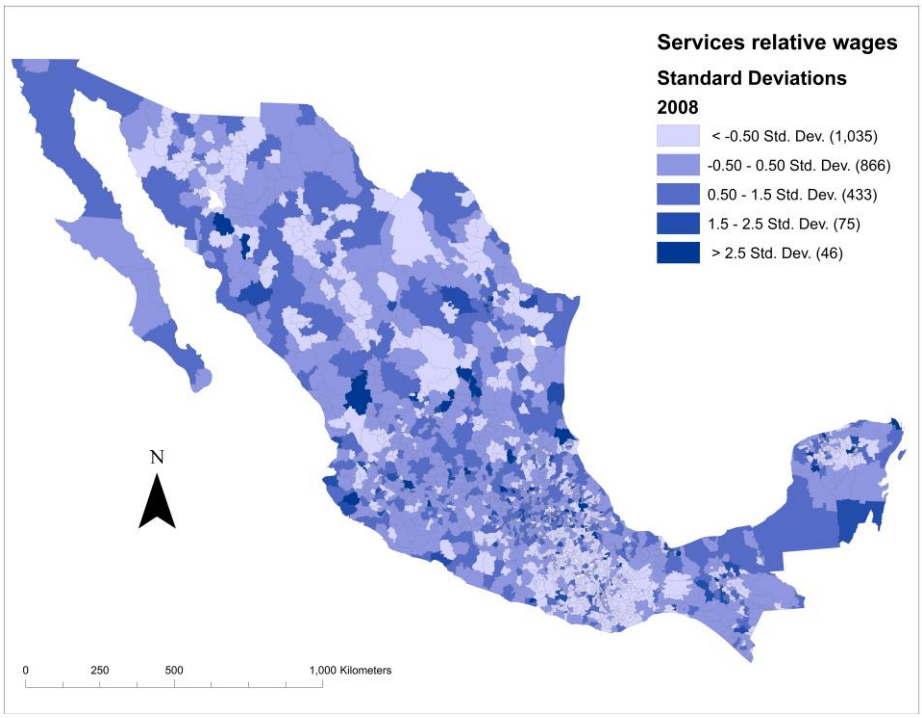
(b) Levels 2008

Note: The variable plotted is the average relative wages as the ratio of skilled to unskilled wages for all sectors.
Source: Author's own elaboration with data from INEGI Censos Economicos (1999, 2009)

Figure A4 – Relative wages in services: Average relative wages by municipality, 1998-2008



(a) Levels 1998



(b) Levels 2008

Note: The variable plotted is the average relative wages as the ratio of skilled to unskilled wages for all sectors.
Source: Author's own elaboration with data from INEGI Censos Economicos (1999, 2009)

Table A1 – Summary Statistics at the municipality level by FDI presence in 1998

Total FDI	No FDI		FDI	
Variable	Mean	SD	Mean	SD
Labour productivity	2.80	.93	4.11	.74
Capital	8.32	2.23	13.39	1.98
Exports	.01	.05	.09	.16
Average schooling	5.11	1.30	7.14	1.38
Population aged 15 to 29	.25	.03	.28	.05
Development index	.75	.08	.83	.05
Skilled wages	1.70	1.59	3.76	.53
Unskilled wages	2.08	.98	2.93	.34
Observations	1,854		412	

Manufacturing FDI	No FDI		FDI	
Variable	Mean	SD	Mean	SD
Labour productivity	2.85	1.09	4.50	.95
Capital	7.68	2.26	12.99	2.37
Exports	.01	.07	.12	.18
Average schooling	5.40	1.32	7.52	1.38
Population aged 15 to 29	.26	.02	.28	.01
Development index	.76	.07	.84	.04
Skilled wages	1.85	1.48	3.94	.63
Unskilled wages	2.16	.98	3.02	.40
Observations	1,621		254	

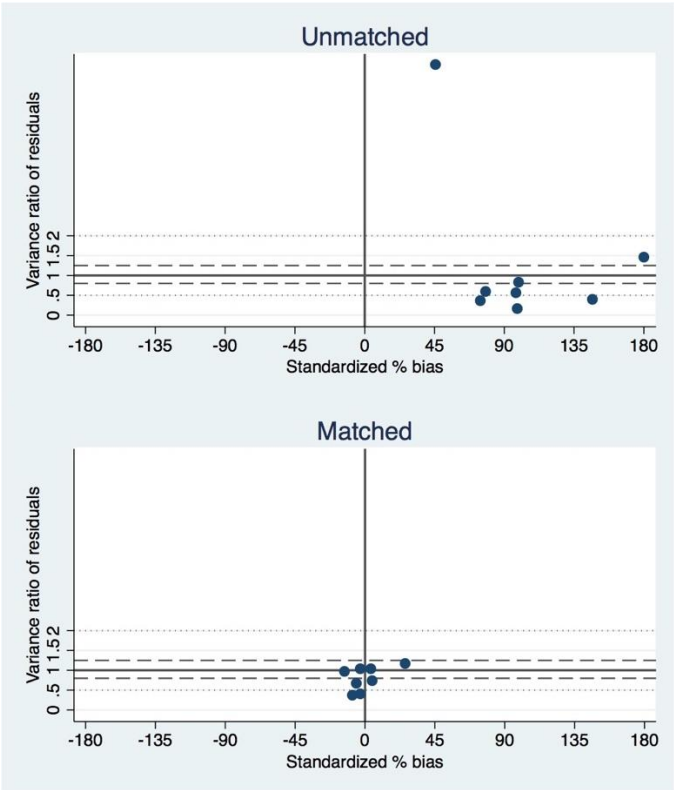
Services FDI	No FDI		FDI	
Variable	Mean	SD	Mean	SD
Labour productivity	2.58	.81	3.80	.84
Capital	7.23	2.36	12.96	2.04
Average schooling	5.55	1.32	7.88	1.44
Population aged 15 to 29	.26	.02	.29	.01
Development index	.77	.07	.85	.04
Skilled wages	1.25	1.57	3.74	.69
Unskilled wages	1.92	.98	2.96	.42
Observations	1,583		166	

Table A2 – Industry composition of aggregated sectors

Sector / Subsector	Description
	All Industries
11	Agriculture, Forestry, Fishing and Hunting
21	Mining, Quarrying, and Oil and Gas Extraction
22	Utilities
23	Construction
31 – 33	**Manufacturing**
	Food & Beverages
311	Food Manufacturing
312	Beverage & Tobacco Product Manufacturing
	Chemical
325	Chemical Manufacturing
326	Plastics & Rubber Products Manufacturing
327	Nonmetallic Mineral Product Manufacturing
	Electronics
334	Computer & Electronic Product Manufacturing
335	Electrical Equipment, Appliance, & Component Manufacturing
	Automobile
336	Transportation Equipment Manufacturing
(13 subsectors)	Others
42	Wholesale Trade
44 – 45	Retail Trade
48 – 49	Transportation and Warehousing
51 – 81	**Services**
	Real Estate & Finance
52	Finance and Insurance
522	Credit Intermediation & Related Activities
523	Securities, Commodity Contracts, & Other Financial Investments & Related Activities
524	Insurance Carriers & Related Activities
53	Real Estate and Rental and Leasing
531	Real Estate
532	Rental & Leasing Services
	Business & Media
51	Information
(8 subsectors)	Publishing Industries (except Internet), Motion Picture & Sound Recording Industries, Broadcasting (except Internet), Telecommunications, Data Processing, Hosting &
54	Related Services, Other Information Services
55	Professional, Scientific and Technical Services
56	Management of Companies and Enterprises Administrative and Support, Waste Management and Remediation Services
61	Educational Services
62	Health Care and Social Assistance
71	Arts, Entertainment and Recreation
72	Accommodation and Food Services
81	Other Services
	Tourism
485	Transit & Ground Passenger Transportation
487	Scenic & Sightseeing Transportation
488	Support Activities for Transportation
711	Performing Arts, Spectator Sports, & Related Industries
712	Museums, Historical Sites, & Similar Institution
713	Amusement, Gambling, & Recreation Industries
721	Accommodation, including Hotels & Motels
722	Food Services & Drinking Places

Source: SAIC 2013, own aggregation of subsectors

Figure A5 – Standarised Bias and Variance Ratios for Unmatched and Matched data



Note: all industries considered

Table A3 – Balancing tests from matched data for all manufacturing industries

Variable	Means		%	% Bias	T-test		Variance
	Treated	Control	Bias	reduction	t-stat.	P-val.	Ratio
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Labour productivity	3.6491	3.637	1.2	98.3	0.07	0.942	0.73
Capital	10.511	10.487	1.2	99.1	0.07	0.942	0.72
Exports	.09072	.09164	-0.8	98.9	-0.04	0.972	0.65
Average schooling	6.6079	6.6315	-2.0	98.0	-0.13	0.899	0.68
Population aged 15 to 29	.28047	.27924	5.7	92.9	0.38	0.702	0.61
Development index	.82401	.8282	-6.8	92.0	-0.56	0.573	0.61
Skilled wages	3.259	3.2828	-2.0	98.2	-0.17	0.868	0.81
Unskilled wages	2.8104	2.7408	10.1	87.2	0.86	0.389	0.75

Note: Matching is shown for the pool of all manufacturing industries, initial $FDI^{\rightarrow}$ treatment variable, and group 1. There are 89 treated municipalities and a pool of 1,449 comparison municipalities, yielding a sample size of 1,538 observations.

Table A4 – Balancing tests from matched data for all service industries

Variable	Means		%	% Bias	T-test		Variance
	Treated	Control	Bias	reduction	t-stat	P-value	Ratio
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Labour productivity	3.2925	3.2194	9.0	89.5	0.56	0.579	1.38
Capital	11.122	11.254	-6.6	96.6	-0.45	0.650	1.01
Average schooling	7.1464	6.9667	15.3	88.6	0.93	0.355	0.81
Population aged 15 to 29	.28135	.27912	10.5	86.1	0.72	0.473	0.91
Development index	.83378	.82781	9.8	89.2	0.66	0.510	0.53
Skilled wages	3.3842	3.2714	8.7	94.7	0.68	0.499	0.99
Unskilled wages	2.7441	2.7164	3.8	96.4	0.40	0.692	1.35

Note: Matching is shown for the pool of services, initial $FDI^{\rightarrow}$ treatment variable, and group 1. There are 69 treated municipalities and a pool of 1,366 comparison municipalities, yielding a sample size of 1,435 observations.

2. Chapter II: Inward FDI and youth educational choices in Mexican municipalities

2.1. Introduction

Inward Foreign Direct Investment (IFDI) has been often considered to play a prominent role in the development of human capital in the host economy (Blomström & Kokko, 2002; Miyamoto, 2003). There is hardly any doubt that multinational enterprises (MNEs) are carriers of important productive knowledge (Blomström & Kokko, 1998; Caves, 1974; Markusen, 2002). By large, the study of the effects of FDI on human capital development has been confined to the different types of spillovers within the host economy (Blomström & Kokko, 1998; Clark et al., 2011; Görg & Greenaway, 2004; Smeets, 2008). Nonetheless, one of the chief mechanisms through which IFDI operates is the labour market: MNE entry is likely to affect both the local demand and supply of skilled labour (Blomström & Kokko, 2002; Miyamoto, 2003; Slaughter, 2002). MNEs are typically expected to pay, on average, higher wages largely due higher productivity and technological advantages over domestic firms (Lipsey, 2004). The so called foreign wage premium allows MNEs to operate in an unfamiliar environment, reduce labour turnover to prevent proprietary knowledge from leaking into incumbent firms, as well as attracting the best available workers (Blomström & Kokko, 2003; Lipsey, 2004; Lipsey & Sjöholm, 2004). By providing attractive employment opportunities, MNEs will modify the relative wages, which in turn may incentivise students to continue in formal education (Blomström & Kokko, 2002; Checchi et al., 2007; Miyamoto, 2003; Slaughter, 2002).

Insofar as FDI raises demand for skilled labour —for a given supply of productive factors— via the introduction of a foreign wage premium for skilled workers, it may contribute to the incentive of individuals in host countries to acquire education and training, thence increasing the future supply of skills (Slaughter, 2004). This could arguably contribute to the region's development through skill upgrading and human capital formation (Iammarino & McCann, 2013). If individuals in host countries have access to formal education and vocational training, they should be able to respond to price signals emerging from the labour market (Slaughter, 2002). Changes in the returns to education will modify households' willingness to invest in education, ultimately affecting the working age population's level of educational attainment and

therefore the supply of certain skills (Thorbecke & Charumilind, 2002). However, if foreign firms increase the demand for low-skilled labour (Braconier et al., 2005), there will be little incentive to continue in formal education, and the impact on educational outcomes will materialise in the decrease of enrolment rates and educational attainment (Atkin, 2012; Federman & Levine, 2005). IFDI will have divergent effects depending on the productive sector in which foreign presence concentrates, since each industry requires a different skill set according to the knowledge intensity of their productive process (Checchi et al., 2007). Furthermore, pre-existing differences in labour market conditions and educational opportunities across regions are expected to affect the educational choices of the youth in different ways (Levison et al., 2001). In the context of large disparities in access to education, the economic opportunities will be likely captured by the educated (Rodríguez-Pose & Tselios, 2009).

The effect of IFDI on the educational outcomes in regions experiencing FDI inflows may have two opposing effects (Asali et al., 2016; Atkin, 2016). If foreign presence raises the prospective returns to education –in the form of skilled wages— enough to compensate for the opportunity cost of additional schooling –embodied in forgone unskilled wages— more students will remain in school and progress on to the next educational levels, thus increasing the youth level of education over time. However, if such returns do not outweigh forgone wages, young cohorts at certain educational thresholds will be more likely to drop-out of school, and hence their average years of education might decrease in the long run. The question of which effect tends to dominate during a period of increasing FDI inflows and changes in sectoral patterns is the one we address here.

Mexico has become one of the largest recipients of FDI inflows world-wide; the value of inward FDI stock as percentage of national GDP increased from 7.8% in 1990 to over 30% in 2013 (UNCTAD, 2014). Moreover, in recent decades, the sectoral composition of FDI has significantly changed with the services sector gaining participation at the expense of manufacturing; while the former represented 30.3% of the total accumulated FDI stock in 1980-1990, the equivalent share rose to 50.2% for the 2000-2010 period (Ministry for Economics, 2016). As far as the level of educational attainment is concerned, Mexico is still lagging considerably behind other emerging countries, with an working-age population average of 6.6 years of education in 2010 (INEGI, 2010) and only 53 percent of 15-19-year-olds enrolled in education in 2012 (OECD, 2014), territorial inequalities and disparities in the access to education are still a common feature of the Mexican economy.

Against this background, the potential effects of foreign presence will have different effects across sub-national regions, with disproportionate consequences on vulnerable groups of the population. With labour earnings being the largest income source for most households in Latin America, changes in the relative returns to education will have important implications for the evolution of inequality (Manacorda et al., 2007). In particular, we investigate the effect of FDI on the educational choices of young cohorts enrolled in the last year of lower secondary education at the time of FDI arrivals in their municipality of residence. The results herein suggest that new highly paid foreign unskilled jobs have negative effects on a cohort's subsequent enrolment rates and individual probability of school attendance, both for services and manufacturing. Contrarily, the effects of additional foreign highly paid for skilled workers, might lead to positive educational outcomes. The labour market effects of foreign entry are not only short-lived, affecting school enrolments, but they are also long-lasting, resulting in lower educational attainment years later.

Studying this relationship in Mexico is compelling for three main reasons. First, in a country with high levels of inequality in human capital and access to education, it seems important for development and educational policy to understand what are the types of foreign jobs affecting the relative returns for households to invest in education, particularly for disadvantaged youths. The consequences of early drop-outs are negative and long-lasting, not only for the individual but for society as well (e.g. Rumberger, 1987). Second , regions face a trade-off between the deepening of technological capabilities and relying on the technology brought in by multinational firms (Lall, 2003). Since positive externalities, stemming from MNEs in the form of knowledge transfers, tend to be realised if the host economy reaches a sufficient stock of human capital (Borensztein et al., 1998), then governments aiming to attract FDI should select the types of investments appropriate to boost their human resources and stage of development (Bartels & de Crombrugghe, 2009). Third, the country is still heavily reliant on FDI and subnational regions strive to attract MNEs into their territories. Frequently, emerging economies put great expectations on FDI to alleviate skills constraints (Noorbakhsh et al., 2001). However, FDI might be associated with a perverse effect affecting the bottom end of the income distribution that will negatively affect the accumulation of human capital.

The existing evidence on this relationship is thin and the contributions of this paper are threefold. First, we explore the wider effects of foreign presence through changes in the labour market —in terms of job opportunities and foreign wage premium— on educational choices by young individuals that are exposed to FDI presence earlier in their academic advancement. Second, we exploit cross-sector FDI-induced temporal variation of returns to education for

different types of jobs (skilled and unskilled) across fine-grained geographical units. Finally, we study the extent of the FDI effects as a factor affecting youth educational choices in Mexico from 1990 to 2010, which has seen substantial changes in the sectoral distribution of FDI.

The remainder of the paper is organised as follows. Section 2.2 provides the theoretical underpinnings for the empirical analysis and existing evidence on this relationship. Section 2.3 offers the context and motivation for our research question by describing the Mexican geography of FDI and education. Section 2.4 comprises the empirical strategy as a whole; data and construction of the variables and the details of the empirical instrumentation, along with the threats for internal validity. Results are presented and discussed in Section 2.5. The final Section 2.6 advances conclusions and forward avenues of research.

2.2. Background Literature

2.2.1. FDI and the labour market

IFDI has been regarded as a major vehicle of international technology and knowledge diffusion (e.g. Blomström & Kokko, 1998; Caves, 1974; Iammarino & McCann, 2013). There is hardly any doubt that multinational enterprises are carriers of important productive knowledge (Blomström & Kokko, 1998; Caves, 1974; Markusen, 2002), hence MNEs have been conferred a prominent role in contributing to human capital development in the host economies (Blomström & Kokko, 2002; Miyamoto, 2003). By large, the study of this relationship has been confined to the different types of spillovers within the host economy. Generally speaking, these spillovers rely on the assumptions that MNEs are highly knowledge-intensive firms (Caves, 1971; Markusen, 2002), and they may be either technological or pecuniary externalities (for detailed reviews see Blomström & Kokko, 1998; Clark et al., 2011; Görg & Greenaway, 2004; Smeets, 2008). While the former arises when FDI introduces a benefit or a cost that is not directly transmitted through a market, the latter operate through changes in the market prices. For example, whereas a technological externality occurs when a worker trained by an MNE is hired by a domestic firm, a pecuniary externality arises when the MNE pays their workers a higher wage to prevent them from leaving the firm (Fosfuri et al., 2001).[25] It is important to note that potential benefits of FDI's presence may only take place if local firms have the ability to learn and absorb foreign technologies and skills, for which the initial level of education and

[25] It must be stressed that some of these spillovers are unintended since MNEs will try to capture the full returns of their investment, hence domestic firms will only benefit if some sort of indirect technology transfer takes place (Görg & Greenaway, 2004; Iammarino & McCann, 2013).

human capital should be sufficiently high (Borensztein et al., 1998; Cohen & Levinthal, 1990; X. Li & Liu, 2005; Noorbakhsh et al., 2001).

Perhaps, one of the most prominent mechanisms through which IFDI operates is the labour market: FDI's role in human capital development may take several forms since MNEs are likely to affect both the demand and the supply of skilled labour (Blomström & Kokko, 2002; Miyamoto, 2003; Slaughter, 2002). On the supply side, MNEs can have an effect through numerous mechanisms that have been deemed to enhance the quantity and quality of skilled labour in the host economy (Blomström & Kokko, 2003; Slaughter, 2002; Zhuang, 2011). Examples of these are; on-the-job training of workers[26], interactions with local suppliers and subcontractors[27], increased local competition[28], direct support and collaboration with educational institutions, as well as increasing tax revenue for public expenditure on education and training programmes. As far as the demand side is concerned, attention has centred on factors that tend to boost the demand –both from MNEs and domestic firms— of skilled labour in the host economy; such as intra- and inter-firm technology transfer, capital investments and technological spillovers to the domestic sector (Slaughter, 2002; Smeets, 2008).

The link between FDI and its labour market effects is rooted in explanations as to why MNEs are expected to have higher marginal labour productivity *vis-à-vis* domestic firms (e.g. Caves 1974; Markusen 2002). In explaining the aforementioned difference in performance, the 'OLI eclectic paradigm' has envisaged MNEs as technologically superior firms, in possession of ownership, localisation and internationalisation advantages (Dunning, 1977, 1980, 1988, 2000b). These advantages confer MNEs a competitive edge over their domestically owned counterparts, hence they will typically pay higher wages (Lipsey, 2002). The so called foreign wage premium allows MNEs to operate in an unfamiliar environment, reduce labour turnover to prevent proprietary knowledge from leaking into incumbent firms, as well as attract the best available workers (Blomström & Kokko, 2003; Lipsey, 2002; Lipsey & Sjöholm, 2004).

[26] Most MNEs undertake substantial efforts in the education and training of local workers (Blomström & Kokko, 2002). This training programmes may target a wide range of employees, from manufacturing operatives to top-level managers (Blomström et al., 1994).

[27] By establishing backward and forward linkages with domestic firms, MNE's may enable access to new technologies and higher standards, by knowledge-sharing interactions with external suppliers and subcontractors (Driffield et al., 2002; Rodriguez-Clare, 1996).

[28] Increased competition following foreign firm entry forces domestic firms to imitate or introduce innovations in order to remain competitive (J.-Y. Wang & Blomström, 1992).

2.2.2. FDI and education

The accumulation of foreign presence is frequently associated with an expansion of the demand for skilled labour (e.g. Bandick & Hansson, 2009; Feenstra & Hanson, 1997). By providing attractive employment opportunities, MNEs will modify the relative wages, which in turn may incentivise students to continue in formal education (Blomström & Kokko, 2002; Checchi et al., 2007; Miyamoto, 2003; Slaughter, 2002). The focus of this paper is on this particular transmission mechanism, i.e. how FDI-induced changes in the labour market are likely to affect households' demand for formal education (Markusen & Venables, 1997). Insofar as FDI raises demand for skilled labour, for a given supply of productive factors, via the introduction of a foreign wage premium for skilled workers, it may contribute to the incentive of individuals in host countries to acquire education and training, thence increasing the future supply of skills (Slaughter, 2004). This could arguably contribute to the region's development through skill upgrading and human capital formation (Iammarino & McCann, 2013).

If individuals in host countries have access to formal education and vocational training, they should be able to respond to price signals emerging from the labour market (Slaughter, 2002). To the extent that MNEs affect the skill-bias of the labour demand, then more gifted students will have the incentives to continue on to higher education (Blomström & Kokko, 2003). As returns to education rise, household willingness to pay for their children's education increase, resulting in a higher level of educational attainment in the population and therefore the supply of certain skills (Thorbecke & Charumilind, 2002). While the effect of FDI on tertiary education is fairly straightforward, the effects on lower levels of education —primary or secondary— have been considered negligible and hence not received much attention. Perhaps due to the presumption that MNE's are more knowledge-intensive and hence less reliant on low-skilled labour: Even when off-shored production activities are low-skill intensive relative to knowledge-based activities held back home, they are likely to be high-skill intensive relative to the initial activity mix of host locations (Slaughter, 2004). Another reason for the disregard of the effects on lower educational levels may be related to the fact that access to primary and secondary education has become significantly more widespread in middle income economies across the world (OECD, 2016). Finally, the fact that pre-tertiary education is compulsory in most countries, it has been thought as being non-responsive to incentives arising from the economic environment (Mughal & Vechiu, 2011).

However, FDI will have divergent effects on educational attainment depending on the productive sector in which foreign presence concentrates, since each industry requires a

different skill set according to the knowledge intensity of their productive process (Checchi et al., 2007). If unskilled labour is relatively cheaper in the host country, foreign firms will typically increase the demand for low-skilled labour (Braconier et al., 2005). Hence, there will be little incentive to continue in formal education, and the impact on secondary education is likely to materialise in the increment of high-school dropouts who fail to progress on to higher education (Atkin, 2012; Federman & Levine, 2005). This labour market effect might be magnified in the context of emerging economies. For instance, while some emerging economies have transitioned to complete primary and secondary education attainment, differences in attendance rates and educational attainment of the work force are still strikingly large across countries (Collin & Weil, 2018). In addition to this, compliance with compulsory schooling laws is frequently disregarded in emerging economies (Borraz, 2005; Levison et al., 2001).

Furthermore, pre-existing differences in labour market conditions and educational opportunities across regions are expected to affect the educational choices of the youth in different ways (Levison et al., 2001). In the context of large disparities in access to education, the economic opportunities will be likely captured by the educated, thus preserving pre-existing inequalities (Rodríguez-Pose & Tselios, 2009). Inequalities of opportunities have been consistently associated with higher income inequalities and lower investment in human capital (Mejía & St-Pierre, 2008). One of the ways through which inequality is posited to be perpetuated is by hindering the investments in education. If poor families are unable to garner the resources needed to send their children to school, then income inequality will be transmitted from one generation to the next (Binder & Woodruff, 2002). Moreover, parents in low income households might also lack the information and sophistication to assess the size of the returns to education (Attanasio, 2015).

2.2.3. Returns to education and opportunity cost of schooling

The expected returns to education lie at the heart of the theories of human capital accumulation and skill acquisition, in which households choose a level of investment on their young members' education (Atkin, 2016; G. S. Becker, 1965; G. S. Becker & Tomes, 1986; Mincer, 1995). Household demand for schooling is not only a function of individual, household and regional characteristics, but also of the expected returns from schooling, which might be translated into higher future income for educated children (Birdsall, 1999). Therefore, decisions on educational investment will also depend on labour market outcomes and how these affect future earnings (Attanasio & Kaufmann, 2012). Different skill levels are rewarded differently, therefore returns to education will also vary across labour markets (Attanasio, 2015).

When making educational choices individuals attempt to maximise their net earnings which equate to the difference between potential earnings and total costs, including direct and foregone wages (G. S. Becker, 1962). Forward-looking students will trade off the foregone earnings from continuing in school and progressing to the next academic level —the opportunity cost of schooling— with the future wage benefits from more education —the returns to schooling (Atkin, 2016). For young individuals that have not completed basic education, a rise in the availability of highly-paid low-skilled jobs, either in services or manufacturing, increases the opportunity cost of remaining in school which may lead to declining enrolments and lower subsequent education levels, particularly for poorer households in more deprived locations. Hence increasing the returns of lower skill sets might hinder school attendance and consequently accumulated years of education (Le Brun et.al., 2011).

The consequences of early drop-outs are negative and long-lasting, not only for the individual but for society as well (Rumberger, 1987); whereas individuals might struggle finding steady and well-paying jobs over their lifetimes, aggregate losses might stem from lower human capital, lower taxes and higher demand for social services. This potential FDI effects are of particular relevance for emerging economies, since they usually put great expectations on FDI to alleviate skills constraints (Noorbakhsh et al., 2001). However, FDI might be associated with a perverse effect affecting the bottom end of the income distribution that will negatively affect the accumulation of human capital. The resulting dispersion of schooling among the labour force will tend to enhance income inequality (Park, 1996).

2.2.4. Evidence

Measuring the effect of FDI on relative wages allows to draw implications for role of FDI on the transfer of knowledge and human capital formation (Aitken et al., 1996). Most of the evidence regarding the FDI host labour market effects largely focuses on changes arising from MNEs skill-biased demand for labour. Overall, evidence points to a significant association between rises in the demand for skilled workers in host economies with increasing foreign presence resulting in higher skilled wages both in developed countries (e.g. Aitken et al., 1996; Doms & Jensen, 1998; Figini & Görg, 1999; Girma & Görg, 2007; Taylor & Driffield, 2005) and developing ones (e.g. Aitken et al., 1996; Arbache, 2004; Lipsey & Sjöholm, 2004; Te Velde & Morrissey, 2004). In the particular case of Mexico, various studies for different time periods have found that FDI is associated with increases in the demand for skilled workers, resulting in higher wages for this group of workers (Chapter *I* of this thesis; Aitken et al., 1996; Feenstra & Hanson, 1997; Noria, 2015; Villarreal & Sakamoto, 2011).

Although this robust body of literature certainly suggests that FDI has the potential to contribute to human capital accumulation, by providing incentives for the local labour force to acquire higher education, it falls short in assessing the full extent of this association. First, it relies on the assumption that the skilled foreign wage premium will diminish over time, as more workers move to become skilled (Galor & Tsiddon, 1997), while neglecting the fact that MNEs also hire unskilled workers at higher wage rates, thus providing a different set of incentives in the labour market (see Chapter *I*). Finally, it does not directly consider any concrete measure of human capital such as educational attainment or school enrolments.

Empirical studies devoted to directly exploring the effect of FDI on human capital accumulation are relatively scarcer, and the evidence on educational outcomes is inconclusive still. For example, most cross-country analyses have found that total FDI is associated with increases in the average years of education (Asali et al., 2016; Checchi et al., 2007; Egger et al., 2010). Conversely, when considering only developing countries, Mughal and Vechiu (2011) find increasing FDI to be associated with decreases in tertiary education enrolments and attainment, and no significant effects on secondary education enrolments. On a world-regional scale, a study for sixteen East Asian economies show that FDI has a significantly negative effect on tertiary schooling, yet it presented a positive and significant impact on secondary schooling, implying that FDI flowing into the region may be of low technological content (Zhuang, 2017). However, they find that FDI from OECD countries has a positive effect on tertiary education, suggesting that this type of investment may embody more advanced technology. At the country level, Arbache (2004) finds that IFDI in Brazil has a positive but modest effect on average years of schooling. On a subnational region level, evidence suggests that in the USA, FDI in manufacturing is negatively associated with educational attainment in host states, while FDI in services has a positive correlation (M. Wang, 2011).

The evidence of this relationship in Mexico is very sparse if not absent. For instance, it has been found that during 1984-92, a period of increasing low-skilled employment, full-time school attendance rates declined while labour force participation rates increased (Abler et al., 1998). Moreover, young girls aged 16-18 ended up having, on average, less education the more unskilled employment in their municipality of residence (Le Brun et al., 2011). A more recent study, shows that amid the reduction of school enrolments, low skilled employment has a significant and detrimental effect on younger cohorts' average years of education, who were prematurely exposed to foreign employment within their commuting zones (Atkin, 2016). While these studies have considered the FDI-induced labour market effects on educational choices,

the primary focus has been the early stages of foreign low skilled (*maquiladora*)[29] jobs in the country.[30] However, there is growing evidence that FDI in Mexico has undergone sectoral changes; whereas in manufacturing it still has positive effects on employment creation –both for skilled and unskilled workers— (Nunnenkamp & Bremont Alatorre, 2007; Waldkirch et al., 2009), its importance has been declining, with the services sector gaining predominance (Chiatchoua et al., 2016). The recent shifts in FDI sectoral trends and spatial relocation compel us to add to the incipient evidence on the effects of the new types of foreign jobs on Mexican youth's educational choices.

The main drawback of empirical studies attempting to disentangle the effects of FDI is that they treat the mechanism as a "black-box" (Gorg & Strobl, 2001). Given the extant empirical evidence, we contribute by unpacking the relationship between FDI and human capital accumulation in the host economy. In particular, we bridge the gap between the literature on FDI-induced labour market effects with that on educational choices; (i) focusing on one of the main mechanisms through which this relationship operates, i.e., the labour market; (ii) studying the heterogeneous effects of foreign job creation in the manufacturing and services sectors; (iii) teasing out the differences in economic incentives across types of jobs, skilled and unskilled; and (iv) exploiting the FDI-induced temporal variation of returns to education, across fine-grained geographical units, throughout a 20-year period of time from 1990 to 2010. The next section lays the ground for analysis by providing the context for Mexican economy and its subnational regions.

2.3. The geography of FDI and Education in Mexico

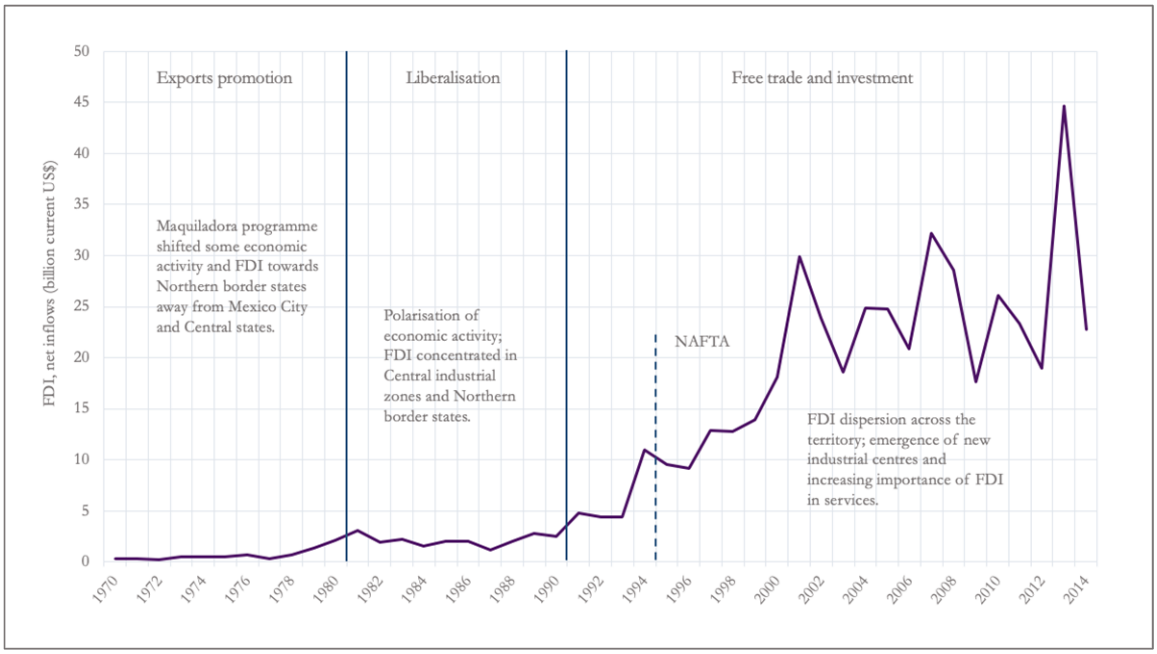
In the context of increasing internationalisation of production, Mexico has become one of the largest recipients of FDI inflows world-wide. Moreover, the value of inward FDI stock as percentage of national GDP increased from 7.8% in 1990 to over 30% in 2013 (UNCTAD, 2014). Mexico's inward FDI flows first rose at the beginning of the 1980s, when the country began to adopt policies towards the liberalisation of the economy. The flows remained relatively constant throughout the decade. However, it was the onset of the North American Free Trade

[29] See footnote 31.

[30] Outside the realm of FDI effects and for different countries, there is compelling evidence that increasing availability of unskilled jobs will have detrimental effects on the population's educational attainment. For example, the construction boom in Spain, led to significant reductions in enrolment and completion rates among 16-18-year-olds (Aparicio-Fenoll, 2016). Another example is the coal boom in some US states back in the 1970s that drove low-skilled wages up, resulting in significant decreases in high school enrolment rates (Black et al., 2005).

Agreement (NAFTA) in 1994, that marked the beginning of a steadily rising flow of inward FDI into Mexican territory (see Figure 6). Ten years later, in 2004, the net inflows had increased in 126 percent. In the following decade, annual flows averaged 25 billion US dollars.

Figure 6 – Mexico: Total FDI Net inflows 1970-2014



Source: Author's own elaboration with World Bank data.Annotations from López-Villafañe (2004) and Cárdenas (2000)

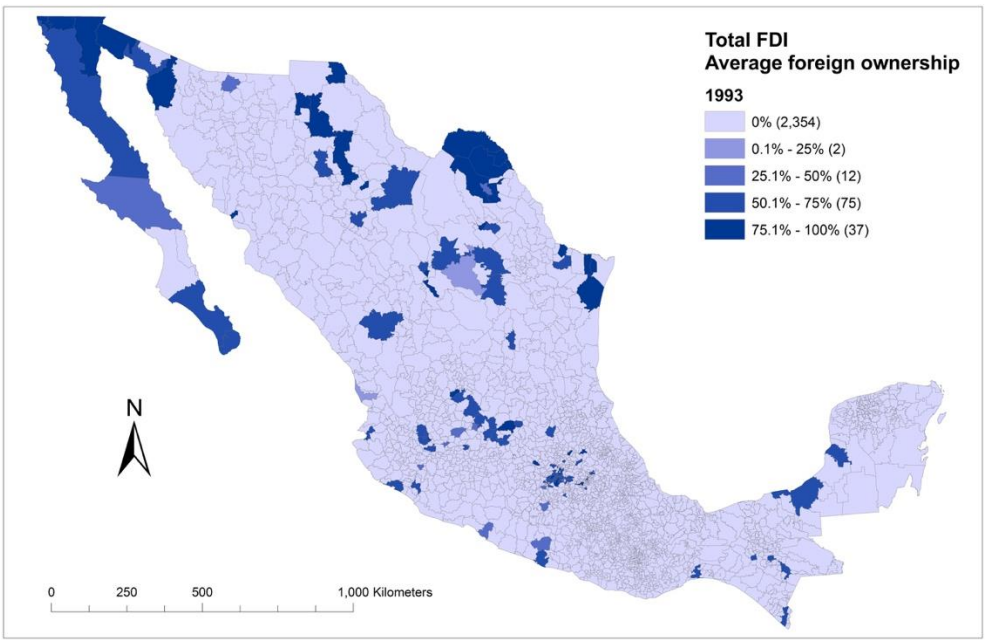
The geographical distribution of foreign firms, and economic activity as a whole, have experienced noticeable changes during the last four decades. Prior to the introduction of policies of trade promotion in the mid 1980s, the distribution of economic activity was concentrated in and around Mexico City, that represented the single largest domestic market (Krugman & Livas Elizondo, 1996). Although export promotion policies under the *maquiladora* programme[31] date back from the early 1970s, it was not until the early 1980s that the regional distribution of foreign activity shifted dramatically away from Mexico City and towards the Northern states. In the wake of NAFTA, the bulk of FDI was concentrated in municipalities[32] along the Northern border and some central regions with industrial history. Panel A in Figure 7 shows a map of the

[31] In 1971, the Mexican government launched the programme that enabled the establishment of *maquiladoras* under the framework of the earlier *Programa de Industrialización de la Frontera* (1965). Under the former decree, the territories along the Northern border were constituted as a platform for the export of manufactured goods assembled in the country with raw material and components imported duty free in plants largely owned by foreign capital (Lopez Villafañe, 2004).

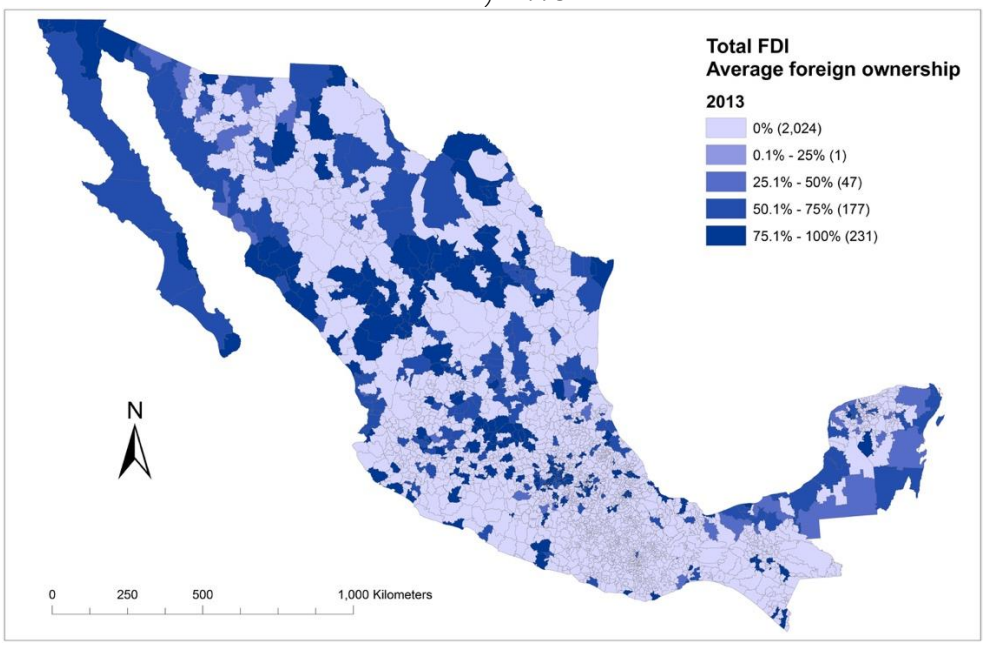
[32] This administrative unit represents the third level of government, after the state and federal administrations. It is the equivalent of US counties. There are 2,457 *municipalities* in Mexico. Population sizes range from 100 to 1.8 million inhabitants. The smallest municipality is 4.3 km^2, while the largest occupies 52 km^2. All municipalities are autonomously governed by town halls of popular election.

distribution of the average percentage of total foreign ownership across municipality in 1993.

Figure 7 – Total FDI in Mexico: Average foreign ownership by municipality, 1993-2013



A) 1993



B) 2013

Source: Own elaboration with data from Economic Census, *Censos Economicos* (INEGI, 1994, 2014)

By the end of the 1990s, a second stage of FDI redistribution had begun taking place. Even though, foreign investment was still significant along the Northern border, foreign firms commenced spreading to other parts of the territory. The spatial distribution of total FDI was far less concentrated twenty years later in 2013 (see panel B in Figure 7). This spatial redistribution during the post-NAFTA period, was partly driven by Asian and European multinationals, that increased their presence in Mexico in order to gain preferential access to the US market (Lopez Villafañe, 2004). These firms chose not to locate along the border but in other Central and Southern municipalities, possibly guided by determinants, other than proximity to the US, such as regional markets demand, labour costs and quality, infrastructure, agglomeration economies (Jordaan, 2012, 2008) and proximity to the west coastline that has direct access to Asian imports.

Furthermore, this relocation of economic activity was accompanied by important sectoral shifts in the composition and ownership of foreign investments. Even though manufacturing still accounted for a significant share of incoming FDI, the services sector began experiencing considerable expansions after NAFTA. In 2001, the services sector accounted for 77 percent of total inward FDI, and ever since its share has averaged 45 percent of the annual inward foreign capital flows (see Figure A6 in Appendix). These sectoral shifts were also reflected in changes in the geography of foreign investment by sector. At the end of 2013, FDI in manufacturing remained concentrated in and around traditional manufacturing hot-spots, while in services it increased in medium-sized cities and tourist destinations (compare the maps in Figure A7 and Figure A8 in the Appendix). In sum, while IFDI flows have steadily increased, especially after the enactment of NAFTA, the geography of FDI in Mexican territory has considerably changed during the 20 years period of our study. Not only has the intensity of FDI increased in municipalities with initial foreign presence, but it has also dispersed across the territory. This spatial relocation has been accompanied by important sectoral changes, with the services sector gaining predominance over manufacturing.

On the education side, Mexico's educational attainment has increased steadily after the 1970s. A relatively rapid catch up until the 1990s was the result of increases in the coverage of basic education[33] and the reduction of primary school dropout rates (López-Acevedo, 2006). However, enrolments and educational attainment have continued to lag behind, and still remain below the international trend line. Only 63 percent of the adults have attained lower secondary

[33] Basic education in Mexico refers to pre-tertiary education, usually 12 years of education; 6 years of primary, 3 of lower secondary, plus 3 of upper secondary education.

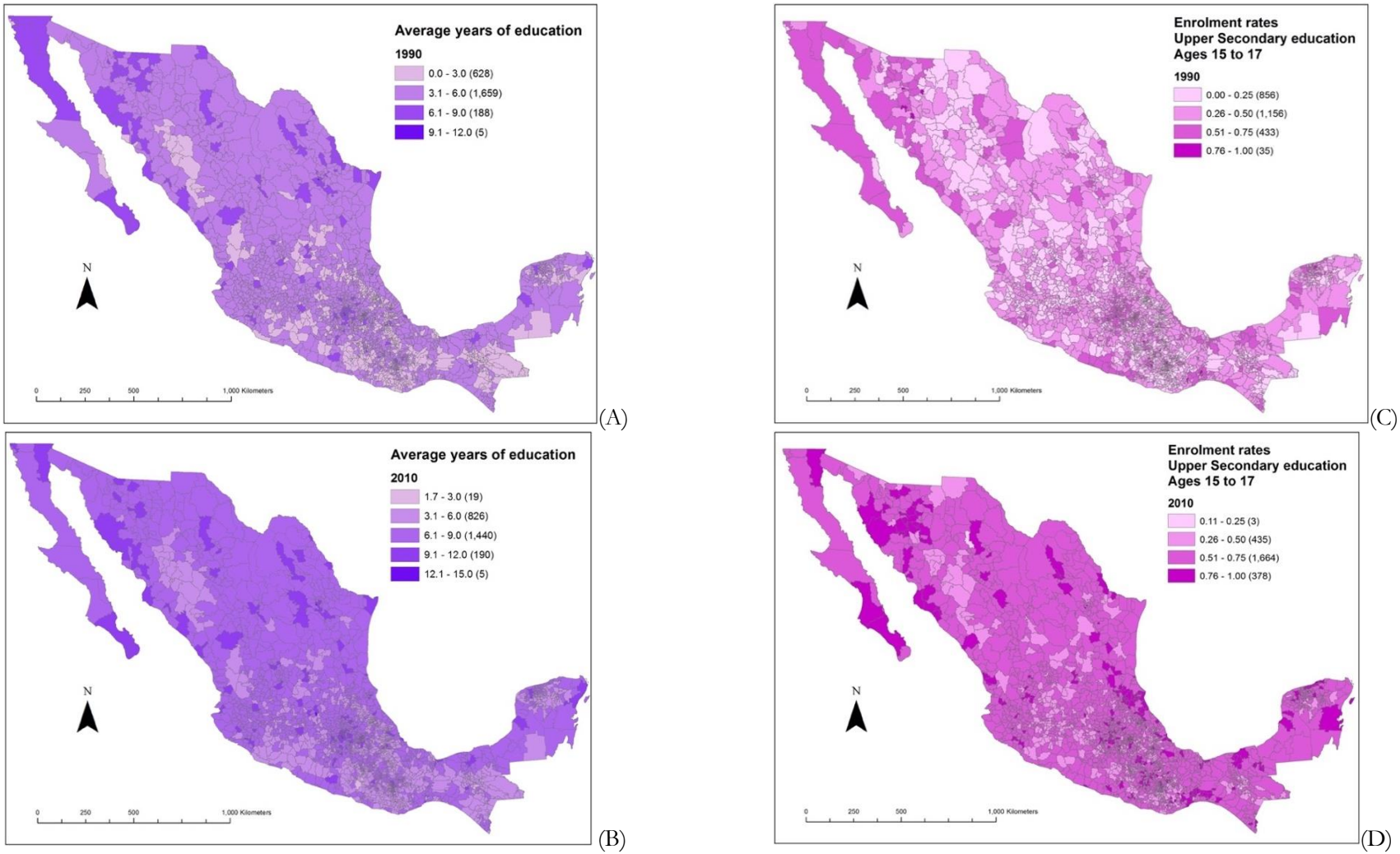
education; and the proportion of those who have attained at least upper secondary education is as little as 37 percent (OECD, 2014).[34] While access to primary and secondary is universal and compulsory, Mexico has one of the smallest proportions of 15- to 19-year-olds enrolled in education —53 percent— among OECD countries. Students in Mexico tend to leave education early. In 2012, only 66 percent of 15-year-olds participated in education while only 62 percent of 16-year-olds were enrolled (OECD, 2014).

Differences in educational attainment in Mexico are still strongly tied to income territorial inequalities and differences in access to education. In 1990, the national average education was 3.9 years for the working age population. Higher educational attainments were generally found in the Northern regions and in Mexico City and surrounding municipalities (Panel A in Figure 8). At the turn of two decades, the national average rose to 6.6 years of education in 2010. The spatial trend remained relatively unchanged and the Southern territories continue to lag behind (Panel B in Figure 8). Inequalities are also evident in terms of access to education. We use enrolment in upper secondary since the focus of this paper is centred on this level of education. At the national level, only 33 percent of youths 15 to 17-years-old in were enrolled in their correct year of schooling in 1990. Overall, although the north-south divide is still evident, enrolment rates tend to vary more and pockets of low enrolments are scattered across the territory (Panel C in Figure 8). The national average of this rate rose to 62 percent of the youths in 2010, but the spatial patterns remain virtually unchanged (Panel D in Figure 8).

The current situation still presents bleak prospects regarding the availability and quality of human capital in Mexico: even though in two decades' time the enrolments and educational attainment rose, the improvements are almost imperceptible: while the average education of the workforce went from incomplete primary to complete primary schooling, school enrolments for 15 to 17-year-olds are still far from being complete, despite upper secondary education being compulsory in the country.

[34] Typically, lower secondary education refers to grades 7 to 9, whereas upper secondary comprises grades 10 to 12.

Figure 8 – Educational attainment and enrolments by municipality, 1990-2010



Source: Own elaboration with data from Population Census, *Censos de Población y Vivienda* (INEGI, 1990, 2010)

2.4. Empirical Strategy

The previous section laid the ground for the analysis. Against this background, IFDI will have different effects across municipalities, with disproportionate consequences on vulnerable groups of the population. In particular, we investigate the labour market effects of IFDI on educational choices of young cohorts in a particular threshold of formal education that are more exposed to foreign presence. We considered two types of jobs –skilled and unskilled— in both manufacturing and services sectors.

2.4.1. Data description and variables

In order to answer the empirical question at hand, we constructed a rich dataset by combining two sources of information. Firstly, we use the Population and Housing Census (INEGI, 1990, 2000, 2010), which contains data from the universe of Mexican households or a representative sample of them, conducted every ten years by the National Institute of Statistics. The censuses cover a 20-year period[35], from 1990 to 2010, and collects data on a number of variables related to income, expenditure, education and employment for households and individuals within them. Secondly, we use data from the Economic Census (INEGI, 1994, 1999, 2004, 2009) regarding foreign ownership, employment creation and wages. Data for these censuses is collected every 5 years from the whole universe of economic units in the country. These cover a 15-year period from 1993 to 2008.[36] The data obtained is aggregated at the municipality level and by manufacturing and services sector following confidentiality principles[37]. We construct several datasets in order to provide different pieces of evidence on the relationship between FDI and educational outcomes.[38] Summary statistics are reported for each dataset in Table A5 in the Appendix.

We use two versions of the explanatory variable of interest; namely foreign presence. The first measure is meant to capture the employment opportunities offered by MNEs in their respective sectors and municipalities in which they are located. Foreign jobs are considered to be those for which the aggregate of firms has a strictly positive foreign participation in the ownership of total assets at the municipality-sector level. The new foreign jobs variable, ΔF, is defined as the

[35] In the last specification in subsection 2.5.4 we use a 25 year-long period, from 1990 to 2015

[36] Data refers to the year prior to publication, e.g., the census for 1993 is published in 1994.

[37] Wherever there are three or less economic units in the industry-municipality observation, data is concealed to prevent the identification of individual firms through INEGI's geolocation tool.

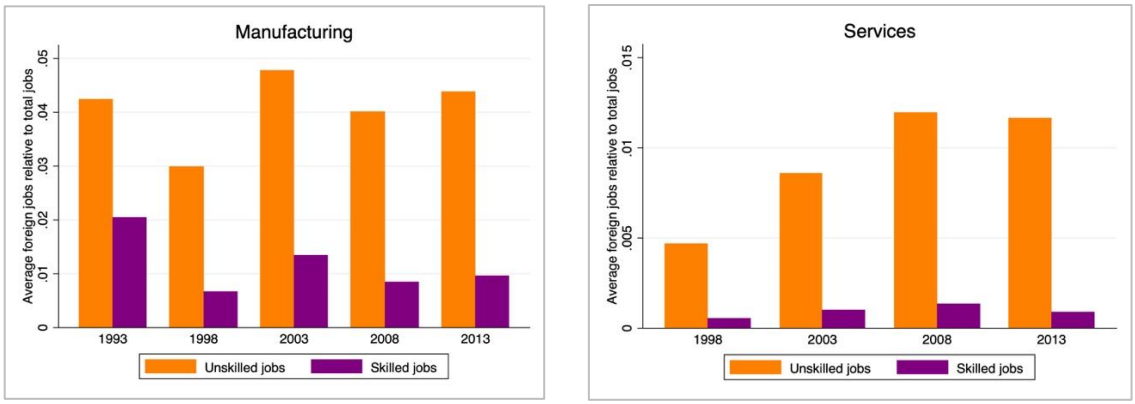
[38] Due to the different periodicity of the two data sources, we use linear interpolation when needed to complete the missing years and be able to perform the merging of the two datasets.

difference between foreign —skilled or unskilled— jobs in municipality m between years $t - x$ and t in each sector;

$$\Delta F_{mt} = \frac{F_{mt} - F_{mt-x}}{L_{1990}} \qquad \text{(Equation 1)}$$

Effects of additional foreign jobs are likely to vary in magnitude depending on the size of the local labour markets (Atkin, 2012). The change in jobs is then scaled by the working age population —15 to 64 years old— in each municipality. We use the population figures of 1990, in order to avoid the potential simultaneity stemming from additional foreign jobs and a growing working age population in a given municipality. Within our time frame, the contribution of foreign jobs relative to total jobs is considerably larger manufacturing than in services, both for skilled and unskilled (Figure 9). However, the relative number of foreign jobs in services has steadily grown, particularly for unskilled workers. These trends are confirmed by findings suggesting that the growth of foreign employment was mildly positive in the manufacturing sector, while it turned out to be much more accelerated in the services sector (Chiatchoua et al., 2016). Furthermore, FDI in manufacturing has been found to have a similarly positive effect on both skilled and unskilled employment growth (Nunnenkamp & Bremont Alatorre, 2007).

Figure 9 – Foreign jobs relative to total jobs by sector and type of worker, 1993-2013.



A) Manufacturing B) Services

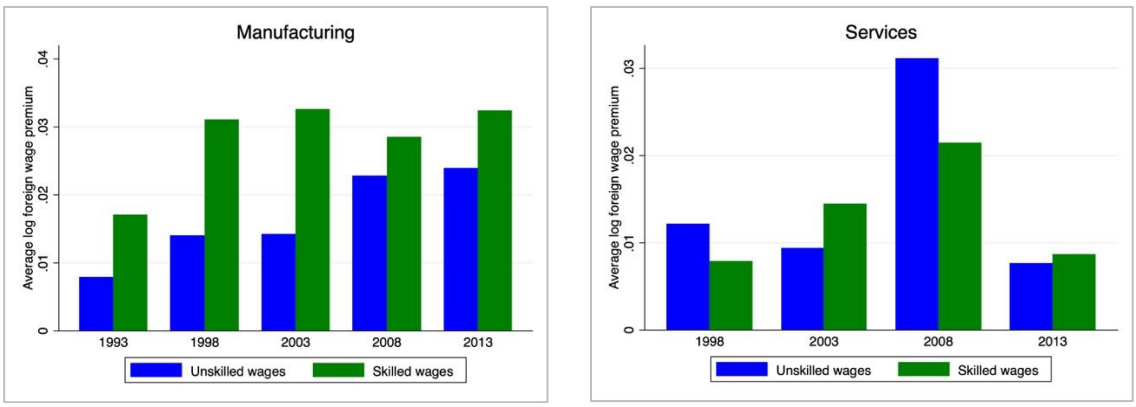
Source: Own elaboration with data from Economic Census, *Censos Economicos* (INEGI, 1994, 1999, 2004, 2009, 2014). Note: data on unskilled jobs in 1994 was not recorded for services.

A second definition of the independent variable is the change in foreign wage premium, W^P, in each sector to account for the fact that MNEs might pay higher wages than domestic firms for identical workers. We construct said variable by taking the change in the differences in logs between average foreign (f) and domestic (d) wages between years $t + x$ and t, both for skilled and unskilled workers separately and by sector;

$$\Delta W^P_{mt} = \left(w^f_m - w^d_m\right)_{t+x} - \left(w^f_m - w^d_m\right)_t \qquad \text{(Equation 2)}$$

In the manufacturing sector, foreign wage premium exhibits an increasing trend and it is considerably larger for skilled workers (Figure 10). In the services sector, the foreign wage premium also follows a rising trend, albeit more erratically. Nonetheless, for some years, the foreign wage premium for unskilled workers exceeds that for skilled. It seems that, on average, MNEs in Mexico tend to pay higher wages than their domestic counterparts. These wedges in the prices of labour and their temporal changes, constitute our source of variation to identify the labour market effects of IFDI on educational choices.

Figure 10 – Foreign wage premium by sector and type of worker, 1993-2013.



A) Manufacturing B) Services

Source: Own elaboration with data from Economic Census, *Censos Economicos* (INEGI, 1994, 1999, 2004, 2009, 2014). Note: data on unskilled jobs in 1994 was not recorded for services.

Our dependent variable is a given educational outcome depending on the specification. They are all defined for age cohorts that were 15-years-old at the time of foreign jobs arrival. We use both cohort's average enrolment rate and average years of completed education. These are constructed by collapsing the census data by municipality and year of birth using the associated expansion factors. Our vector of controls includes for each cohort-municipality, percentage of females in the cohort, changes in the percentage of employment, average of parents' years of education, whether both parents work, household income and household size (see Table A5 in the Appendix for summary statistics of the different subsamples).

2.4.2. Instrumentation

The underlying theoretical model we adopt is a general utility maximization problem in which households make educational choices for its young members depending on a number of factors (G. S. Becker, 1965; G. S. Becker & Tomes, 1986; Levison et al., 2001): Individual characteristics such as gender and age; household features like family size, household income and parental labour force participation as well as educational background; and finally regional determinants such as foreign firms' labour market conditions and sectoral composition. The motivation for

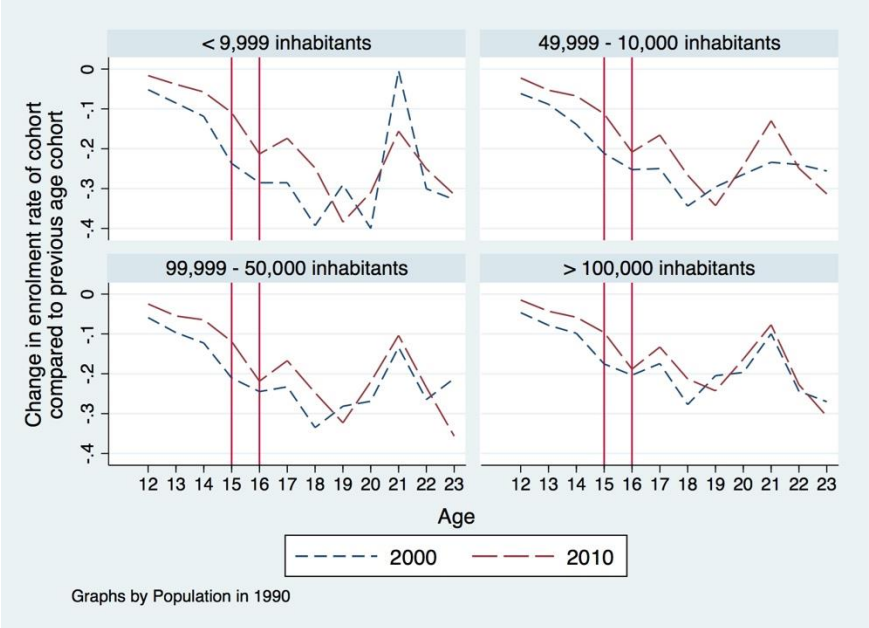
our empirical model stems from the recent spatial redistribution of FDI across national territory and shifts in sectoral trends that in unison with the institutional context of the Mexican educational system, may be affecting disproportionately particularly young cohorts by early exposure to foreign presence. In the Mexican educational system, there are at least two moments during secondary education when students face higher risks of dropping out of school; the first one is between lower and upper secondary education, grade 9, and the second one is at the end of the grade 12. Until 2012, compulsory schooling in Mexico covered only nine years of education, so we use the threshold between lower and upper secondary education (grade 9) to identify the effects of FDI on youths that are disproportionately exposed to foreign presence.[39] Moreover, grade 12 corresponds to students deciding whether or not to continue on to tertiary education, hence it entails a greater selection bias stemming from the more motivated and better able students continuing on to university.

The argument to choose grade 9 unfolds as follows. Students enrolled in this grade, the last year of lower secondary education, are typically 15 years old. By the time they complete their current course they will be allowed to work, since the legal working age in Mexico is 16-years-old. We argue that these youths are more likely to drop-out before the beginning of the next academic year, if they observe an increase in the number of unskilled jobs or the wages offered by foreign firms, such that the returns to further education are not enough to compensate for the opportunity cost (in the form of forgone wages) of continuing on to upper secondary education through to grade 12. In Mexico, the opportunity cost of this next level of education is particularly high to begin with. On the one hand, lower and upper secondary are administratively two separate educational systems and progression requires students take a nation-wide admission exam —*Examen Nacional de Ingreso*— that sorts them into their different school choices according to performance. On the other hand, the two systems are seldom located physically within the same building and sometimes students see their commuting journeys significantly increased. In sum, the opportunity cost of progression at this threshold is particularly high: the inflow of new highly paid foreign jobs is more likely to outweigh the returns of further education and lead to a reduction in enrolment rates and average years of education for these youth cohorts. Figure 11 depicts this threshold for the years 2000 and 2010, by municipalities grouped by population size, a crude proxy for the rural-urban divide. Naturally, enrolment rates fall with age, however, the dip in enrolments seems to be quite pronounced

[39] The educational reform of 2012 included upper secondary education as mandatory, elevating from 9 to 12 the years of compulsory schooling (Political Constitution of the United Mexican States, amended 2012). This does not constitute a problem for our identification strategy since the analysis of enrolments is done from 1990 to 2010.

between 15 and 16-years-old across all municipality sizes. Not surprisingly, the drop in the proportion of enrolled 16-year-olds compared to the previous age cohort is largest for smaller rural municipalities and smallest for bigger urban ones. We plot the spatial distribution of the changes in this particular enrolment rate (map in Figure A9 in the Appendix); there is significant variation in the changes, even when across the board municipalities experienced decreases in enrolment of 16-year-olds compared to the previous age cohort in 2010.

Figure 11 – The 15/16-years-old threshold by municipality population size.



Source: Author's own elaboration with Population Census data (INEGI, 2000, 2010)

2.4.3. Threats to internal validity

Three main sources of endogeneity are identified that might yield inconsistent estimates of the effect of FDI employment and foreign wage premia on educational choices. The first one is the reverse causality between FDI and the initial level of education of the working age population. Foreign investment locational choices could be driven by the pre-existing level of education in recipient municipalities. An upward bias will occur if MNEs are attracted to locations with higher levels of human capital as measured by the average years of education. Conversely, if foreign investment is flowing to municipalities with lower initial levels of education, then the main coefficient will suffer from a downward bias. To test whether such correlations exist in our sample of municipalities, we regress foreign job creation on the 3-year-lag of average years of education by municipality (see Table A6 in the Appendix). The model in first differences, allows us to rule out a significant relationship that can potentially bias our results. Changes in initial average years of education do not seem to be correlated with subsequent foreign job

creation, even when including the squared term of education –to account for a potential non-linear relationship— and year fixed effects. Furthermore, the significantly low R-squared coefficient suggests that changes in educational attainment do not explain the variation of subsequent FDI flows.

A second obvious threat to internal validity is the one stemming from the omission of time-varying variables that are correlated with both FDI inflows and educational attainment. We could be concerned that due to increases in the local government's revenue coming from foreign firms, more expenditure in public education is made, hence affecting the level of educational attainment. Even though such controls are not available at the municipality level, we are confident that this constitutes a non-issue for the following reason. Provision of public basic education is not funded with local taxes in Mexico. Budget allocation and planning is done at the federal level in consultation with states, with municipalities having little to no say. Public tertiary education is somewhat more decentralised, and funding is done at the state level.

Thirdly, unobservable characteristics for particular cohort-municipalities will be accounted for by first-differencing the equations of interest. First differences at cohort-municipality-level will capture differences across municipalities, for example, municipalities with upward educational trends or better infrastructure for education. Year specific shocks affecting all municipalities in the sample will be accounted for by the year dummies. On the macroeconomic side, these year shocks are likely to be the 2001 and 2009 world economic recessions, and the rolling out of the widely known conditional cash-transfer social programme *Oportunidades* in 2000 which required students be enrolled in school up to the 12th grade.

2.5. Results and discussion

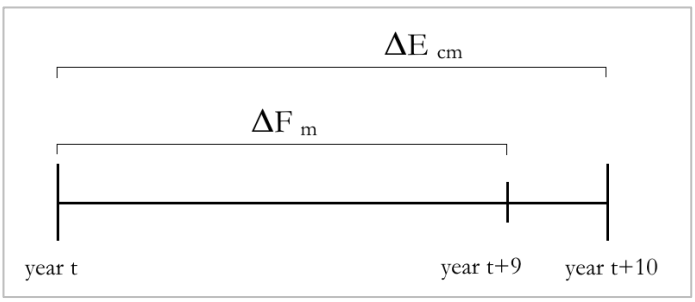
To the extent that FDI modifies the local labour market conditions, we test the general hypothesis of whether new foreign jobs and foreign wage premia raise the returns to education such that they exceed the opportunity cost of schooling, thence leading to higher educational outcomes for exposed cohorts in each municipality, against the alternative in which case FDI-induced returns to education do not offset the opportunity costs, hence resulting in negative effects on educational outcomes. To account for this trade-off facing youths, we include jobs (or foreign wage premia) for skilled and unskilled in the same equation. Whereas the former represents the returns to further education in terms of future wages, the latter constitutes the opportunity cost in terms of forgone wages. Lastly, to account for sector heterogeneity of FDI,

the foreign presence variable is broken down in manufacturing and services, since each economic activity has different knowledge intensities according to the sector (Checchi et al., 2007). We put forward four pieces of evidence below.

2.5.1. Foreign job creation and enrolment rates

Do municipalities with larger foreign job creation exhibit lower enrolment rates? The first piece of evidence pertains the effect of changes in foreign presence on changes in the enrolment rates for 16-year-olds. Estimating the effect of foreign MNEs on education from the repeated cross-section of individuals will result in a biased coefficient because of unaccounted heterogeneity, since we can only observe each one individual once in time; for example, forward-looking or gifted individuals are more likely to invest in their education. To overcome this complication, we construct a pseudo-panel that allows us to control for time-invariant individual characteristics (Cameron & Trivedi, 2005). Although individuals cannot be tracked through time, it is possible to follow cohorts defined by year of birth at the time of foreign jobs arrivals. To this end, we convert individual-level data into cohort-level by averaging across members of the cohort.[40] The time series variation from sample average of cohorts constitutes the basis of our specification. We first obtain the 16-year-olds cohort-municipality average of enrolment rates, E, both in year t and $t + 10$, by collapsing the census data using the associated expansion factors. Then the corresponding changes in foreign presence F (here measured as new foreign jobs) are obtained from year t to $t + 9$, one year before we observe enrolment rates again. The logic is presented in the diagram in Figure 12 below.

Figure 12 – Diagram: Changes in Foreign presence and enrolments



Our estimation comprises three population census rounds 1990, 2000 and 2010. Finally, we fit a first difference model to account for unobserved time-invariant cohort-municipality characteristics. The specification in first differences takes the following form;

[40] For large samples, successive census waves will generate random samples of members of each cohort.

$$\Delta E_{cmt+10} = \beta \Delta F_{mt+9} + \gamma \Delta Z_{cmt+9} + \delta \Delta X_{cmt+9} + \alpha_{t+10} + \Delta u_{cit+9} \quad \text{(Equation 1)}$$

where ΔE are the changes in 16-years-old enrolment rates. Our parameter of interest, β, estimates the effect of net changes on foreign jobs scaled by working age population size as established in Equation 1 above. γ captures the effect of average individual characteristics; namely percentage of females in the cohort and percentage of individuals also working. δ is the coefficient of the effect of average household characteristics such as parental educational background and labour force participation, income and household size. Finally, α is a year dummy for each census round it absorbs differences in enrolments across time. The estimates for this specification are shown in Table 5. We examine FDI effects by fitting the model for the different economic sectors; manufacturing (column 1) and services (column 2).

Table 5 – First differences: Effects of job creation on 16-year-old's enrolment rates

Dependent variable: Δ Enrolment rate	Manufacturing (1)	Services (2)
Δ *Foreign unskilled jobs*	-0.232*	-1.587***
	(0.131)	(0.427)
Δ *Foreign skilled jobs*	0.309	1.953***
	(0.535)	(0.545)
Δ Employed	-0.473***	-0.468***
	(0.024)	(0.023)
Δ Female	-0.173***	-0.149***
	(0.029)	(0.030)
Δ Parents' average education	0.009***	0.013***
	(0.002)	(0.002)
Δ Both parents work	0.043	0.053**
	(0.036)	(0.023)
Δ Household size	-0.009**	-0.006
	(0.004)	(0.004)
Δ Household income	0.001	0.002
	(0.002)	(0.002)
Observations	3,311	3,339
Cohort-municipalities	1,672	1,668
Year dummies	yes	yes
R-squared	0.218	0.232

Clustered standard errors by cohort-municipality in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

The effect of foreign unskilled job creation is significantly associated with lower enrolment rates within a ten-year period. In other words, municipalities with positive net job creation by MNE's experienced lower enrolment rates for 16-year-olds. This result holds both for manufacturing and services alike, although the effect appears to be larger for unskilled jobs in services. The latter jobs could be those in the expanding industry of customer services (e.g. call centres).

Conversely, municipalities with a high foreign skilled jobs creation in the services sector had higher enrolment rates for these youths. Put differently, prospects of employment opportunities in the skilled service sector outweighs the opportunity cost of schooling, incentivising young students to remain in school. Interestingly, skilled job creation in manufacturing does not have a significant effect on enrolment, possibly due to the relatively slower expansion of the foreign manufacturing sector. This represents an interesting result, especially for a country like Mexico with longstanding tradition in manufacturing industries. Despite the important shares of foreign ownership in this sector, direct employment in foreign manufacturing only accounted for 26% of the total employment during the period. Furthermore, recent foreign investments in manufactures have also concentrated in more capital-intensive stages of the value chain that require less labour. Both trends are a possible explanation of the null impact of foreign manufacturing employment on educational choices of younger cohorts.

In sum, it would seem that youths are sensitive to job creation by MNEs, these effects are heterogeneous across sectors and skill groups. The prospects offered by these firms are appealing and they will have opposite effects depending on the level of skills required. In our specifications we also control for the usual predictors of educational choices. They all turn out to behave in the expected direction and they are generally the same across sectors.

We include the percentage of the cohort that is employed to account for the possibility that if more youths drop-out of school they might have taken a job instead. The negative and significant coefficient confirms this assumption. Unfortunately, we cannot know whether these young individuals were hired by the MNEs or they found a job in a domestic firm. We do know, however, that they are working in the formal sector. Consistently, the percentage of females in the cohorts is negatively associated with enrolments and the association is statistically significant across specifications. This does not come as a surprise in the Mexican case, since young females are still expected to work at home and thus tend to have lower school attendance rates than other groups of young workers (Abler et al., 1998). Furthermore, parental background seems to play an important role in educational choices. Similarly to the findings by Levison et al. (2001), higher parental educational background is significantly associated with positive changes in enrolment rates. However, having both parents participating in the labour market does not seem to have a significant effect on youth educational choices, suggesting a family outlook in which decisions less centralised (Federman & Levine, 2005). Household size is negatively associated with enrolments; resources in larger households are scarcer and hence investment on education for all its members becomes more burdensome (though this only holds in the manufacturing sector). Finally, higher income households are more likely to invest in their children's education.

Although the coefficient is not significant, we decide to include it to reduce the omitted variable bias since it is highly correlated with educational choices.

2.5.2. Foreign wage premia and enrolment rates

Do municipalities with higher foreign wage premium have lower enrolment rates? As we posited from the beginning, our hypothesis is that MNE's not only introduce new jobs in the local labour markets, but on average, these jobs are highly paid compared to domestic wages. Since we are interested in studying the effects of changes in relative wages on youth educational choices, we now define our covariate of interest in terms of foreign wage premia for skilled and unskilled workers (see Equation 2), to allow for the comparison between foreign and domestic wages. We do this for the manufacturing and services sectors separately by substituting the main independent variable in Equation 3. The estimated effects are presented in Table 6.

Table 6 – First differences: Effects of foreign wage premia on 16-year-old's enrolment rates.

Dependent variable: Δ Enrolment rate	Manufacturing (1)	Services (2)
Δ *Unskilled foreign wage premium*	-0.040***	-0.031***
	(0.009)	(0.008)
Δ *Skilled foreign wage premium*	0.007	-0.005
	(0.006)	(0.008)
Δ Employed	-0.473***	-0.468***
	(0.024)	(0.023)
Δ Female	-0.174***	-0.150***
	(0.029)	(0.030)
Δ Parents' average education	0.008***	0.013***
	(0.002)	(0.003)
Δ Both parents work	0.041	0.054**
	(0.035)	(0.023)
Δ Household size	-0.009**	-0.006
	(0.004)	(0.004)
Δ Household income	0.001	0.002
	(0.002)	(0.002)
Observations	3,311	3,339
Cohort-municipalities	1,672	1,668
Year dummies	yes	yes
R-squared	0.219	0.231

Clustered standard errors by cohort-municipality in parentheses
*** p<0.01, ** p<0.05, * p<0. 1

The effect of foreign wage premium for unskilled workers is negative and significant for both sectors. In other words, holding all covariates constant, a 10 percent increase in observed foreign wages relative to domestic ones, is associated with a decrease the in the expected enrolment rate for 16-year-olds by 0.38 percent for manufacturing and 0.29 for services. This result suggests

that in municipalities in which foreign wages increased, relative to domestic, during the considered period, less youths were enrolled in upper secondary education afterwards. These estimates coincide with those on foreign jobs in the previous subsection. Together, they seem to indicate that young individuals at the critical threshold are more susceptible to drop out from school if they observe an increase in the number of foreign higher-paid unskilled jobs in their municipality of residence. Contrarily, foreign wage premium for skilled jobs in either sector had no significant effect on enrolment rates. When contrasted with the results in subsection 2.5.1, it would seem that young individuals are not affected by changes in the relative wages of skilled jobs that they might deem too farfetched for them (with the exception of new skilled jobs in the services sector). The rest of the controls behave similarly to the specification in the previous section.

2.5.3. Foreign wage premium and individual school attendance

Does being exposed to foreign presence at age 15 affects the individual's probability of school attendance at age 16? Up until know we have presented cohort-level evidence on the relationship being scrutinised. We now put forward cross-sectional individual level evidence and estimate the effect of changes in foreign presence on the individual probability of attending school the year after. To this end, we construct a data set of youths that were aged 15-years-old at the year of FDI arrival in their municipality of residence, defined by the year in which they were born. Since we observe individual enrolment status both in 2000 and 2010, we keep those youths born in 1984 and 1994. We then regress changes in foreign presence on the school attendance status the following year, as shown below;

$$A_{icmt} = \beta \Delta F_{mt} + \lambda_{cm} + \lambda_s + \epsilon_{icmt} \qquad (4)$$

where A_{icmt} is a dummy for school attendance status of individual i (equal to 1 if the individual is enrolled in school; zero otherwise) that belongs to cohort-municipality cm in year t. Again β captures our association of interest; foreign presence is measured as changes in the foreign wage premia for both types of workers as defined in Equation (2). λ_{cm} is s set of dummies that capture differences across cohort-municipalities, while λ_s is a vector of state dummies to account differences in enrolment rates across a larger administrative region. ϵ_{icmt} is the remaining error term. The estimates for the logit model are presented in Table 7.

Table 7 – Logit: Effect of foreign wage premia on individual probability of school attendance.

Dependent variable: Individual school attendance dummy	Manufacturing (1)	Services (2)
Δ Unskilled foreign wage premium	-0.036**	-0.051***
	(0.018)	(0.007)
Δ Skilled foreign wage premium	0.035***	0.026***
	(0.012)	(0.005)
Observations	402,273	407,678
Cohort-municipality dummies	yes	yes
State dummies	yes	yes

Cluster standard errors at the municipality level in parentheses. Marginal effects at the mean.
*** p<0.01, ** p<0.05, * p<0.1

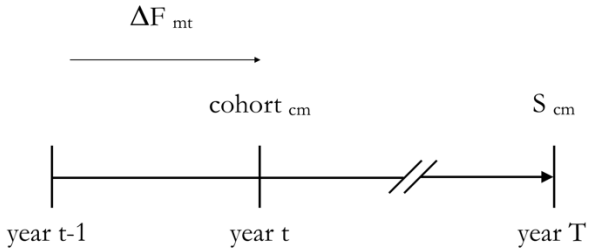
Much in line with the estimates in the previous sections, the coefficient on unskilled foreign wage premium are associated with decreases in the odds of school attendance for individuals. A one percent increase in the foreign wage premium is associated with a decrease in the odds of being enrolled in school the year after; 3.6 percent for manufacturing and 5.1 percent for services. Contrarily, this relationship is positive for skilled foreign wage premia; a similar increase is associated with increases in the odds of school attendance, 3.5 percent and 2.6 percent for manufacturing and services, respectively. Even though this is a cross-section of individuals, we find evidence that changes in the labour market following foreign firm entry, have effects on individual educational choices, controlling for cohort-municipality-specific and state-specific effects. High-paid foreign unskilled jobs might outweigh the returns to education for some individuals at the threshold. Meanwhile, some individuals might find the returns to further education higher than the opportunity cost of further schooling when the foreign wage premium increases for skilled jobs. We find these effects hold across sectors. Obviously, the prevalence of one effect over the other will depend on the individuals' characteristics and household background as suggested by the results in sections 2.5.1 and 2.5.2.

2.5.4. Foreign wage premia and educational attainment

Do exposed 15-year-olds have lower average years of completed education later in time? Lastly, we consider the long-term effect of FDI exposure on the educational attainment of young cohorts. Following the rationale to identify this effect (shown in Figure 13 below); let cohort cm be that of individuals born in year c, that were 15-years-old in year t in and were residents in municipality m, at which point we have records on changes in foreign presence, ΔF, in

municipality m between years $t-1$ and t. We then match the average years of completed education S for each exposed cohort-municipality cm some years later, specifically in year T.

Figure 13 – Diagram: Foreign presence and average years of education



We use the inter-census representative survey for 2015 (INEGI) to increase the number of observations in the sample. Therefore, the cohorts' educational outcome is observed in T = 2015. The resulting sample comprises 20 cohorts in ~2,457 municipalities. The oldest cohort was born in 1978 while the youngest in 1997. The group variable is cohort-municipality, and the specification adopts the following functional form,

$$S_{cm} = \beta \Delta F_{mt} + \lambda_c + m\lambda_c + \epsilon_{cm} \qquad \text{(Equation 2)}$$

where S_{cm} is the average years of education for the exposed cohort in T. β measures the effect of changes in the foreign wage premium both for skilled and unskilled jobs. λ_c is a cohort fixed effect and $m\lambda_c$ is a municipality-specific trend. The latter to account for municipalities' pre-existing trends on educational attainment. Note that year and cohort fixed effects are equivalent since we only observe each cohort once at the end of the sample period. ϵ_{cm} is the remaining unobservable error term. We exploit the municipality year-on-year variation in foreign job creation to identify the effect of FDI on young cohorts' educational attainment. Results are presented in Table 8 for manufacturing and services separately.

Once again, we confirm our hypothesis. The estimated relationship between of foreign wage premia and years of completed education is negative for unskilled jobs and positive for skilled ones, consistently across sectors. Cohorts at the threshold that were exposed to higher foreign wage premia have lower average number of completed years of education. Conversely, exposure to foreign wages premia for high skilled jobs, seems to be related with higher educational attainment for those cohorts.

Table 8 – Effects of foreign wage premia on cohorts' average years of education.

Dependent variable:	Manufacturing	Services
Average years of education	(1)	(2)
Δ Unskilled foreign wage premium	-0.398***	-0.047***
	(0.075)	(0.007)
Δ Skilled foreign wage premium	0.308***	0.357***
	(0.063)	(0.024)
Observations	45,537	43,660
Cohort FE	yes	yes
Municipality linear time trends	yes	yes

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

These results suggest that the effects of being exposed to foreign job creation are not short-lived, but in fact they translate in longer-term lower educational outcomes for individuals that where at the critical threshold of secondary education. These findings echo those by Atkin (2016), who finds that averages years of education are consistently lower for cohorts that were more prematurely exposed to foreign *maquiladora* employment in their commuting zones. However, we expand this evidence by providing findings for the broader manufacturing sector and services.

2.6. Conclusions

By considering the effects of FDI-induced labour market changes on educational choices of youths, this paper adds to the scarce empirical evidence of IFDI and its potential role in shaping human capital development in host regions, in the context of emerging economies. The period under scrutiny, 1990 to 2010, has seen significant increases in IFDI flows and shifts in the industrial sectors in which it concentrates. Concurrently, the evolution of educational outcomes for individuals in their early academic advancement has not seen major improvements. In particular, we explicitly consider one of the mechanisms through which this relationship operates, i.e., the labour market, in terms of job opportunities and foreign wage premium. We exploit FDI-induced temporal variation of the returns to education across fine-grained geographical units and sectors to study the effects of different types of foreign jobs on educational outcomes. This paper also builds on the findings put forward in Chapter *I* as evidence that, overall, IFDI in Mexico is associated with significant changes in regional labour markets, and may result in higher skilled and unskilled wages, both in manufacturing and

services, therefore modifying the relative returns to education. To the extent that these FDI-driven pecuniary externalities arise, foreign presence is likely to have an effect on the incentives to acquire further formal schooling (Blomström & Kokko, 2002). The findings herein are in line with the literature suggesting that FDI-induced changes in the labour market will have different effects on the human capital development of a host region largely depending on the types of jobs and the sector in which they are being offered (Atkin, 2016; Checchi et al., 2007).

Overall, our results suggest that young individuals that are unsure about whether to stay in school or not, are more likely to drop out when MNEs offering better unskilled job prospects lower the returns to further education. In municipalities experiencing FDI inflows, as measured by new unskilled jobs created by foreign firms, both in services and manufacturing, enrolment rates have declined for students at the critical threshold. The effects are not restricted to mere job creation, but it also holds when accounting for the foreign wage premium, i.e., the wage differential between foreign and domestic firms. Conversely, the positive and significant coefficient on skilled jobs in services is indicative of the potential of FDI in modifying labour market incentives by providing attractive employment opportunities for skilled workers and yielding positive educational outcomes. However, when considering the wage effects in services, it appears that the average cohort is not responsive to increases in the foreign wage premium for skilled jobs. This is result might be driven by some youths not being able to consider the returns to education as sufficiently high, perhaps due to disadvantages in the access to education (Attanasio, 2015).

Regarding the individual probability of school attendance, results suggest that foreign presence both increases the individuals' opportunity costs of further schooling —via unskilled wage premium— and rises the returns to higher education —via skilled wage premium—. Whether one or the other prevails for particular youths, will of course depend both on their household background and the opportunities for access to education. It is hardly debatable, that students in disadvantaged contexts will be disproportionately affected by changes in the labour market conditions in their municipality of residence (Levison et al., 2001). Finally, we have explored the extent of foreign presence on educational choices over a 25-year long period of time. Although, FDI-induced returns to higher education are still positive, foreign wage premia for unskilled jobs raises the opportunity cost of schooling affecting educational outcomes negatively as posed by the lower average years of completed education for exposed cohorts. These youths' life-long earning potential might be truncated as dropping out of school early closes off future professional development paths. Building on our results we advance two broad implications and room for policy action.

The first one relates to the repercussions of low investment in human capital both for individuals and regions. In a country with high levels of inequality in human capital and access to education, it seems important for development and educational policy to understand what are the types of foreign jobs that are affecting the relative returns for households to invest in education, particularly for disadvantaged youths. The consistency of the FDI-induced effects is particularly worrisome since it suggests that for an average 15-year-old, a highly paid unskilled job is greater and more than outweighs the returns to higher education. Moreover, if disadvantaged households lack the sophistication to assess the size of the returns to education there will consistently be lower investment in human capital (Attanasio, 2015). FDI-induced labour market effects might be polarising the educational distribution, since foreign firms do not only hire skilled workers but unskilled workers as well; the resulting dispersion of schooling among the labour force will tend to enhance income inequality (Park, 1996).

Consequences of early drop-outs are negative and long-lasting, not only for individuals but for society as a well (Rumberger, 1987). In the former case, there is little doubt that schooling might have something to do with higher life-long earnings (Angrist & Krueger, 1991; G. S. Becker, 1962; Mincer, 1958), albeit formal education might only be part of the story (Ashenfelter et al., 1999). In the latter case, schooling has been found to be associated with sizable human capital externalities (Acemoglu & Angrist, 2000; Moretti, 2004) and higher human capital, particularly attained through education, implies more skilled and productive workers, which may be associated with economic growth (Barro & Lee, 2001). When it comes to public policy, findings suggest that educational policies should be strengthened around critical thresholds of the academic progression to ensure rising levels of individual investment in education. As mentioned in subsection 2.4.2, grade 9 in the Mexican context is a problematic one, especially due to initially high opportunity costs. Ensuring that vulnerable youths continue investing in education is crucial to jump on an upward development path.

The second implication revolves around enhancing the potential technology transfers from IFDI via the improvement of local learning capabilities at the regional level. Positive externalities, stemming from MNEs in the form of knowledge transfers, tend to be realised if the host economy has reached a sufficient stock of human capital (Borensztein et al., 1998). Human capital of the workforce is a crucial factor facilitating the adoption of new and more productive technologies (Nelson & Phelps, 1966). While the presence of MNE subsidiaries does not guarantee technology transfer, the process of absorption and assimilation of foreign technology entails substantive domestic efforts (Iammarino et al., 2008). In order to enhance the learning capabilities, educational policies that improve labour skills may encourage higher

technology transfers from the MNE to its subsidiaries (J.-Y. Wang & Blomström, 1992). As documented by Padilla-Pérez (2008) for the particular case of the electronics industry in Jalisco, Mexico, higher local capabilities in the region have been crucial to attract more complex types of technology. Another policy realm for the fostering of positive FDI spillovers are the requirements of local content and local R&D (Blomström et al., 1994). By establishing backward and forward linkages with domestic firms, MNE's may enable access to new technologies and higher standards, by knowledge-sharing interactions with external suppliers and subcontractors (Driffield et al., 2002; Rodriguez-Clare, 1996). Finally, local labour markets are an important channel for knowledge transmission, hence public policies should be designed to improve the quality of the labour force and foster mobility of highly skilled employees (Capello & Faggian, 2005): worker mobility between MNEs and domestic firms will increase the potential of knowledge spillovers at the local level (Fosfuri et al., 2001).

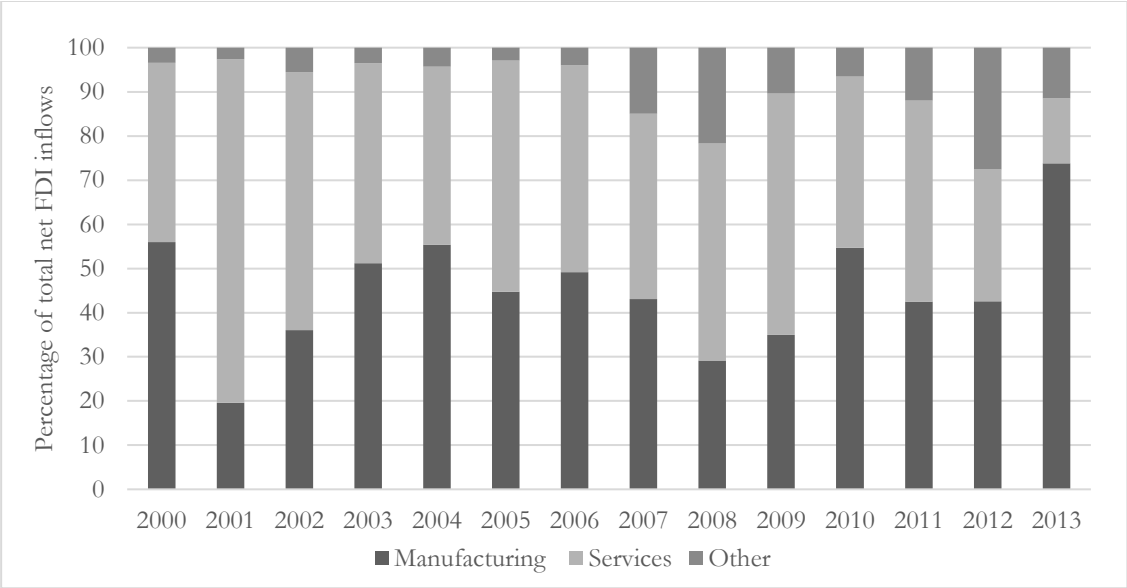
To a greater or lesser extent, some emerging economies rely on FDI as a means for acquiring technology, organisational practices and skills; often times placing great expectations on IFDI to alleviate resource and skills constraints (Noorbakhsh et al., 2001). However, not all FDI embodies advanced and complex technology and knowledge, as the evidence put forward in Chapter *I* would suggest. There might be a trade-off between the deepening of technological capabilities and relying on the technology brought in by multinational firms (Lall, 2003). Then, governments aiming to attract FDI should select the types of investments appropriate to boost their human resources and stage of development (Bartels & de Crombrugghe, 2009). This type of strategies require an integrated vision of local small and medium sized firm development and upgrading (Pietrobelli & Rabellotti, 2004)

In the context of the increasing geographical dispersion of production, emerging economies face fiercer competition. The process of "upgrading" –first defined for nations by Porter (1990)— as producing more efficiently or transition to more skill-intensive activities, has been also applied to a regional scale in the literature of global value chains (Gereffi, 1999). Participating in a global value chain has become a widespread strategy to enhance competitiveness (Giuliani et al., 2005); by increasing the skill content of their activities, regions may be able to move up the value change (Humphrey & Schmitz, 2002). For example, the Blue Jeans industry in Torreon, Mexico went from basic *maquila* to full-package apparel production (Bair & Gereffi, 2001), which resulted in some upgrading of the local skill base with improvements in wages and working conditions. The development of indigenous technological capabilities is particularly important for long-term sustainable growth (Iammarino et al., 2008).

Further research is required in some respects. Formal education is one way of accumulating human capital. There is a widely held view that training enhances workers' productivity and that of the economy as a whole (Miyamoto & Todo, 2003). While most MNEs carry out on-the-job training for their employees, covering a wide range of employees, from manufacturing operatives to top-level managers (Blomström et al., 1994; Blomström & Kokko, 2003), these firms can also shape the local training and vocational systems in the host economies, thus contributing to human capital formation (Slaughter, 2002). For example, in Vietnam, German and Japanese MNEs have set up practical apprenticeship programs with local vocational training institutes and applied universities in order to satisfy their skill demand while prompting reforms on regional training and vocational systems (Wrana & Revilla Diez, 2016). In the case of Mexico, it has been shown that technical system graduates are able to find a highly-paid job matching their skill-sets (Lopez-Acevedo, 2003). Being an alternative to formal schooling, it is worthwhile exploring how IFDI affects youth educational choices when it comes to this dimension of human capital.

2.7. Appendix

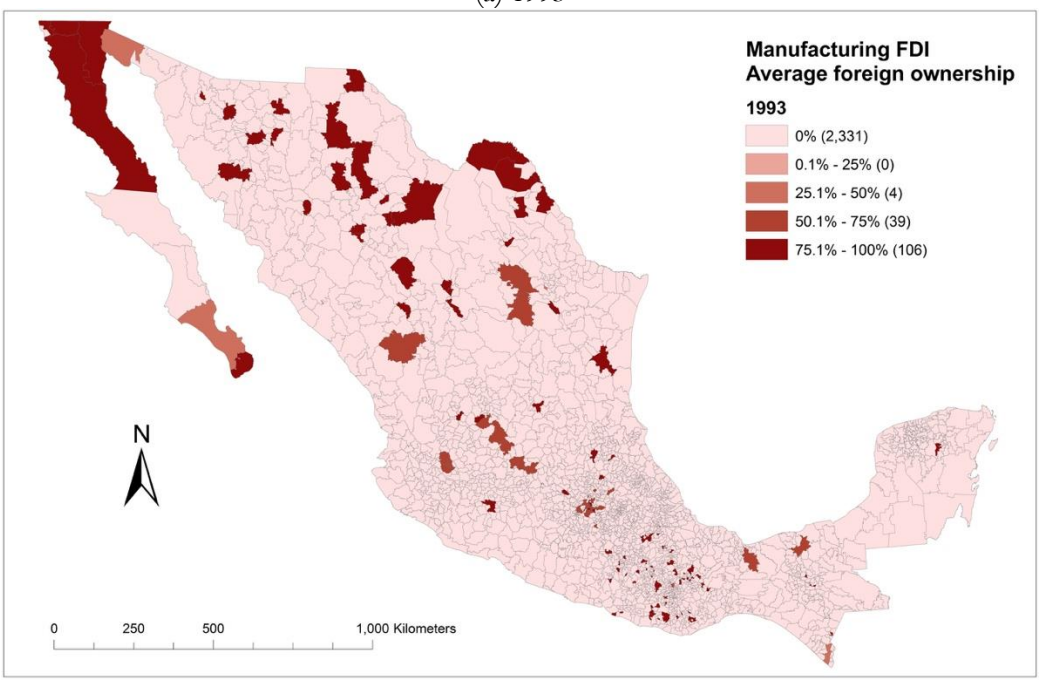
Figure A6 – Mexico: Sectoral composition of inward FDI, 2000-2013



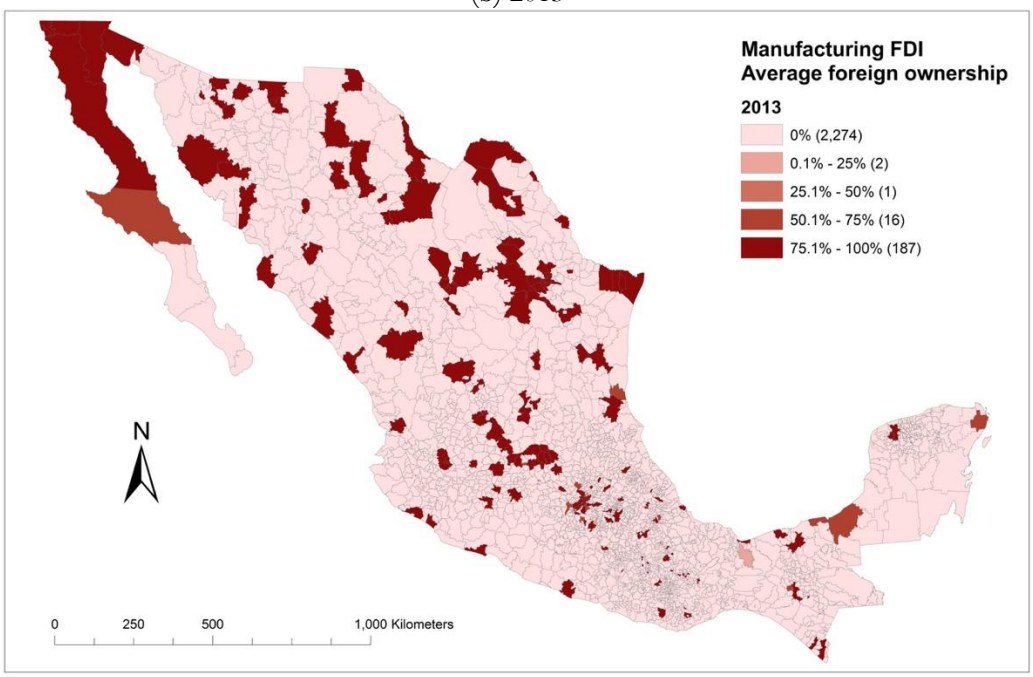
Source: Author's own elaboration with data from the Ministry for Economics, *Secretaría de Economía, Gobierno de México* (2016)

Figure A7 – Manufacturing FDI: Average foreign ownership by municipality, 1993-2013.

(a) 1993



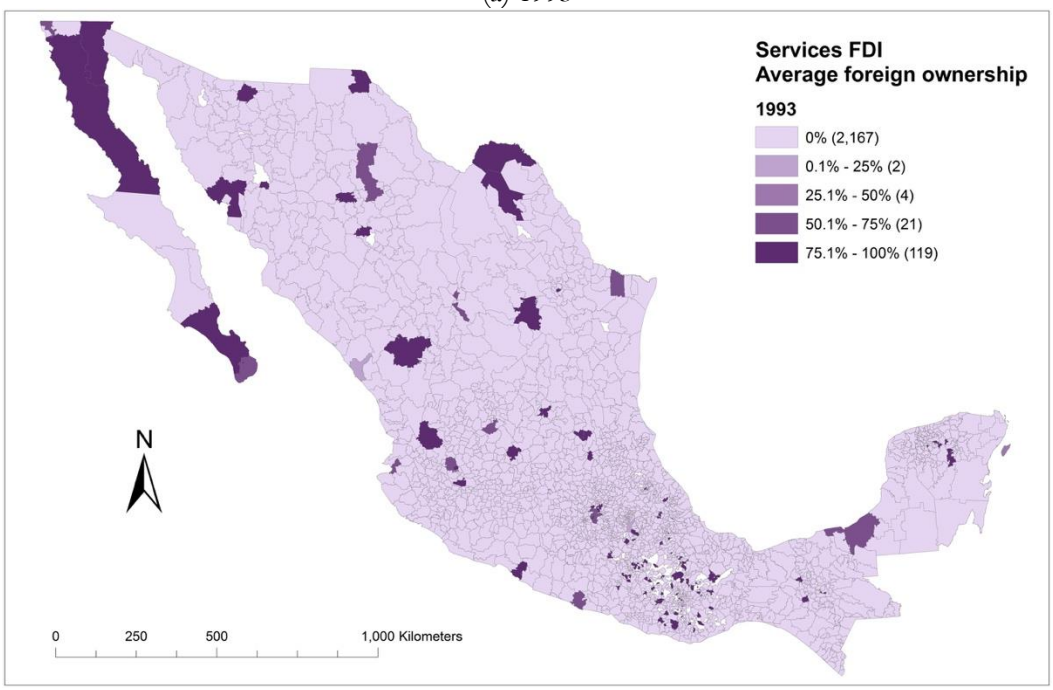
(b) 2013



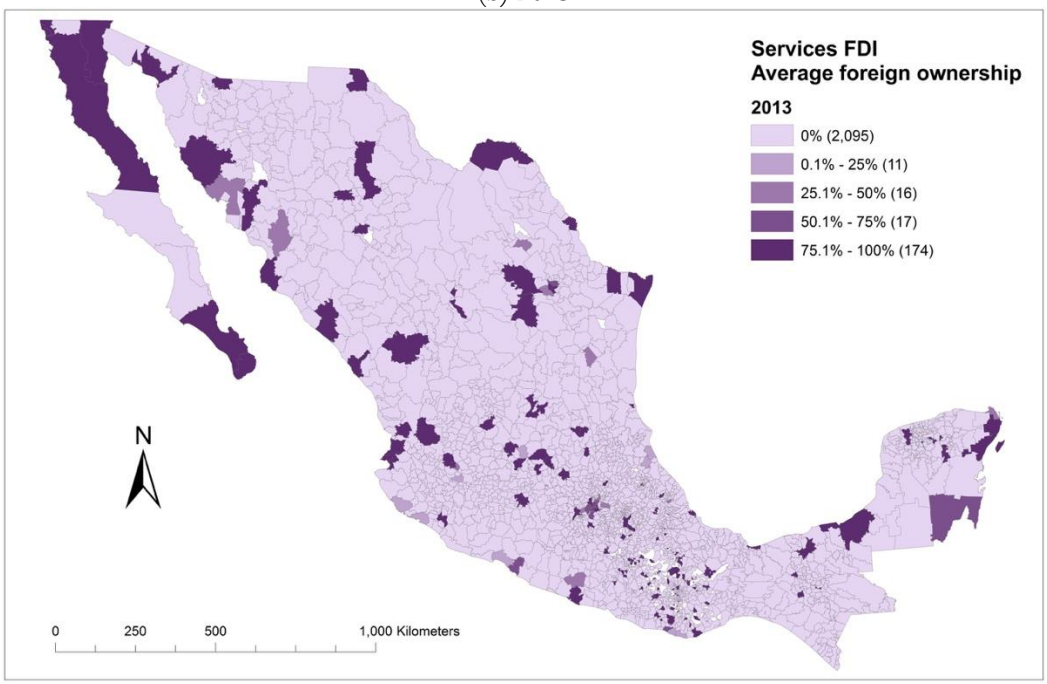
Source: Own elaboration with data from Economic Census, *Censos Economicos* (INEGI, 1994, 2014)

Figure A8 – Services FDI: Average foreign ownership by municipality, 1993-2013.

(a) 1993



(b) 2013



Source: Own elaboration with data from Economic Census, *Censos Economicos* (INEGI, 1994, 2014)

Table A5 – Summary statistics by specification: IFDI and education

Model 1 and 2. First differences: Cohort-municipality 16-year-olds' enrolment rates

	Manufacturing				Services			
	(1) mean	(2) sd	(3) min	(4) max	(5) mean	(6) sd	(7) min	(8) max
Dependent variable								
Enrollment rate 16 y-o	0.533	0.169	0.000	1.000	0.533	0.166	0.030	1.000
Main regressors								
Foreign unskilled jobs	0.0054	0.0391	0.0000	0.9338	0.0005	0.0059	0.0000	0.1578
Foreign skilled jobs	0.0012	0.0097	0.0000	0.2851	0.0002	0.0035	0.0000	0.1378
Unskilled foreign wage premium	0.0386	0.2008	-2.4448	2.3621	0.0178	0.2076	-2.5295	2.3805
Skilled foreign wage premium	0.0241	0.1487	-1.3032	1.5725	0.0273	0.2069	-0.8858	2.6158
Controls								
Female	0.498	0.074	0.150	0.863	0.498	0.071	0.198	0.837
Employed	0.282	0.123	0.000	0.946	0.279	0.120	0.000	0.770
Parents' average education	5.331	2.018	0.231	14.333	5.413	1.989	0.231	14.333
Both parents work	0.173	0.122	0.000	1.000	0.165	0.114	0.000	0.794
Household size	5.935	0.778	3.708	9.269	5.919	0.777	3.708	8.911
Household income	9.761	1.638	4.544	13.498	9.851	1.597	5.580	13.472
	N = 3,312				N = 3,339			

Continues next page

Table A5 – Summary statistics *(continued)*

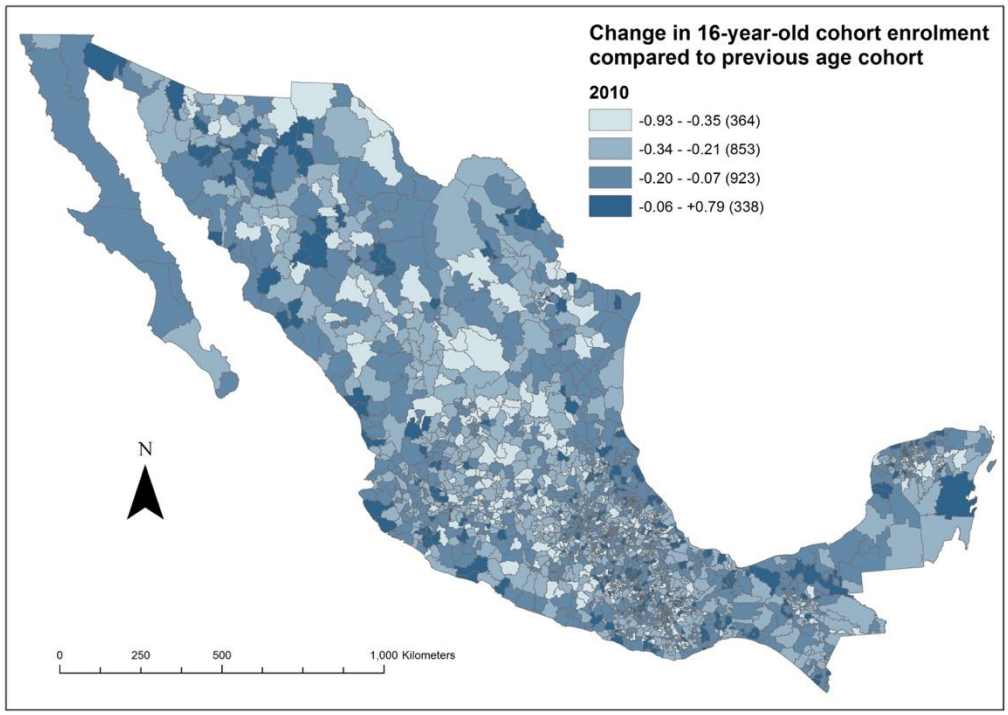
Model 2. Logit: Individual school attendance

	Manufacturing				Services			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Manufacturing	mean	sd	min	max	mean	sd	min	max
Dependent variable								
Enrollment rate 16 y-o	0.5591	0.4965	0.0000	1.0000	0.5570	0.4967	0.0000	1.0000
Main regressors								
Changes in Unskilled foreign wage premium	0.0510	0.3449	-3.3954	2.3621	0.0919	0.4093	-1.6836	2.8603
Changes in Skilled foreign wage premium	0.0281	0.2484	-1.5919	1.8921	-0.0006	0.4014	-3.1398	3.9490
	N = 402,273				N = 407,678			

Model 3. OLS with Fixed effects: Average years of education.

	Manufacturing				Services			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Manufacturing	mean	sd	min	max	mean	sd	min	max
Dependent variable								
Average years of education	9.1382	1.6938	0.0000	17.000	9.1794	1.6660	0.9765	17.000
Main regressors								
Changes in Unskilled foreign wage premium	0.0025	0.0969	-1.0379	1.0777	0.0049	0.2558	-2.0858	9.6346
Changes in Skilled foreign wage premium	0.0033	0.1160	-1.2620	1.2282	0.0007	0.0972	-1.2650	1.3928
	N = 45,537				N = 43,660			

Figure A9 – Change in 16-years-old's cohort compared with previous age cohort, 2010.



Source: Author's own elaboration with Population Census data (INEGI, 2000, 2010)

Table A6 – Reverse causality: Average years of education on Foreign jobs

Dependent variable: Δ Foreign jobs	(1)	(2)	(3)
Δ Av. Years of education	0.218	0.142	0.132*
	(0.146)	(0.088)	(0.076)
Δ (Av. Years of education)^2		0.049	0.047
		(0.053)	(0.052)
Observations	4,837	4,837	4,837
R-squared	0.001	0.001	0.001
Year FE	no	no	yes

Note: The model fitted is in first differences, changes in the independent regressor is measured 3 years before changes in the dependent variable.
Municipality clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

3. Chapter III: Outward FDI from Mexican Regions: Structural and policy determinants[41]

3.1. Introduction

In the context of intensifying globalisation and interdependence of the world's economies, international integration and participation in global production networks (GPNs) and value chains (GVCs) have become key strategies for survival and long-term economic growth. 'Going multinational' impacts not only the firm itself but also the economy of origin as a whole. Within the academic literature, there is a long-standing belief that outward foreign direct investment (OFDI) may enhance the competitiveness of the home economy (Barba Navaretti & Venables, 2004; Blonigen, 2005; Buckley et al., 2007; Cantwell & Barnard, 2008; Dunning, 1994; Kokko, 2006). Within policy environments, understanding the factors that influence active internationalisation of domestic firms through OFDI is becoming imperative for industrial and territorial policies under globalisation pressures (e.g. Bailey & Driffield, 2007; Iammarino, 2018). The geography of world investors has widened hugely in the past two decades and emerging economies' enterprises have played an increasing role (e.g. Padilla-Pérez & Gomes Nogueira, 2016; UNCTAD, 2015, 2017). The literature has extensively analysed the determinants of OFDI predominantly at the country or firm level; analyses at the sub-national level are still scarce in relation to advanced economies (e.g. Bannò et al., 2014, 2015), and even more so with respect to the region-specific determinants behind active internationalisation in the context of emerging countries.

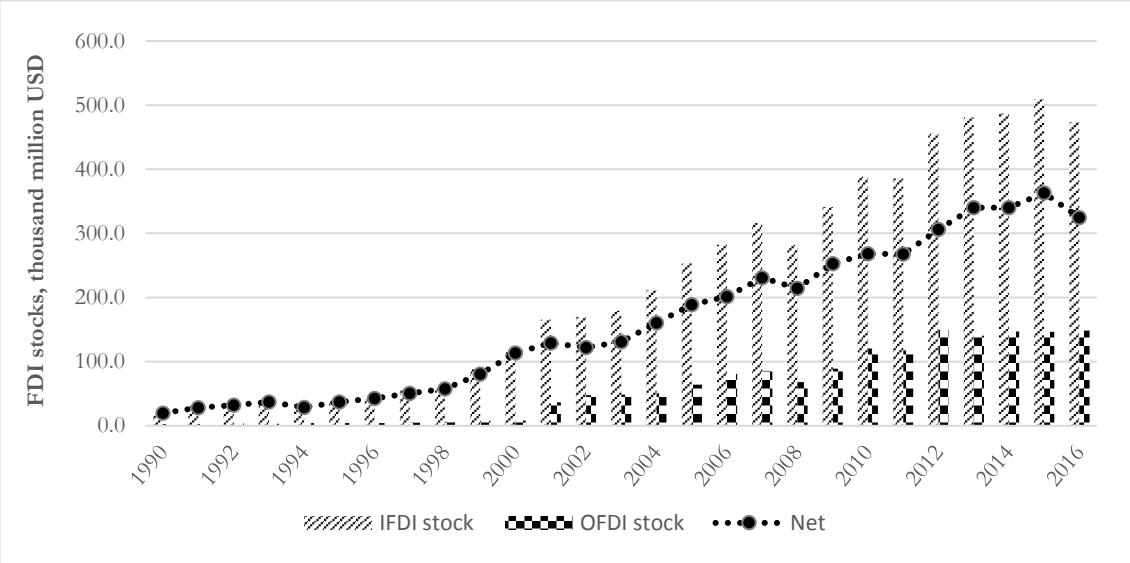
This paper investigates the factors influencing the internationalisation of Mexican subnational regions through OFDI, considering both regional structural determinants and public financial incentives aimed at supporting domestic firms' activities abroad. The empirical analysis is conducted by examining data on the internationalisation of 32 Mexican regions[42] observed over the period 2006-2017. Mexico provides an interesting setting to conduct this research because of its high degree of internationalisation, also relative to other emerging economies in Latin America, and its rather decentralised structure at this subnational administrative level

[41] In coauthor-ship with Simona Iammarino and Lucia Piscitello.

[42] We refer to the second administrative level after the federal government; there are 32 *Estados* including Ciudad de Mexico.

(Rodríguez-Pose & Gill, 2004, 2005). The last two decades have witnessed significant changes in the patterns of Mexican FDI. The trends 1990-2016 are plotted in Figure 14, showing both inward and outward FDI stocks.[43] The inward FDI stock reached 475 billion US dollars (USD) by 2016: Mexico is still a net recipient of inward FDI, ranking 13th worldwide and 2nd in Latin America (UNCTAD, 2017). Outward FDI stocks, on the other hand, have been rising steadily since the early 2000s. In 2016, Mexico was the 2nd largest outward investor in Latin America with an OFDI stock hitting around 150 billion US dollars, after Brazil with 172 billion USD.[44]

Figure 14 – Aggregate Outward and Inward FDI Stocks in Mexico



Source: Authors' own elaboration with data from UNCTAD, 2018

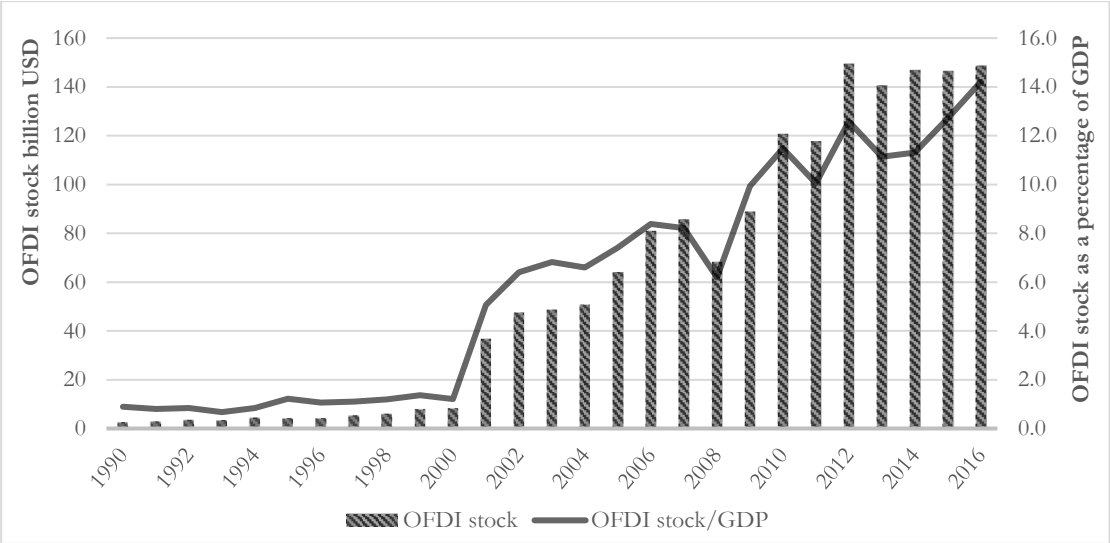
Not only has the investment abroad of Mexican firms risen substantially in the last two decades, but its importance relative to the country's GDP has also increased, as it can be observed in Figure 15. The share of OFDI increased sharply in 2001 and it has exhibited an upward trend ever since, reaching 14.2 percent of GDP in 2016[45]: during the years of the financial crisis it almost doubled in size.

[43] FDI stock is the value of the share of their capital and reserves (including retained profits) attributable to the parent enterprise, plus the net indebtedness of affiliates to the parent enterprise. FDI stocks are estimated by either cumulating FDI net flows over a period of time or adding flows to an FDI stock that has been obtained for a particular year from national official sources or the IMF data series on assets and liabilities of direct investment. They reflect the prices at the time of investment (UNCTAD, 2017).

[44] In the Latin American OFDI ranking 2016, Chile was 3rd (110 billion USD), followed by Argentina (39 billion USD) and Venezuela (27 billion USD). It is worth noting that the difference between the first and fourth positions is more than fourfold (*ibid*). See Figure A11 in the Appendix.

[45] The corresponding share for Brazil is 9.6 percent, and for Chile 44.6 percent (*ibid*).

Figure 15 – Aggregate Outward FDI Stocks, absolute and relative to GDP in Mexico



Source: Authors' own elaboration with data from UNCTAD, 2018

The objective of this research is to contribute to the literature in two ways: (i) exploring the regional variation in the propensity to engage in OFDI; (ii) providing insights on the structural and policy determinants behind the recent active internationalisation of Latin American economies at the regional level. To the best of our knowledge this is the first paper that examines this issue at a subnational scale. The remainder of this paper is organised as follows. Section 3.2 reviews the relevant literature and presents the research questions. Section 3.3 describes the data and provides descriptive evidence to understand the context. Section 3.4 illustrates the empirical strategy and models, while Section 3.5 presents the econometric results. Section 3.6 concludes by discussing the findings, providing some preliminary policy implications, and suggesting future research directions.

3.2. Literature background

3.2.1. OFDI from emerging economies

The theoretical and empirical literature on active internationalisation through investment abroad has mostly investigated the determinants at the firm level. The eclectic paradigm developed by Dunning (1981, 2001) draws together elements of previous international economics and business and management theories to identify ownership, location and internalization (OLI) advantages that are behind firm internationalisation. It has been argued that the rapidly growing OFDI from emerging economies' Multinational Enterprises (EMNEs) can still be explained on

the basis of the typical firm ownership advantages, insofar as they are seen as a function of the location advantages of their home economy (Narula & Nguyen, 2011; Purkayastha, 2015).

Other scholars have been more critical on the grounds that this international business perspective derives primarily from research on large MNEs from advanced countries, presuming that firms only internationalise on the basis of competitive advantages that allow them to cover the costs of operating in a foreign environment (Child & Rodrigues, 2005; Luo & Tung, 2007; Mathews, 2006). The possibility that firms from emerging or developing economies could become multinationals to seek for assets in order to address *relative disadvantages* has only been addressed until recently by a slowly-growing body of literature, albeit mainly focused on the BRICS (Child & Rodrigues, 2005; Mathews, 2002a; Ramamurti, 2012; Wesson, 1999). Firms from emerging economies can overcome "resource position barriers" (Wernerfelt, 1984) – at both firm and country level – by integrating into the international division of labour: the combination of the global slicing up and modularity of production stages in current GVCs and GPNs with the relative disadvantages in the home innovation system is behind the sourcing of strategic intangible assets from abroad through OFDI (Amighini et al., 2010; Luo & Tung, 2007).

EMNEs seek to overcome their competitive disadvantages at home by targeting resources in the host countries that are least rare, most transferable, and most imitable, attempting to tap into more advanced technologies, and displaying catching-up as their primary goal (Amighini et al., 2010; de Alcântara et al., 2016; Mathews, 2002a). Evidence on EMNEs entering EU regions confirms that these firms pursue knowledge-seeking OFDI into advanced countries and are particularly responsive to agglomeration economies and knowledge externalities, with their location choices being positively affected by population density and R&D intensity of host regions (Jindra et al., 2016). The investments in other countries to address the competitive disadvantage are usually made in the form of acquisitions of companies in advanced countries with more sophisticated technologies (Chittoor et al., 2008; Filippov, 2010; Madhok & Keyhani, 2012). The challenges and need for sophisticated advantages for establishing FDI are reflected in longer times before establish presence abroad as exemplified by some Latin American MNEs (Cuervo-Cazurra, 2008)

The relatively low purchasing power within the home market and institutional weaknesses in the local business environment contribute further to push firms to seek growth opportunities abroad (Holtbrügge & Kreppel, 2012; Hoskisson et al., 2013; Witt & Lewin, 2007). The habit of operating in weak institutional settings can even turn into an advantage when EMNEs

establish subsidiaries in other emerging or developing economies (Cuervo-Cazurra & Genc, 2008). Research on the Asian NICs and on the early internationalisation of Chinese firms has shown that, in order to compete in high value-added markets with direct presence, beyond cost advantages due to low wages at home (Guthrie, 2005), Chinese MNEs have pursued further differentiation and branding (Zhang, 2003) and different internationalisation strategies (Child & Rodrigues, 2005).

On the other hand, internationalisation through OFDI from emerging economies also reflects – far more often than in the case of technologically leading MNEs – the use of industrial policies by their governments to strengthen and upgrade their national institutional settings (Buckley et al., 2007; Rasiah et al., 2010; C. Wang et al., 2012). The most salient recent case is again China, whose OFDI has grown at an accelerating rate since 2000 as a result of the adoption of a strong government policy to encourage domestic enterprises to become global and to connect inward and outward internationalisation (Buckley et al., 2007; K. Davies, 2010; Sauvant & Chen, 2014). The case of India, where public policy regarding OFDI went from merely permissive to actively encouraging, shows how state policy can play an important role boosting the internationalisation of domestic firms (Gill & Singh, 2012). As far as other areas of the world are concerned, Argentina, Brazil, Chile and Mexico are among the countries in Latin America that have explicit policy mechanisms for actively supporting the internationalisation of their domestic enterprises (Alcaraz & Zamilpa, 2017; Finchelstein, 2017; Fleury & Fleury, 2011). In particular, the public trust fund of the Mexican Federal government (ProMexico) for the internationalisation of domestic firms was created in 2007. Before 2013 the efforts of the agency were largely aimed at investment attraction and exports; in that year, with the creation of an ad hoc department, more explicit efforts were aimed at supporting the active internationalisation of Mexican firms through a wide range of both financial and non-financial incentives.

The rise of EMNEs as players in the geography of global investment, and the accelerating pace of their participation in GVCs and GPNs after the start of the economic and financial crisis in 2008, have urged a deeper understanding of their internationalisation behaviours and the influence of the home economy (see Cuervo-Cazurra, 2008, 2011). Scholars have highlighted the heterogeneity of responses in internationalisation strategies by EMNEs to their home country conditions, indicating as crucial other firm-level variables such as industry of operation, internationalisation stage, innovation propensity, as well as system variables such as links between inward and outward FDI, and between home and host economies (Cuervo-Cazurra et al., 2018; Ramamurti, 2012; Rugman et al., 2012). In the following, we focus on regional determinants of OFDI that, instead, have been largely neglected.

3.2.2. The regional determinants of OFDI

The influence of the home subnational region may determine heterogeneous responses of firms to the imperative of internationalisation. Indeed, all the factors that the literature has traditionally associated to the home country influence on firms' investment strategies (e.g. Gammeltoft et al., 2010) —such as the technology gap, innovation propensity, institutional and business environment, internal demand, openness, links between inward and outward FDI, policy incentives— may also be particularly significant at the regional level too (e.g. Bannò et al., 2015; Iammarino, 2018; Iammarino & McCann, 2013; Masciarelli et al., 2010). Indeed, firms are normally embedded in local political, economic, and social contexts that, eventually, shape their actions (Hitt et al., 2000). Namely, it has been recently shown that the influence of the 'cluster-of-origin' is far more important than that of the 'country-of-origin' in explaining firms' investment location choices (e.g. Li & Bathelt, 2018; Turkina & Van Assche, 2018), and that localised regional and cluster networks affect the shape of global urban networks (Bathelt & Li, 2014). Despite the recognition that integrating firms' organisational issues with the characteristics of the subnational regions is crucial for the understanding of MNEs and their spatial environment (Beugelsdijk et al., 2010), the literature on the geography of internationalisation at the regional sub-national level has mainly dealt with international trade (e.g. Becchetti et al., 2007; Guerrieri & Iammarino, 2007; Shin et al., 2006), or with inward FDI (e.g. Driffield, 2006; Menghinello et al., 2010).

In the economic geography literature, the determinants of regional competitiveness (Rodríguez-Pose, 1998; Scott & Storper, 2003) have been primarily connected to "two intangible sources of territorial competitiveness, i.e. the knowledge and competence base of regions, and their institutional settings" (Boschma, 2004). Regional competitive advantages rely upon the cumulative, localized, and interactive nature of knowledge creation and collective learning (Camagni, 1995; Capello, 1999). Specifically, in advanced countries, a circular relationship has been envisaged between innovation and internationalisation strategies of firms (e.g. Cantwell, 1989). Innovation gives rise to proprietary advantages which enable firms to grow abroad and establish themselves on the relevant markets, capitalising the exclusive rents that derive therefrom (e.g. Cooke & Morgan, 1998). The innovativeness of firms is crucially determined by the endowment of scientific and technological infrastructures, and of the qualified localised capabilities that foster collective learning processes, which are highly localized and region-specific (e.g. Mariotti & Piscitello, 2001; Maskell & Malmberg, 1999)

Relatedly, the link between productivity and internationalisation through OFDI has been considered to be positive at the firm level: since FDI involves substantial fixed costs, only the most productive firms will become MNEs (Helpman et al., 2004). Whilst empirical studies at the firm level show a strong positive association between productivity and the internationalisation of firms originating from both advanced and emerging economies (Castellani & Zanfei, 2007; Damijan et al., 2007; Greenaway & Kneller, 2007; Kimura & Kiyota, 2004), the evidence for countries is rather mixed (Arbix, 2010; Goldstein & Pusterla, 2010), and the regional dimension of productivity externalities as a determinant to OFDI is largely absent in the literature.

Economic linkages and exposure of regions to international markets occur through the presence of trade and inward FDI (Boschma & Iammarino, 2009; Crescenzi & Iammarino, 2017). The international experience that is accumulated in a region over time through exports and imports or previous inward investments, provides opportunities to acquire tacit and valuable knowledge regarding international business practices and information on foreign markets, increasing the propensity of the region's firms to make riskier decisions —e.g. through localised imitation and competition effects, or access to pre-established distribution networks (see for an account of these effects, Driffield, 2006; Görg & Greenaway, 2004). From a complementary perspective, openness to export and inward investment is critical to the processes of technological absorption and diffusion, not only because of the competitive pressure that it exerts at the regional level but also because of the exposure to global best practices that such openness provides to local firms (e.g. Frost, 2001). Foreign MNEs established in a region may encourage domestic firms to expand their activities abroad, leading to an overall increase in the level of outward internationalisation of such a region (e.g. Mariotti et al., 2008).

The economic geography literature on agglomeration economies has dealt at length with the question of whether a specific industrial structure enhances knowledge diffusion, innovation and ultimately regional competitive advantages (e.g. Delgado et al., 2010; Porter, 1990). The question at the core is whether firms learn more from local firms in the same industry – i.e. regional specialisation – or from local firms in other industries – i.e. regional diversification. The extent to which a particular industry structure influences innovative activities, also depends on the spatial characteristics of the geographical area, i.e. whether it is an urban area, a local district or a non-urban area (Capello, 2002). However, despite its emphasis on the relevance of knowledge, much of the vast literature on agglomeration economies and spillover mechanisms has been largely unconcerned with OFDI, overlooking the fact that the dynamics of local specialisation – and thus change in comparative advantages – may stem also from the

establishment of such outward extra-local linkages (e.g. Cook et al., 2012; De Propris et al., 2008; Enright, 2016). An evolutionary interpretation of these issues indicates that there is no univocal relationship between regional industrial structure and economic growth or internationalisation, and that the links between diversification and innovation at the spatial level are far more complex than what assumed by a mechanistic view of the type 'structure-conduct-performance' (Frenken et al., 2007; Iammarino, 2011).

In a similar vein, regional global connectivity has also been shown to play also a critical role in the creation of information externalities by allowing for tremendous movements of capital, labour, and other tangible and intangible resources (McCann & Acs, 2011). International infrastructure positively contributes to determining the international connectivity of a region and can therefore stimulate OFDI.

The internationalisation of firms within a region is likely to be affected by public programmes. Indeed, by recognising the importance of internationally active firms and the barriers to becoming internationally active (e.g. European Comission, 2008), governments have generally supported internationalisation both at national, regional and local level. However, while the promotion of exports has long been a prominent element of government policies, government support to promote deeper forms of internationalisation, such as OFDI, is a more recent phenomenon, still very little investigated when it comes to regional and territorial policies (Bailey & Driffield, 2007; Bannò et al., 2015; Iammarino, 2018). Governments use both financial incentives and non-financial measures to promote OFDI (e.g., information provision and assistance to promote or otherwise influence OFDI, see Sarmah, 2003). The process of internationalisation demands substantial capabilities and resources, which are likely to substantially differ across subnational regions. The acquisition of sufficient financing serves as a cushion against unforeseen setbacks and enables firms to explore and better exploit a broad range of international activities (De Maeseneire & Claeys, 2012)[46].

[46] It is worth acknowledging that the literature indicates that public financial support may also lead to allocative inefficiencies by encouraging a non-optimal mix of factors; or that resources might be transferred to less productive firms or to firms with no financial constraints, and that subsidised firms may also utilise some of the investment opportunities that unsubsidised firms would have exploited in the absence of incentives (Bronzini & de Blasio, 2006). Additionally, government funding may also create a crowding effect on the potentially profitable businesses of private financiers and may thus distort the investment incentives of the private sector (Mosselman et al., 2004).

3.3. OFDI from Mexican Regions: Data and Features

3.3.1. OFDI Data

At present, there are no publicly available government figures on regional or sectoral OFDI in Mexico. However, ORBIS database from *Bureau Van Dijk* provides information about the Mexican subnational region in which Mexican parent firms with subsidiaries abroad are located (ORBIS, 2018).[47] We use the 32-region geographical disaggregation because lower territorial administrative levels have too many missing values. Nonetheless, even at the chosen level of aggregation there are considerable differences across space, providing sufficient variation to analyse home-region OFDI determinants.

The ORBIS historical files contain year-to-year information of the ownership links between a shareholder (parent company)[48] and a subject company (affiliate)[49]. Each link represents one of different types of relationships depending on the position of the Mexican-owned parent relative to its affiliate abroad. For the present analysis we only consider two types of relationship that will allow us to construct our OFDI measures: Global Ultimate Owner and Headquarters, and they both fulfil the following criteria:

i. the parent firm is *located* in the Mexican territory;
ii. the parent firm has at least one *affiliate abroad*;
iii. the parent firm is *independent*, i.e., has no ultimate owner;
iv. the parent firm has *direct* participation in the affiliate abroad.

In other words, to construct our measures of OFDI we only consider companies based in Mexico that are solely owned by Mexican investors and that play a direct role as shareholders with the highest percentage of ownership of the affiliates located outside the Mexican territory.[50]

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[47] The universe of Mexico-based firms that ORBIS considers for the Historical Ownership data base is slightly above two million, this number includes all firms based in the Mexican territory regardless of their ownership status, i.e., domestic or foreign.

[48] *Parent companies* are enterprises that control assets of other entities in at least one country other than its home country, usually by owning an equity stake of 10% or more of the shares or voting power. ORBIS refers to any parent company as "the shareholder" of a subject company or "the subsidiary". For consistency (see footnote below) we will use the terms *parent* and *affiliate* companies or firms.

[49] A *foreign affiliate* is an incorporated or unincorporated enterprise in the host country in which another entity directly owns between 10 and more than a half of the shareholder's voting power. According to UNCTAD (2006), *foreign affiliates* include subsidiaries, associates and branches. A *subsidiary* is an incorporated firm in the host country in which another entity directly owns more than 50% of the shareholders' voting power; for an *associate*, the investor owns a total of at least 10 percent, but not more than half, of the shareholders' voting power; a *branch* is a wholly or partly owned unincorporated enterprise in the host country. Since we consider all three types of affiliates abroad, we will use the terms *affiliates abroad* throughout the paper.

[50] For definitions and criteria used to consider ownership links in ORBIS see "Bureau van Dijk historical ownership databases - User Guide - 2017 Q2**"**

When applying these criteria, and excluding those observations for which there are missing data, either for the Mexican region or the sector of origin, we end up with a regionalised subsample of 2,297 unique Mexican-owned parent firms with affiliates abroad during the observed period.[51] The data is collapsed by region-sector-year. In the same way, we are able to retrieve the number of Mexican-owned affiliates abroad by region-sector-year, which totals to 19,036 unique affiliates over the sample period. These will constitute the basis of our measures of OFDI at the 32-region level, further disaggregated in 8 macro-sectors, for the years 2007-2017.

3.3.2. OFDI from Mexican regions

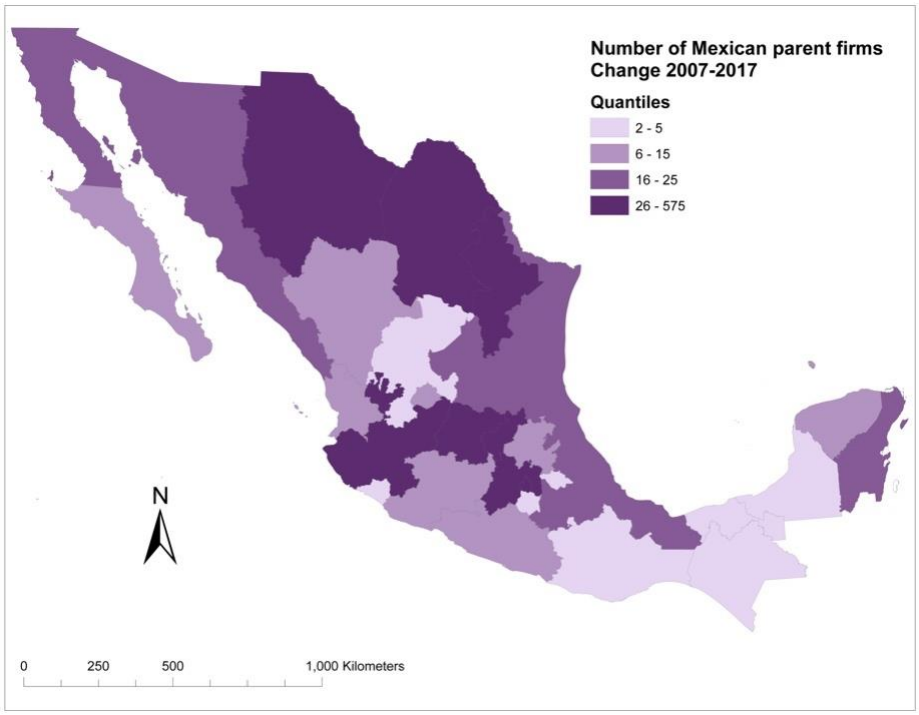
The growth of aggregate regional OFDI — measured by the variation in the number of both parents and affiliates abroad — is depicted in the maps in Figure 16. Map (a) shows the change in the number of Mexican MNEs across regions[52] during the observed period. The highest increase of internationalised firms (darkest shade) is recorded in three Northern-border regions (Nuevo Leon, Coahuila and Chihuahua), three regions in the *Bajio*[53] region (Jalisco, Guanajuato and Queretaro), and two Central regions (Ciudad de Mexico and Estado de Mexico). Map (b) shows the change in the number of Mexican-owned affiliates abroad. Not surprisingly, the same regions with the largest increase in parent companies have the highest growth in the number of affiliates abroad, with the exception of Queretaro, which is replaced by Veracruz on the East-coast.

[51] The Historical Ownership ORBIS files contain a total of 3,425 parent firms based in Mexico with affiliates abroad during the 2007-2017 period. However, it does not provide the subnational location of firms within a country. We used unique IDs to find the parent companies' region of origin in the ORBIS online records. 566 of these parent companies had the region of origin missing. For these cases, the company name was manually geo-located and assigned to its region using additional tools in a stepwise procedure: (i) the company name provided in ORBIS was looked up on INEGI's *National Directory of Economic Units* (DNUE); if the firm's address was not found, (ii) the name was entered in Bloomberg; if this step failed, (iii) the company was searched on Google, the first five entries were considered, typically firm directories; if these three steps failed, the company record was dropped from the final sample. 135 firms where not found all together. Further, a total of 922 firms, although geo-located within Mexico, had missing values for the sector, and hence they were also dropped. Finally, we were left with 2,297 parent companies, which represent 67 percent of the total in the raw Historical Ownership files.

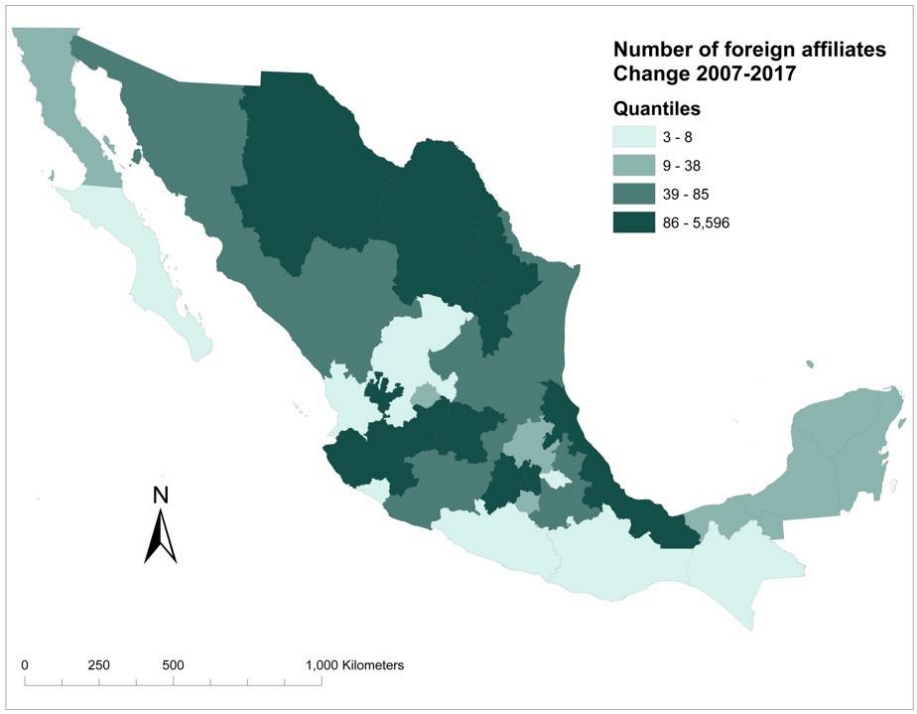
[52] A labelled map can be found in Figure A10 in the Appendix.

[53] *Bajio* translates into Lowlands. It is a region located in the West North-Central Mexico.

Figure 16 – OFDI in Mexican regions: Parent firms and affiliates abroad



(a) Mexican parent firms

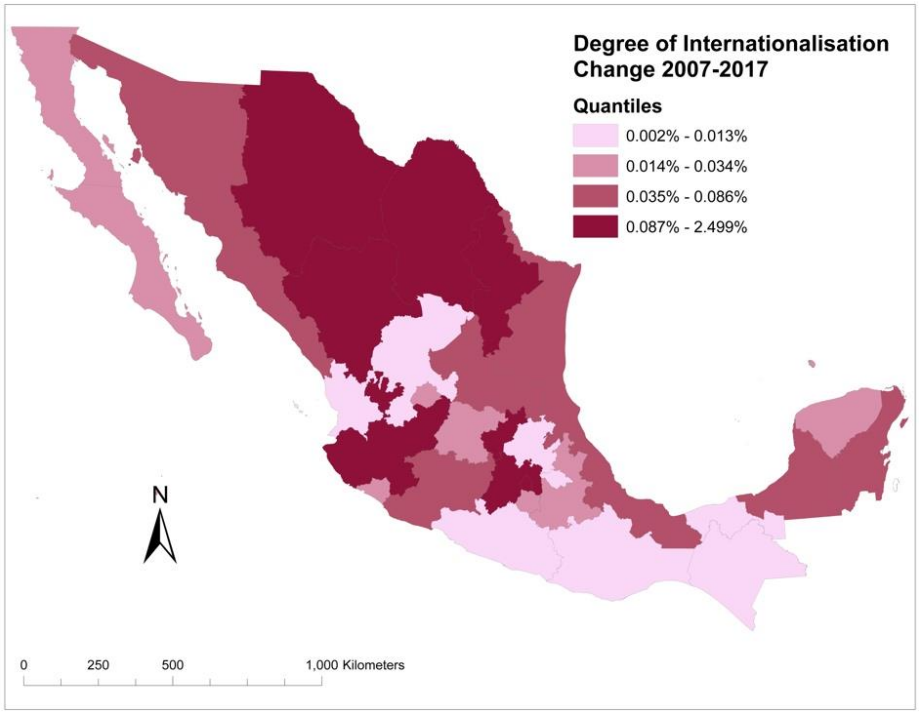


(b)Mexican-owned affiliates abroad

Source: Authors' own elaboration on data from ORBIS, Bureau Van *Dijk*

When we consider the number of affiliates abroad relative to the total number of firms in the region, the geographical distribution of the normalised measure does not vary substantially (see Map in Figure 17), with the exceptions of Guanajuato and Veracruz, which are replaced in the top quintile by Campeche and Queretaro.

Figure 17 – OFDI in Mexican regions: Degree of internationalisation



Note: the variable is percentage of affiliates abroad on total firms by region.
Source: Authors' own elaboration on data from ORBIS, Bureau Van *Dijk*

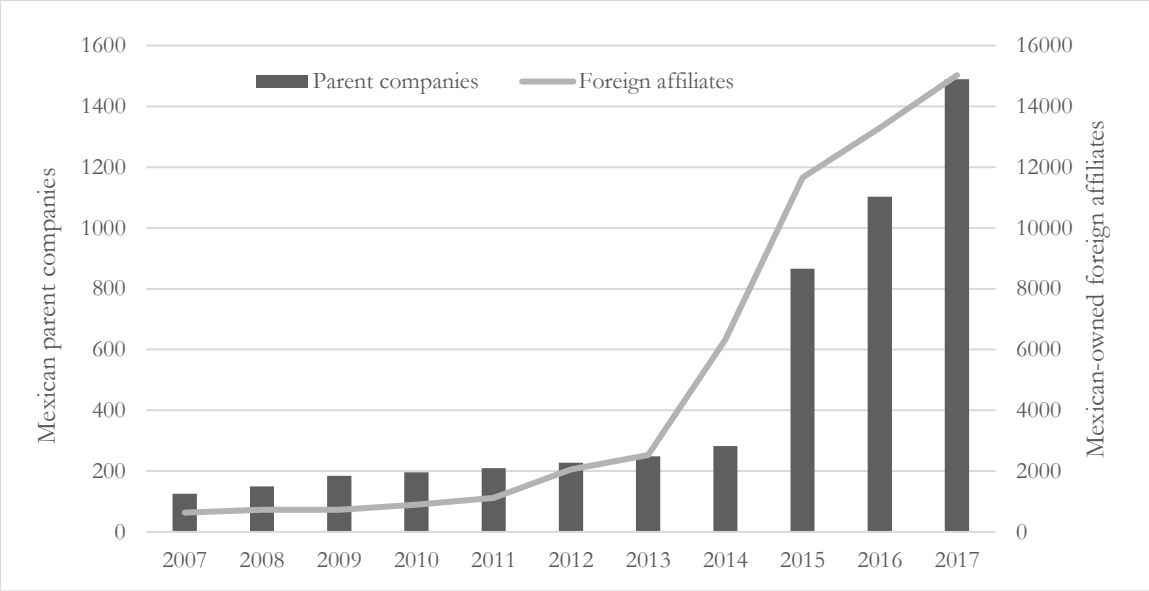
Whilst being generally the most outward-oriented regions, these regions differ enormously in their economic development paths, and consequently their internationalisation patterns are highly diverse. In order to provide some context, we distinguish between three region-groups in terms of their broad economic development features. First, the Northern-border regions, largely industrialised regions that surged as a result of the export promotion policies in the early 1970s, and further grew boosted by the *maquiladora* programme during the 1980s. Under this programme, the territories along the Northern border were constituted as an export platforms for the manufactured goods assembled in the country with raw material and components imported duty-free in plants largely owned by foreign capital (Lopez Villafañe, 2004). Although Nuevo Leon, Chihuahua and Coahuila stand out, all the Northern-border regions are in the highest quantiles of the distribution. Second, we have Ciudad de Mexico and the neighbouring Estado de Mexico. Before the beginning of the export promotion period (1940-1960), most economic activity was concentrated in and around Ciudad de Mexico, since firms were

predominantly locating close to the largest final demand. While Ciudad de Mexico has undergone deep deindustrialisation for a couple of decades, Estado de Mexico remains an important industrial player. Nonetheless, the highest concentration of the service sector — in particular, financial, business and professional services — is by far concentrated in Ciudad de Mexico. Third, the *Bajio* regions present yet another distinctive story. Their industrial development started in the 1990s, in the wake of the North American Free Trade Agreement (NAFTA). Jalisco along with Queretaro, Guanajuato and, to a lesser extent, Veracruz, benefited from the decentralisation of economic activity and successfully attracted foreign manufacturing investments during a time in which proximity to the final demand – the US or Ciudad de Mexico – turned out to be less important. It is worth mentioning that the nationality of foreign investors in this area has been predominantly Asian or European, as opposed to the traditional FDI from the USA.

3.3.3. Temporal variation of OFDI

As discussed above, the last decade has seen a notable increase in Mexican OFDI at the country level. Figure 18 shows the number of both parent firms and their affiliates abroad by year. In line with the OFDI national data from UNCTAD – which however includes also OFDI by foreign-owned companies based in Mexico – the number of Mexican parent companies (left axis) rises persistently across the board, with a national net increase of 1,363 internationalised parent firms over the period 2007-2017. This increasing trend is mirrored by the number of affiliates (right axis), with a net increase of 14,998 firms in the same period. Two sharp jumps in the data can be detected between 2014 and 2015 for parent firms, and between 2013 and 2014 for affiliates abroad. These could be, according to ORBIS, due to changes in the information providers used to construct the database. Although potentially problematic for our estimations, reassuringly, the data follows the same increasing trend after these jumps: we are able to control for this by including year fixed effects in our econometric estimations.

Figure 18 – Mexican-owned parent firms and affiliates abroad by year, 2007-2017



Source: Authors' own elaboration on data from ORBIS, Bureau Van *Dijk*

Beyond the national trends, ordering regions with respect to their relative contribution to total new parent firms between 2007 and 2017 allows us to detect the noticeable concentration of OFDI across Mexican regions (Table A7 in the Appendix).[54] Ciudad de Mexico alone hosts slightly over 45 percent of these parent firms. The next two top regions are Nuevo Leon and Estado de Mexico — with 11 and 8 percent respectively; together with Jalisco (6 percent), they account for the next 26 percent of total Mexican MNEs. Queretaro and Guanajuato follow with very similar shares averaging 2.5 percent; Chihuahua and Veracruz are close to 2 percent in individual shares. The following ten regions, with a share of at least (or close to) 1 percent, represent 13 percent of the total number of parent companies; the remaining 5 percent is distributed among 14 regions. The bulk of Mexican parent firms are located in the most industrialised and economically developed regions of the country. However, it appears that the distribution is spreading across regions over the observed period: we can identify new players — such as Guanajuato, Queretaro and Veracruz — that not only have become more competitive during the last decade but are also now hosting domestically-owned MNEs. The distribution of OFDI in terms of number of affiliates abroad exhibits an even more concentrated pattern (Table A8 in the Appendix). Ciudad de Mexico accounts for 41 percent of

[54] The number of observations with missing fields in the ORBIS database might lead to under/over-representation of some regions-sectors. It is common knowledge that many firms might be headquartered in Ciudad de Mexico with production facilities in other regions. However, we only selected headquartered and independent firms based in each region. Furthermore, in our analysis as explained below, we condition our estimations on time invariant characteristics and account for selection bias, thus mitigating the possibility of this occurrence driving our results.

total Mexican-owned affiliates abroad, whilst Nuevo Leon and Jalisco average each 22 percent. The next top regions are Estado de Mexico and Chihuahua, with 5 and 2 percent respectively. These five regions represent 92 percent of total affiliates abroad, with the remaining 8 percent distributed among 27 regions with individual shares under 1 percent.

3.3.4. OFDI by sector of origin

The sectoral distribution of Mexican parent companies and their affiliates is shown in Table 9. Manufacturing alone represents 37 percent of the total: within it, the five most important sectors are: (i) primary metal, non-metallic and their products; (ii) food, beverage and tobacco; (iii) chemical; (iv) transportation equipment; and (v) plastic and rubber. Specialised services account for 29 percent of Mexican MNEs, and the top sectors are: (i) finance and insurance; (ii) management of enterprises; (iii) information services; (iv) professional, scientific and technical services; and (v) real estate. The Wholesale and retail trade macro-sector constitutes 17 percent.

Table 9 –Mexican parent firms and affiliates abroad by macro-sector of origin, 2007-2017

	Parent firms		**Affiliates abroad**	
Macro-sector of origin	*Count*	*Share*	*Count*	*Share*
Manufacturing	855	37.2	7,569	39.8
Specialised Services	674	29.3	8,847	46.5
Wholesale and Retail Trade	400	17.4	1,267	6.7
General Services	125	5.4	321	1.7
Construction	99	4.3	306	1.6
Transportation and Warehousing	77	3.4	369	1.9
Mining, Quarrying, and Oil and Gas Extraction	49	2.1	323	1.7
Agriculture, Forestry, Fishing and Hunting	18	0.8	34	0.2
TOTAL	2,297	100	19,036	100

Source: Authors' own elaboration on data from ORBIS, Bureau Van *Dijk*

Affiliates' figures are shown in the last two columns, and represent all affiliates abroad including those for which destination country and sector are not specified.[55] Both Specialised services and Manufacturing take the first two positions with 46.5 and 40 percent of total affiliates respectively. Wholesale and retail trade accounts for almost 7 percent; the remaining 7 percent is distributed among 5 macro-sectors.

[55] Since this paper focuses on the home-region determinants of OFDI, we do not report here the sector of destination of Mexican affiliates abroad.

3.3.5. OFDI geographical destination

The destination by world region of OFDI originated in Mexico provides an idea of the internationalisation strategy of Mexican MNEs (Table 10).[56] Slightly more than half of the affiliates abroad in our sample are established in North America, mostly in the United States (for individual country shares see Table A9 in the Appendix). Europe – with Spain as top recipient with 60 percent of the area total, followed by Germany, Austria and the United Kingdom – and Central Asia follow with almost 30 percent. Next is Latin America and the Caribbean with 19 percent of total affiliates: the main host countries are Brazil, with almost 65 percent, followed by Colombia and Argentina.

Table 10 –Mexican-owned affiliates abroad by world region of destination

World region	**Count**	**Share**
North America	5,282	50.8
Europe & Central Asia	3,017	29.0
Latin America & Caribbean	1,997	19.2
East Asia & Pacific	53	0.5
Middle East & North Africa	30	0.3
South Asia	9	0.1
Sub-Saharan Africa	2	0.0
Total	**10,390**	**100**

Source: Authors' own elaboration on data from ORBIS, Bureau Van *Dijk*

The geography of OFDI by world income groups (defined by the World Bank, 2017) consistently shows that 79.5 percent of the affiliates abroad are established in High-income countries; Upper middle income economies account for about 20 percent; and the Lower middle income group hosts only 0.5 percent of affiliates.[57] For the purpose of analysis we collapse Upper middle and Lower Middle income countries into one category. Furthermore, we exclude Lower income destination countries, due to their negligible figures.

[56] The total of foreign affiliates does not correspond to that in Table 9 and it is lower due to missing values in the destination country.

[57] Using the geographical destination cross-section might potentially lead to biases in our results due to the increasing probability of missing values in the ORBIS dataset. We validate our data with an additional external source. We compare our ORBIS data with the regional distribution of Mexican OFDI stock across host countries in the International Trade Centre (ITC) Market Analysis Tool. Reassuringly, we confirm the regional distribution and the temporal trends.

3.4. Empirical strategy

3.4.1. Model specification

Our empirical strategy exploits the year-to-year variation of structural determinants at the region-sector level in order to explain the temporal variation of the outcome variable of OFDI, given by the number of affiliates abroad that remain, enter or exit the sample. The empirical model takes the following general functional form:

$$ofdi_{skt} = \beta_0 + \beta_1 det_{skt-1} + \gamma_{sk} + \gamma_t + \varepsilon_{skt} \qquad \text{Equation (1)}$$

for region s, sector k and year t. The dependent variable, $ofdi_{skt}$, takes different forms depending on the econometric model, always capturing a proxy of the OFDI from Mexican parent firms in region s, sector k in year t. The vector det_{skt-1} includes one-year lags for region-sector sk OFDI determinants: labour productivity, exports (goods and services), share of skilled labour, presence of foreign-owned MNEs and sector size. Furthermore, the vector also includes the following region-level variables: intramural R&D expenditure, industry structure, and financial incentives for internationalisation. The dummy γ_{sk} is a region-sector fixed effect that captures time-invariant characteristics for each sector in each region. Year fixed effects are picked up by γ_t; ε_{skt} is the error term.

Estimating Eq. (1) by means of a pooled OLS would pose several problems to the identification of the effect of the determinants on OFDI. We identify two main threats to the internal validity of our estimates. First, omitting region-sector characteristics correlated with the error term may lead to biased estimates of the OFDI determinants. For instance, access to public infrastructure such as roads, railways and ports are likely to be correlated with inward FDI or with our measure of OFDI. To partly address the potential omitted variable bias, we account for time-invariant factors by including a number of fixed effects in the estimation of probit and negative binomial regressions. Furthermore, firms in any region-sector face the decision to invest abroad or not. Hence, whether or not we observe the OFDI outcome depends on the firms' decision to internationalise: Firms undertaking active OFDI are arguably different from those that do not. We are thus left with a non-random sample to estimate our OFDI equation. However, the presence of selection can be treated as an omitted variable bias (Heckman, 1976). To address this incidental truncation problem, we first estimate a set of selection equations to capture the effects of the covariates on the probability of internationalisation, and in a second step the outcome equation that includes a selection term.

Second, reverse causality is likely to arise, in so far as OFDI has an effect on the structural determinants. For example, OFDI may influence labour productivity or the share of skilled workers of firms in a particular region-sector. We introduce the independent variables in one-year lags.[58] These lags serve a twofold purpose. Firstly, they partially mitigate the simultaneity issue since it is hardly likely that changes in current OFDI explain changes in the explanatory variables in the past. Secondly, they acknowledge the necessary time for investment decisions to be made. Moreover, since we are interested in assessing the effect of a number of structural determinants, we are not able to instrument for the endogeneity of any particular covariate.

The empirical analysis is divided into three parts, each providing evidence on the relationship under scrutiny for Mexican subnational regions.

Part 1. We first estimate the determinants of the likelihood of having at least one affiliate abroad, for each region-sector, by using a probit model specified as follows:

$$\mathcal{P}(int_{skt}) = \beta \mathcal{X}_{skt-1} + \gamma_{sk} + \epsilon_{skt} \qquad \text{Equation (2)}$$

where $\mathcal{P}(int_{skt})$, the outcome variable, is a dummy of internationalisation, equal to one if the region-sector has at least one Mexican firm with affiliates abroad and zero otherwise; $\mathcal{X}_{skt-1}$ includes one year lags of structural determinants and policy incentives. Additionally, we control for region-sector fixed effects, γ_{sk}. Unfortunately, the estimation of fixed effect in probit analysis introduces incidental parameters problem, so we need to make an additional assumption about the relationship between γ_{sk} and $\mathcal{X}_{sk}$. In this context, the fixed effects are modelled in a *correlated random effects* framework (Wooldridge, 2002, 2011). The unobserved heterogeneity is then a function of the average of the covariates for each region-sector across time; $\gamma_{sk} = \xi \overline{\mathcal{X}}_{sk} + \phi_{sk}$. The introduction of time averages allows us to estimate the model as a random effects probit. The intuition is very simple: we estimate changes in $\mathcal{X}_{sk}$ while holding the time average fixed.[59] The usual error term of the general equation is ϵ_{skt}.

Part 2. We then exploit the continuous nature of our dependent variable to evaluate the effect of the determinants on the extensive margin of OFDI (i.e., the count of affiliates abroad owned

[58] We chose one-year lags. Due to our data availability constraint we only have 12 years and using longer lags will considerably reduce our sample size. Furthermore, we cannot analyse the lag structure of the effects for all covariates since we are not focusing on one particular regressor. However, using different lags yield different estimated effects suggesting that there are no pre-rends that we should be concerned about.

[59] This model is also known as Chamberlain's random effects probit model. While the assumption is restrictive in the sense that it specifies a distribution for γ_{sk} given $\mathcal{X}_{sk}$, it at least allows for some dependence between them. Estimation is done through Maximum Likelihood and it is conditional on γ_{sk} and $\mathcal{X}_{sk}$ (Semykina & Wooldridge, 2010; Wooldridge, 2002, 2011). Finally, we omit year dummies since we include region-sector specific averages across time.

by Mexican parent firms). The main problem when modelling count data is the over-dispersion of the outcome variable, which is manifest when the conditional variance exceeds the conditional mean, and it may give rise to inconsistent estimates of the explanatory variables. One possibility is that this over-dispersion in our OFDI measure might be the cause of unobserved heterogeneity.[60] Therefore, we fit a negative binomial regression model on the specification below:

$$cint_{skt} = \beta \mathcal{X}_{skt-1} + \gamma_{sk} + \gamma_t + v_{skt} \qquad \text{Equation (3)}$$

where $cint_{skt}$ captures the count of Mexican-owned affiliates in region-sector sk and year t. One-year lags of the explanatory variables are included in the vector $\mathcal{X}_{st-1}$, for each region-sector sk. The time-invariant unobservables for each region-sector are absorbed by γ_{sk}, while the common yearly shocks are captured by γ_t. v_{skt} is the error term. Because this specification is modelling a count variable, region-sectors with all zero outcomes (not internationalised) across the study period are dropped from the estimation sample.

Part 3. We investigate the determinants of the intensive margin of OFDI that is the ratio of MNE affiliates abroad to the local sector size, i.e., the total number of firms in the region-sector. To do so, we fit an OLS regression with fixed effects, where the outcome variable measures the degree of internationalisation. Further, in order to correct for selection under unobserved heterogeneity, we use a model proposed by Wooldridge (1995) that extends Heckman's (1976) two-step selection model in the context of fixed effects. The main equation adopts the following functional form, for any cross-section sk:

$$doi_{skt} = \beta \mathcal{X}^{s}_{skt-1} + \gamma_{sk} + v_{skt} \qquad \forall \;\; t = 1, \dots, T \qquad \text{Equation (4)}$$

for each year $t = 1, \dots, T$. The outcome doi_{skt} is the ratio of affiliates abroad to total firms in region-sector sk in every year t. Note that not all cross-sections appear in every year, hence t can be viewed as a selection indicator for the year in which the cross-section is observed. The lagged vector $\mathcal{X}^{s}_{skt-1}$ is a given subset of the structural determinants.[61] γ_{sk} absorbs the differences in region-sector unobservable time-invariant characteristics, which are assumed to

[60] We choose to estimate a Negative Binomial as opposed to a Poisson, since the former allows for heterogeneity in the distribution parameter across groups.

[61] Let $\mathcal{X}_{skt-1}$ denote the full set of exogenous explanatory variables observed in every time period t, then $\mathcal{X}^{s}_{skt-1} \subset \mathcal{X}_{skt-1}$, the former is a subset of the latter. In other words, the vector of explanatory variables in the main equation has to contain at least one covariate less than those in the selection equation specified below. This restriction is required to satisfy the rank condition and allows for the identification of the parameters of interest (Wooldridge, 2002).

be correlated with the error term v_{skt}. Next, we introduce the selection equation by defining the latent variable s^*_{skt} which holds for every time period,

$$s^*_{skt} = \theta_t X_{skt-1} + u_{skt} \qquad \forall \ \ t = 1, \dots, T \qquad \text{Equation (5)}$$

where X_{skt-1} is the complete set of explanatory variables and u_{skt} is the error term. Note that the coefficient θ_t is allowed to vary for each $t = 1, \dots, T$. Lastly, we also define a selection indicator as follows,

$$s_{skt} = 1[s^*_{skt} > 0] \qquad \text{Equation (6)}$$

where $1[\cdot]$ is an indicator function. s_{skt} equals to one if doi_{skt} is observed and equals to zero otherwise. While equation (4) describes the degree of internationalisation of region-sectors, equations (5) and (6) together describe whether or not a region-sector has engaged in internationalisation. The distribution of the error terms (u_{skt}, v_{skt}) is assumed to be bivariate normal with correlation ρ. If $\rho \neq 0$, the two equations are related and estimating only doi would induce sample selection bias in the estimate of θ.

Getting consistent estimates of β requires a two-step procedure. First, we estimate the probability of engaging in OFDI by fitting a probit of s_{skt} conditional on the full set X_{skt-1} for each t on the entire sample of region-sectors, i.e. the balanced panel of observations. Let $\hat{\lambda}_{skt}$ be an estimated inverse Mills ratio. We calculate and save these ratios from the t probit regressions. In the second step, we estimate equation (4) by running a pooled OLS on the selected sample, only for observations for which $s_{skt} = 1$, including the subset of explanatory variables[62], plus the estimated Mills ratio $\hat{\lambda}_{skt}$ and its interaction with a set of year dummies $d_1\hat{\lambda}_{sk1}, \dots, d_T\hat{\lambda}_{skT}$.

3.4.2. Variable definition

Our dataset comprises 32 regions, 8 macro-sectors[63] and 12 years spanning from 2006 to 2017, yielding a sample size of 3,072 observations. Data were collected from various sources: The Mexican National Statistical Institute (INEGI), Bureau Van *Dijk* (ORBIS), and Mexican Ministry of Economics (ProMexico). For further detail on the variable definitions, units and sources see Table A11 in the Appendix.

[62] If $X^s_{skt-1} = X_{skt-1}$, the model is, in principle, identified, but identification relies exclusively on the model and the normality assumption concerning the two error terms.

[63] From the original 9 macro-sectors Utilities is dropped because firms in this sector are largely state-owned.

The outcome variable takes three different forms: (i) dichotomous variable of internationalisation, (ii) continuous count of affiliates abroad owned by Mexican parent firms, and (iii) relative degree of internationalisation. Most independent variables vary at the region-sector-year level, with a few exceptions that vary at the region-year level. We lose one year due to the introduction of lags on the explanatory variables, so the full sample comprises a balanced panel of 2,816 observations at the region-sector-year level; 26 percent of the observations are internationally active. Summary statistics for each model are given in Table A12 in the Appendix.

The main explanatory variables are shown in the maps reported in Figure A12 in the Appendix. The innovativeness of firms is captured by the endowment of scientific and technological infrastructures (yearly average of total intramural R&D expenditure), and of qualified human capital (percentage of skilled workers relative to total workers by sector). Labour productivity is given by the logarithmic transformation of gross value added (GVA) per worker. MNE presence is measured as the ratio of firms with foreign participation (totally or partially foreign-owned) to total firms. Exports of both goods and services are included as the log of total exports' values. The international connectivity of a region is proxied by the log transformation of the number of passenger flights per 100,000 inhabitants: of course, this measure does not distinguish between domestic and international passengers, but it is widely used in the literature. The extent of economic diversity/specialization at the region level is captured by the commonly used Herfindahl–Hirschman Index (HHI)[64], specified as follows:

$$HHI_s = \sum_{k=1}^{8} \left(\frac{y_{sk}}{y_s}\right)^2 \qquad \forall \;\; t = 1, \dots, T \qquad \text{Equation (7)}$$

where the HHI_s is defined as the sum of output shares y_{sk} across the $k = 1, \dots, 8$ macro-sectors. y_s is the total region's output. The lower bound is 1/8 whereas the upper bound is 1. At the lower bound we have the case in which output is distributed equally across macro-sectors, in other words, the region is highly diversified. At the upper end, unity means that output is concentrated in one industry, i.e., the region is extremely specialised.

[64] See Palan (2010) for a discussion on the Index properties.

The policy variable measures the amount of *ad hoc* public financial incentives granted to Mexican firms by ProMexico, a subdivision of the Secretariat of Economy. The Financial incentives include all non-repayable monetary grants given to firms located in region s and in year t.[65] The variable is measured in million Mexican pesos; values of the variable are zero from 2007 to 2012 and become positive from 2013 onwards.

3.5. Results and discussion

Results are reported for the three dimensions of OFDI. Each specification providing evidence on the relationship under scrutiny for Mexican subnational regions. Although our unit of analysis is the sate-sector, we turn to regions' averages across sectors to give a more nuanced picture of the regional dimension of internationalisation patterns. Maps of the subnational distribution of the structural determinants and policy incentives are shown in Figure A12 in the Appendix. We discuss the estimated signs of the coefficients for the full sample (column 1 in each table), also reflecting on the results for the two subsamples of OFDI by world income group of destination (in columns 2 and 3).

3.5.1. Propensity to OFDI

The estimates of the probit regression on equation (2) are reported in Table 11. For this sample, $\hat{\beta}$ estimates correspond to the effects of structural and policy determinants on the region-sector's propensity to internationalise. The interpretation of the estimated coefficients is not straightforward since changes in the probability attributed to a one-unit increase of a given predictor depends on its value and the values of the other predictors. In the analysis we only discuss the direction of the estimated coefficients.

When accounting for region-sector heterogeneity, on average, firms in region-sectors with increasing labour productivity show a decreasing propensity to engage in OFDI. The negative effect of rising labour productivity seems to be entirely confined to OFDI when it is directed towards High-income countries; while productivity turns out to be positively associated with

[65] These incentives encompass monetary support for specific activities aimed at the process of becoming an international firm. Examples of these funded activities are legal international counselling, consultancy in productive processes, participation in international events, planning and conducting promotional events abroad, international business training projects, strategic international missions, distribution centres, international certification, international trademark registration, and e-commerce and digital marketing strategies (ProMexico, 2018). The regional distribution of the annual average value of financial incentives can be found in Table A10 in the Appendix. Non-financial incentives – services provided to firms to support their process of internationalisation – are also provided but unfortunately data is not available.

the likelihood of engaging in OFDI towards middle income economies, albeit not significantly. An underlying interpretation of the negative effect can be drawn from the literature on EMNEs investment strategies (Hoskisson et al., 2013; Wright et al., 2005). For instance, firms operating in less economically mature regions such as Michoacán and Veracruz with sluggish productivity growth, are more likely to invest in countries with higher level of development (mainly in the USA) following an asset/resource-seeking strategy in order to boost their competitiveness.

Table 11 – Propensity to OFDI: Probit with Correlated Random Effects

Dep. Var.	(1)	(2)	(3)
Internationalisation dummy	All	High income	Middle income
Labour productivity	-0.329***	-0.619***	0.0998
	(0.120)	(0.182)	(0.191)
Goods exports	0.0242	-0.201*	0.0497
	(0.0761)	(0.112)	(0.0847)
Service exports	0.0403*	0.0194	0.00687
	(0.0216)	(0.0273)	(0.0260)
Share of foreign firms	0.0294**	0.0165	0.0734
	(0.0144)	(0.0232)	(0.0600)
Share of skilled workers	0.0250	0.0393	-0.00816
	(0.0165)	(0.0262)	(0.0175)
R&D expenditure	-0.386	0.628	-0.988
	(0.759)	(0.959)	(0.742)
Industrial structure	0.0537***	0.0303**	0.0247**
	(0.0120)	(0.0139)	(0.0125)
International connectivity	0.195**	0.00267	0.142
	(0.0971)	(0.0993)	(0.128)
Financial incentives	0.144***	0.0981***	0.0721***
	(0.00940)	(0.0125)	(0.0119)
Sector size	0.756***	1.433***	1.038**
	(0.289)	(0.409)	(0.434)
Observations	2,816	2,728	2,728
# Region–sectors	256	248	248
Region-sector FE	yes	yes	yes
Log-likelihood	-723.6	-407.2	-388.1

Notes: *** p<0.01, ** p<0.05, * p<0.1. Independent variables on 1-year lags. Clustered standard errors in parentheses at the region-sector level. The samples by destination are smaller than the sample including all destination because it includes observations for which the destination is not specified. We also estimate column (1) by excluding these, and we obtain the same results.

Among the regional structural variables, consistently with previous literature, region-sectors with increasing shares of foreign firms are more likely to internationalise. For instance, firms based in Durango, a region with rapid increases in foreign presence, have a higher probability of engaging in internationalisation strategies. However, there were no significant patterns found when the destination of OFDI was taken into account.

Furthermore, the coefficient on the HHI is positive and strongly significant for the whole sample. Although the estimated effect on the probability of internationalisation is difficult to

interpret since the explanatory variable is an index, the qualitative interpretation would be that increases in the extent of industrial specialisation of a region is associated with higher propensity to OFDI. In other words, less diversification, and/or the presence of specialised clusters in the region, is associated with more OFDI. This relationship remains significant also for the two subsamples; a reduction in industrial diversification increases the propensity of firms to internationalise, irrespective of the destination of the investment. An example on the regional dimension is Guanajuato, a region with increasing sectoral specialisation. Firms operating, in this region might be more likely to invest abroad, possibly in sectors that are not present or less developed in the region. The argument can be taken forward by considering the level of local competition à la Porter (1990), whereupon firms originating in highly competitive local settings within industrial clusters are more likely to pursue asset/knowledge-seeking internationalisation strategies than firms in other settings (P. Li & Bathelt, 2018).

Higher international connectivity, as proxied by the normalised flows of flight passengers, leads to higher propensity to OFDI. Although connectivity facilitates international flows to better connected regions (McCann & Acs, 2011), it does not appear to be a strong regional determinant when destination of OFDI is taken into account. The variable sector size (total number of firms) controls for a scale effect. Not surprisingly, the larger the region-sector, the more likely its firms are to engage in active internationalisation. Regarding overall service exports, it would seem that they could be initially complementary to internationalisation strategies (Conconi et al., 2016), by increasing the probability to OFDI, but not significantly so when the investment destination is considered. Conversely, increases in goods exports to High income countries reduce the probability of internationalisation, though with a barely significant effect. None of the innovation proxies (R&D expenditure and share of skilled workers) show a significant impact on the region-sector propensity to internationalise.

Turning to our policy variable, increases in the financial incentives for firm internationalisation at the region level are associated with higher expected probability of engaging in OFDI. Government grants to support the process of becoming international seem to have a strongly significant positive effect on the probability of a region-sector to invest abroad, irrespective of geographical orientation of investments. This constitutes a particularly relevant finding for the case of Mexico. Since public policies for active internationalisation in the country are very recent, this could be the first piece of evidence on the potential of financial resources to foster OFDI from Mexican MNEs.

3.5.2. Extensive margin of OFDI

The negative binomial estimates for equation (3) on the effects of the structural determinants and policy incentives on the extensive margin of OFDI are reported in Table 12. For this sample, $\hat{\beta}$ estimates correspond to the effects on the continuous count of affiliates abroad for region-sectors that either began their internationalisation process before or at some point during our sample period.[66]

Table 12 – Extensive margin of OFDI: Negative Binomial with Fixed Effects

Dep. Var.	(1)	(2)	(3)
Count of affiliates abroad	All	High income	Middle income
Labour productivity	-0.234***	-0.312***	0.200
	(0.0829)	(0.0895)	(0.194)
Goods exports	0.0792***	0.0646***	0.0852***
	(0.0105)	(0.0122)	(0.0181)
Service exports	-0.00107	-0.00910	-0.0111
	(0.0110)	(0.0135)	(0.0154)
Share of foreign firms	0.0134	0.00778	0.0184
	(0.0126)	(0.0136)	(0.0568)
Share of skilled workers	-0.0309***	-0.0231***	0.00408
	(0.00705)	(0.00753)	(0.0199)
R&D expenditure	-0.773***	-0.925***	-0.309**
	(0.0979)	(0.108)	(0.143)
Industrial structure	0.519	3.146***	0.382
	(0.481)	(0.814)	(0.808)
International connectivity	-0.00887	0.0657	-0.0289
	(0.0380)	(0.0519)	(0.0582)
Financial incentives	-0.0745***	-0.152***	0.0379
	(0.0194)	(0.0402)	(0.0529)
Observations	1,672	825	770
# Region–sectors	152	75	70
Region-sector FE	yes	yes	yes
Year FE	yes	yes	yes
Log-likelihood	-1862	-1283	-761.8

Notes: *** p<0.01, ** p<0.05, * p<0.1. Independent variables on 1-year lags; Clustered standard errors in parentheses. Region-sector size is used as the exposure variable. The sum of the subsamples is not equal to the total sample. In this case, the total sample includes observations for which there are affiliates both in high- and middle-income countries. We also estimate column (1) by excluding these, and we obtain the same results.

In this model the sector size expressed as the total number of firms is used as the exposure variable to account for any correlation between OFDI and the region-sector size. The interpretation of the estimates is not direct: A given one-unit change in an explanatory variable is associated with a change, by the respective regression coefficient, in the difference in logs of

[66] Because this specification is modelling a (strictly positive) count variable, region-sectors with all zero outcomes (not internationalised) across the study period are dropped from the estimation sample. 104 region-sectors (1,144 obs.) are dropped, and we are thus left with a total sample of 1,672 observations.

expected counts of affiliates abroad, with the other predictor variables in the model held constant.[67]

Among the structural variables, an increase in the region-sector's goods exports leads to an increase in the incidence rate of affiliate firms abroad; this holds for the sample and subsamples. Goods exports and OFDI could be complementary to each other (Greenaway & Kneller, 2007). In absolute terms: region-sectors with increasing volume of manufacturing exports are expected to see an increase in the number of affiliates, both in High- and Middle-income economies. Exports may favour the accumulation of international experience, which diminishes the information costs needed to overcome the 'liability of foreignness' (Zaheer, 1995). For instance, the region of Queretaro that experienced a sector average increase in product exports, had also a high increase in the total number of affiliates.

An increasingly specialised industry structure matters only for OFDI in High-income countries. An example on the regional dimension is Guanajuato; as a region with increasing sectoral specialisation, was also one with the largest increases in the number of foreign affiliates. This is consistent with the premise that investment in High-income destinations from EMNEs is asset/resource-seeking, hence firms operating in a less diversified region, might find it profitable to establish presence abroad to tap into resources not present at home. Concomitantly, industrial structure is of no significant relevance for the internationalising firm investing with a market-seeking incentive, namely in Middle-income countries, since a market-seeking investment will tend to replicate the productive structure abroad to serve the foreign market.

Other independent variables exerting a significant impact all show negative estimated coefficients. An increase in labour productivity is associated with a decrease in the incidence rate of affiliates: region-sectors with decreasing productivity had higher expected incidence in the count of affiliates abroad. Notably, regions such as Durango and Sinaloa, experiencing slower productivity growth, had a relatively high increase in the extensive margin of OFDI. For the subsamples and in line with the results on the propensity to internationalise in subsection 3.5.1, OFDI directed towards High-income countries displays a negative association with the number of affiliates, suggesting that indeed firms within region-sectors experiencing declining or slow productivity growth, will tend to increase their absolute internationalisation. Conversely, OFDI in Middle-income destinations, remains positive and not significant; perhaps due to a relatively lower, however increasing, number of affiliates established in these host countries.

[67] For ease of interpretation, Incidence Rate Ratios are reported in Table A13 in the Appendix.

The aforementioned negative relationship between OFDI and productivity is consistent overall with innovation variables. Sectors in regions with declining shares of skilled workers experienced rising extensive OFDI; examples are Veracruz and Guanajuato, regions with sizable decreases in the relative number of skill employees, also had relevant increases in the count of affiliates. Similarly, sectors located in regions with decreasing intramural R&D expenditure over the period saw increases, on average, in the number of affiliates located outside Mexico; notable cases are Veracruz and Tamaulipas with large reductions in R&D expenditure and high rates of extensive OFDI. These two relationships hold for OFDI in High-income economies, although skills do not seem to affect the absolute number of affiliates in Middle-income economies. OFDI in more advanced countries, via the acquisition of firms that possess sophisticated technologies and knowledge, might ensue from the need to address a relative weakness in the innovation systems at home (Luo & Tung, 2007). The argument can be further extended to an industry-based perspective, whereby a high degree of technology intensity within an industry will motivate new internationalisation ventures from emerging to developed countries (Yamakawa et al., 2008).

Even though financial incentives for internationalisation have a positive effect on the probability of firms to engage in to OFDI, they are found to be associated with lower incidence rate in the number of affiliates abroad. Regions such as Hidalgo and Morelos were among the regions with the largest increases in the sum of financial incentives and yet, they were also among the regions with the lowest increases in extensive OFDI. Inversely, Chihuahua and Coahuila had the lowest increases in public support for internationalisation and had among the highest rates of affiliate firm creation. The result holds only for OFDI toward High-income countries, whereas OFDI to Middle-income countries has no significant effect, though the point estimate is also positive.

3.5.3. Intensive margin of OFDI

Turning to exploring the degree of internationalisation of region-sectors, the dependent variable in this specification is defined as the number of affiliates abroad over total firms in each region-sector, capturing the intensity of internationalisation, as opposed to the absolute count of affiliates owned by Mexican MNEs. Table 13 presents the OLS with fixed effects estimates, corrected for the selection bias as described in subsection 3.4.1.[68] In this case, $\hat{\beta}$ are the estimated

[68] We estimate equation (5) in two steps in order to deal with selection stemming from unobserved heterogeneity. First, eleven probit regressions (one for each year) are fit on the probability that firms in each region-sector engage in internationalisation, taking into account each year's variation for all cross-sections (Table A14 in the Appendix). Next, we estimate a second-stage main regression for the region-sector degree of internationalisation conditional on the mills ratio resulting from the first-stage.

effects on the degree of internationalisation for the selected sample after correcting for selection bias. The interpretation of the coefficients is fairly straightforward: for positive (negative) estimated coefficients, a one unit or one percentage increase in the explanatory variable is associated with an expected increase (decrease) in the degree of internationalisation. The Inverse Mills ratio is reassuringly not significant in none of the regressions, ruling out the presence of selection bias.

Table 13 – Intensive margin of OFDI: Two-step OLS FE with selection

Dep. Var.	(1)	(2)	(3)
Degree of Internationalisation	All	High income	Middle income
Labour productivity	-0.0177	-0.0223**	0.00162
	(0.0116)	(0.00968)	(0.00719)
Goods exports	0.00287	0.00394**	0.00197*
	(0.00234)	(0.00196)	(0.00103)
Service exports	-0.000321	-0.000316	-0.000890**
	(0.000870)	(0.000825)	(0.000444)
Share of foreign firms	-0.577*	-0.511	2.852***
	(0.313)	(0.475)	(0.462)
Share of skilled workers	0.249**	0.334**	0.302***
	(0.122)	(0.145)	(0.0757)
R&D expenditure	-0.0672***	-0.0612***	-0.00867
	(0.0207)	(0.0192)	(0.00758)
Industrial structure	0.0294	0.111	0.000900
	(0.0525)	(0.0976)	(0.0125)
International connectivity	0.000503	0.000567	0.000477
	(0.000885)	(0.000777)	(0.000562)
Financial incentives	0.0148*	0.00635	0.000272
	(0.00886)	(0.00964)	(0.00275)
Inverse Mills Ratio	0.000971	-0.00638	0.00765
	(0.00675)	(0.00736)	(0.00617)
Inverse Mills Ratio*year	yes	yes	yes
Observations	727	454	284
R-squared	0.317	0.339	0.854
# of Region-sectors	153	72	70
Region-sector FE	yes	yes	yes
Year FE	yes	yes	Yes

Notes: *** p<0.01, ** p<0.05, * p<0.1. Independent variables on 1-year lags; Clustered standard errors in parentheses. The sum of the subsamples is not equal to the total sample. Due to the stepwise nature of this method, the total sample here excludes observations for which there are affiliates both in high- and middle-income countries.

Regarding labour productivity, we confirm the direction of the association: slow growing region-sector productivity is associated with significant increases in the ratio of affiliates to domestic firms, in particular for OFDI towards High-income economies. Put differently, controlling for the probability of internationalisation, slow region-sector productivity growth leads to the deepening of Mexican foreign investments in High-income destinations relative to the home

region. OFDI in High-income countries seems to be a dominant internationalisation strategy for firms operating in regions with declining or slowly growing productivity, such as Querétaro, Sinaloa or Durango. Not only this relationship holds for the absolute number of affiliates, but also for the degree of internationalisation. The literature in IB suggests that EMNEs will pursue investment in developed economies due to the possible benefits that accrue to firms entering these hosts; enhanced learning opportunities, lower levels of institutional risk and greater market potential (Yamakawa et al., 2008).

In the same vein, R&D expenditure in the region seems to have significant negative effects, particularly on the degree of internationalisation towards High-income economies. At the regional level, San Luis Potosí and Tamaulipas were among the regions with the highest decreases in R&D expenditure and also experienced significant increases in their degree of internationalisation. Notwithstanding, the estimated coefficient on the share of skilled labour displays the opposite expected sign. Although a positive association may appear puzzling at first sight, we only need to remember the composition of our sample here. After controlling for the probability to internationalise, it is region-sectors with increasing share of skills that are increasing the intensive margin of OFDI. For instance, Chihuahua, Coahuila and Durango are among the regions with the highest increases (smallest decreases) in skills, and they are also those with the largest rises in relative internationalisation.

Goods exports has too a complementary relationship with the degree of internationalisation; increases in the volume of exports is associated with deepening of OFDI in both High- and Middle-income economies. This suggests that previous experience in terms of trade, facilitates the establishment of affiliates in the host country.[69] Regions such as Querétaro, Estado de Mexico and Veracruz, had large increases in the volume of product exports, and significant increase in their degree of internationalisation. Conversely, service exports seem to have a substitution effect on OFDI directed to High-income countries. Although the coefficient is significant, the estimated association is considerably small.

The share of foreign MNEs in the region-sector has a positive effect on the degree of internationalisation when investment is directed towards Middle-income countries. The accumulated experience of admittedly technologically superior foreign firms in sectors located in regions such as Durango, Coahuila and Sonora, abets Mexican MNEs to venture into similarly developed markets resulting in a higher the proportion of affiliates abroad relative to total

[69] The effect is only significant for the two subsamples and not for the full sample; when correcting for the selection bias the effect turns out to be significant only when the destination of OFDI is taken into account.

region-sector firms. The coefficient on foreign presence has a weak negative effect for the whole sample; this might indicate a crowding-out effect of foreign MNEs on Mexican firms expanding to more developed markets, although it loses significance when only OFDI in High-income countries is considered.

Finally, the financial incentives for internationalisation have a positive, although weakly significant, relationship with the intensive margin of OFDI for the whole sample. This is suggestive that, financial resources to support internationalisation have been effective in regions with an initial high degree of internationalisation; increases in the amount of resources only increase the intensity of OFDI, to a very moderate extent, for those region-sectors that are already relatively more internationalised like Ciudad de Mexico, Jalisco and Nuevo Leon.

3.6. Conclusions

Our paper contributes to the extant and growing literature on OFDI from emerging economies by offering insights into how regional heterogeneity of structural and policy factors influence their internationalisation through OFDI. By focusing on the regional dimension, we are able to shed light on the relationship between the characteristics of the subnational regions and the broad OFDI strategies, thus furthering the understanding of MNEs and their immediate spatial environment (Beugelsdijk et al., 2010). We discussed the estimated effects in terms of (i) propensity to internationalise, (ii) incidence rate or extensive margin, and (iii) degree of internationalisation or intensive margin.

Both innovation proxies, skilled workers and private intramural R&D, have no effect on the propensity to internationalise of Mexican region-sectors, whilst there is a strongly negative association during the period of study between them and the extensive margin of OFDI, again particularly for those directed toward High-income economies. This would suggest that the choice to go overseas is not connected in the same way with innovation dynamics, as Mexico and other emerging economies are late-comers, relying in large part on adapted and incremental innovation (Amighini et al., 2010; de Alcântara et al., 2016; Mathews, 2002a). Furthermore, region-sectors with lower growth in innovation activities and skills, expand the number of affiliates abroad in order to source advanced technological knowledge and skills that are not present at home (Filippov, 2010; Luo & Tung, 2007). Regarding the degree of internationalisation, when controlling for selection we find the opposite effect for skills: it would seem that region-sectors with growing shares of skilled workers are those with higher relative

share of affiliates abroad, and the effect is particularly strong for OFDI in Middle-income countries. The sign is still negative for R&D with respect to the relative degree of internationalisation, though not significant for OFDI directed to the Middle-income group. This would indicate a general positive association between skill-intensity and openness of region-sectors at home.

After controlling for unobservable time-invariant region-sector specific characteristics and selection bias, on average, lower labour productivity growth is associated with a higher propensity to engage in OFDI, and higher incidence rate and degree of internationalisation, especially in the case of OFDI towards in High-income countries. In line with previous findings on OFDI from advanced economies, the probability of internationalisation through OFDI increases the larger the number of firms in the region-sector, irrespective of destination; possibly indicating the strong agglomeration forces are behind the relocation of economic activity (De Propris et al., 2008). Again, in accordance with the literature on MNEs originating from both developed and emerging economies (Boschma & Iammarino, 2009; Crescenzi & Iammarino, 2017), presence in foreign markets via trade in goods increases both extensive and intensive margins of OFDI suggesting a complementary effect between trade and investment flows, which, however, is not found for in the case of services exports. The presence of foreign-owned MNEs in a region increases the probability of internationalisation; however, accounting for selection, increases in the intensive margin of OFDI are only detected when Middle-income economies are the target of the investment. Manufacturing exports and overseas investment are complementary both in absolute and relative terms.

Drawing on the results herein, this paper concludes with three general considerations; the implications that arise point towards further research avenues. The first one concerns the policy determinant. The process of internationalisation requires substantial capabilities and resources which, as it has been shown, substantially differ across subnational regions (Bailey & Driffield, 2007; Bannò et al., 2015; Iammarino, 2018), thus access to financial support plays a critical role in firms' efforts of establishing presence abroad, especially in the case of emerging economies as OFDI may enable them to deepen their integration into the world economy (Luo et al., 2010). The coefficient on this variable turns out to be positive and strongly significant on the propensity to undertake OFDI; conversely, it appears that higher financial incentives decrease OFDI in the extensive margin, possibly suggesting that Mexican MNEs located in the more supported regions consolidated their number of affiliates abroad or expanded their size. This occurrence suggests that there is room for improvement in the efficiency of public financial incentives; more resources could be devoted to support the active internationalisation of firms

in less mature regions, since their counterparts in more advanced regions are better equipped to invest abroad. Future research at the firm level will advance our understanding on how individual firms respond to policy incentives to internationalise.

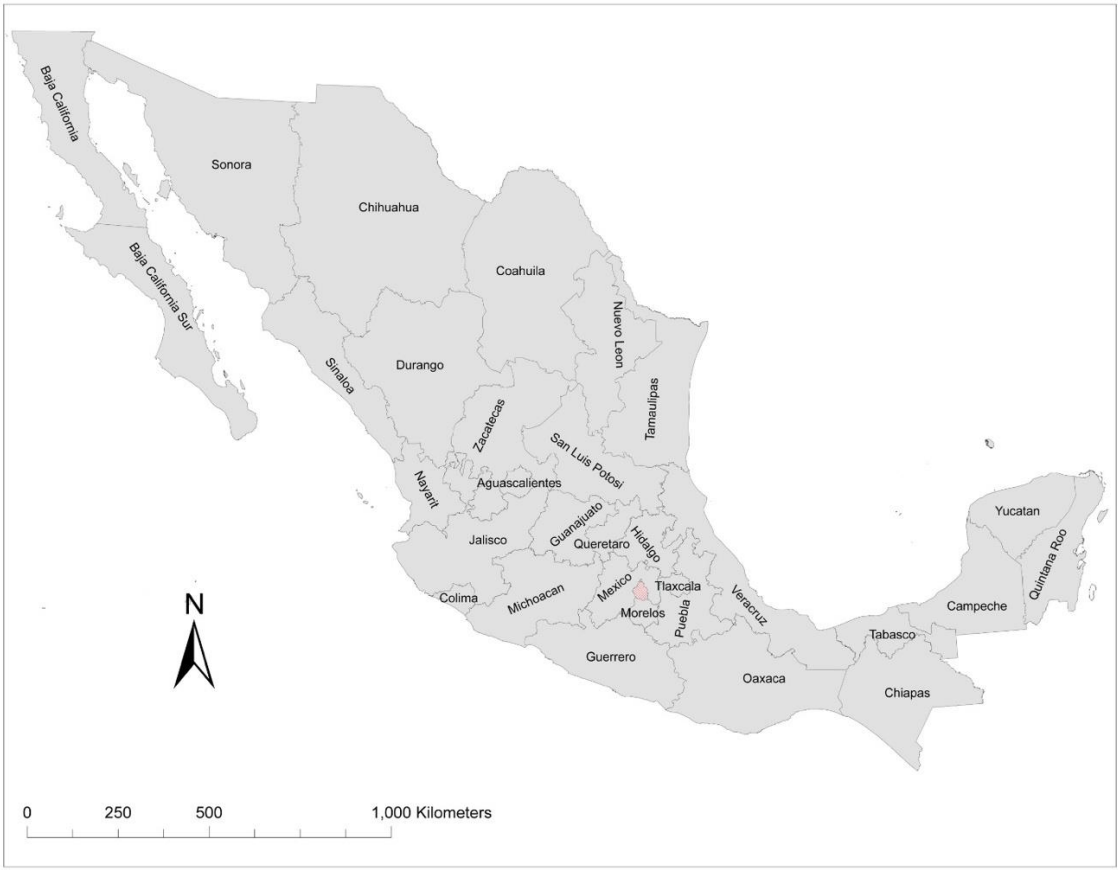
Secondly, the results at the region-sector level provide a framework to understand how region-sector characteristics may shape the internationalisation strategies of EMNEs. These firms from mid-range economies have attracted considerable attention in recent years due to the sharp rise in their international presence. EMNEs have a critical need for resources. For instance, the lack of consolidated local education systems and sufficiently developed capital markets will drive EMNEs to seek opportunities abroad in order to enhance their competitive advantages (Hoskisson et al., 2004, 2013). As EMNEs, Mexican firms invest in similarly developed (Middle-income) and more developed countries (High-income), and thus they may pursue strategies with asset/resource-seeking and market-seeking objectives (Vasquez-Parraga & Felix, 2004). The most consistent results pertain the negative coefficients on labour productivity and innovation proxies (R&D and skills). Regarding the former, it suggests that Mexican firms operating in region-sectors with sluggish productivity growth, might be driven by asset-seeking opportunities in high-income countries in order to enhance their competitiveness (Hoskisson et al., 2004). The effect of labour productivity when OFDI is directed to middle-income countries, is positive but not significant. Nonetheless, it could suggest that firms based in more economically mature region-sectors with rising productivity, might be investing in countries with similar levels of development, mostly in the Central and Latin American region, following a logic of market expansion.

A very notable example of a Mexican firm that might exemplify the regional internationalisation patterns that we found is CEMEX (Lessard & Lucea, 2009). As an EMNE, this cement and concrete producer, started its internationalisation process by investing in Spanish subsidiaries, which granted it access to capital markets and the adoption of better production practices. Later on, CEMEX commenced the expansion of its production processes by establishing affiliates throughout Latin America and the Caribbean. Today the Mexican MNE is a global firm with activities in over 50 countries worldwide. With regards to the negative association between R&D expenditure and OFDI for region-sectors, qualitative firm-level evidence has found that Mexican MNEs of the most recent wave of OFDI, have incurred in the acquisition of new technologies and innovative capacities by investing in R&D centres or buying firms with higher technological expertise in developed countries (Basave Kunhardt, 2016). A natural way forward would be to increase our understanding of these determinants of internationalisation at the firm level for Mexican MNEs.

Third, exploring the profile of emerging region-sectors and the destination of their investments will enable us to understand the likely effects of internationalisation at home (Gammeltoft et al., 2010). As it has long been posited, OFDI may enhance the competitiveness of the home economy (Barba Navaretti & Venables, 2004; Cantwell & Barnard, 2008; Dunning, 1994; Kokko, 2006). For example, the internationalisation of regions may have productivity effects (e.g. Castellani & Pieri, 2016) or change the employment composition in the MNEs' home region (e.g. Elia et al., 2009). However, OFDI has been generally thought of a consequence of economic development (Dunning & Narula, 1996), and thus very little attention has been paid to its contribution to the development of home countries when the investing multinationals come from emerging economies (Knoerich, 2017). To this end, in Chapter *IV* we explore whether OFDI substitutes or complements regional employment in Mexican region-industries, by decreasing or increasing the demand for different types of labour.

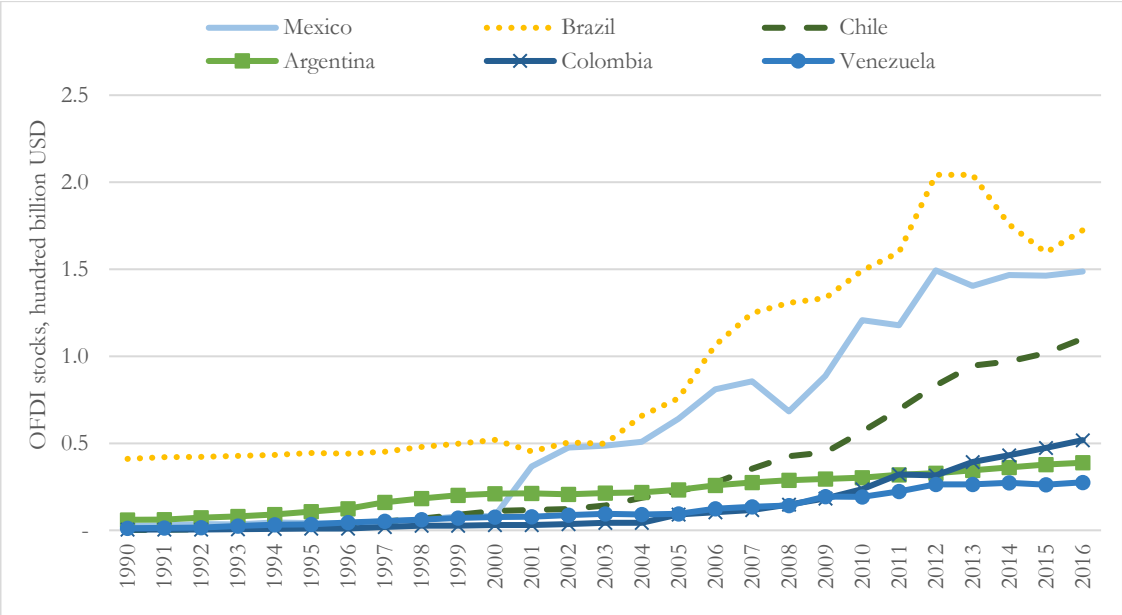
3.7. Appendix

Figure A10 – Map of the Mexican States with names



Note: Ciudad de Mexico is shaded in a different colour.

Figure A11 – Aggregate Outward FDI Stocks, Mexico in Latin America (selected countries)



Source: Authors' own elaboration with data from UNCTAD, 2018

Table A7 – Number of internationalised Mexican parent firms by region-year, 2007-2017

	State	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Δ	%
1	Ciudad de Mexico	91	112	122	133	157	182	215	238	607	650	1,005	914	45.47
2	Nuevo Leon	35	43	52	52	58	63	63	71	167	186	264	229	11.39
3	Mexico	13	11	17	22	19	19	26	29	110	121	179	166	8.26
4	Jalisco	7	8	14	13	12	15	15	17	59	92	133	126	6.27
5	Queretaro	2	3	4	4	6	6	8	9	20	37	60	58	2.89
6	Guanajuato	2	2	4	4	6	2	3	4	22	34	58	56	2.79
7	Chihuahua	4	5	7	6	6	9	10	9	29	36	46	42	2.09
8	Veracruz	2	1	4	9	4	4	3	3	21	27	43	41	2.04
9	Coahuila	1	1	2	1	3	4	5	7	20	30	37	36	1.79
10	Baja California	0	0	1	1	1	2	1	3	13	23	31	31	1.54
11	Tamaulipas	0	1	1	2	2	3	3	4	10	26	31	31	1.54
12	Puebla	1	1	2	3	2	3	3	3	9	17	30	29	1.44
13	Quintana Roo	0	0	0	0	0	1	1	2	13	19	27	27	1.34
14	Sinaloa	0	0	1	0	3	3	1	4	18	22	27	27	1.34
15	San Luis Potosi	2	2	3	3	2	2	1	1	13	19	28	26	1.29
16	Sonora	1	2	1	1	1	2	1	3	11	20	26	25	1.24

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Table A7 – OFDI: Number of internationalised Mexican parent firms by region-year, 2007-2017 *(continued)*

	Region	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Δ	%
17	Aguascalientes	0	0	0	0	0	0	1	2	5	14	19	19	0.95
18	Michoacan	2	2	3	3	2	2	2	2	10	18	20	18	0.90
19	Yucatan	0	2	2	3	3	3	3	3	5	12	15	15	0.75
20	Baja California Sur	0	0	0	0	0	0	1	2	4	9	14	14	0.70
21	Durango	0	0	2	1	1	2	2	2	5	9	13	13	0.65
22	Hidalgo	0	1	1	1	0	0	0	0	2	7	11	11	0.55
23	Campeche	0	0	0	0	0	0	0	2	2	6	8	8	0.40
24	Nayarit	0	0	0	0	0	1	0	0	3	7	8	8	0.40
25	Guerrero	0	0	0	0	0	0	0	0	1	6	7	7	0.35
26	Chiapas	0	0	0	1	1	1	1	1	2	4	6	6	0.30
27	Morelos	1	1	1	1	1	0	0	0	3	3	7	6	0.30
28	Oaxaca	1	2	2	2	2	2	3	3	3	6	6	5	0.25
29	Tabasco	0	0	0	0	0	0	0	0	2	5	5	5	0.25
30	Colima	0	0	0	0	0	0	0	0	2	3	4	4	0.20
31	Zacatecas	0	0	0	0	0	1	1	1	2	2	4	4	0.20
32	Tlaxcala	0	0	0	0	0	0	0	0	2	2	3	3	0.15
	National	**165**	**200**	**246**	**266**	**292**	**332**	**373**	**425**	**1,195**	**1,472**	**2,175**	**2,010**	**100**

Note: the numbers include firms in all sectors Source: Authors' own elaboration with data from ORBIS, Bureau Van *Dijk*

Table A8 – Number of Mexican-owned affiliates abroad by region-year, 2007-2017

	State	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Δ	%
1	Ciudad de Mexico	241	264	237	294	436	1,157	1,209	4,598	8,027	5,444	6,757	6,516	41.13
2	Nuevo Leon	384	441	438	567	643	768	1,174	1,529	2,768	3,580	4,099	3,715	23.45
3	Jalisco	9	11	17	16	17	24	23	22	141	3,308	3,255	3,246	20.49
4	Mexico	12	11	34	27	34	132	175	204	498	419	745	733	4.63
5	Chihuahua	19	20	25	25	22	29	36	37	196	320	383	364	2.30
6	Veracruz	2	1	4	14	4	5	3	3	29	159	132	130	0.82
7	Coahuila	3	3	7	3	4	6	15	17	49	100	123	120	0.76
8	Guanajuato	2	2	4	4	7	3	5	6	56	70	113	111	0.70
9	Durango	0	0	6	3	3	4	2	4	33	38	94	94	0.59
10	Michoacan	2	1	2	2	1	1	2	3	70	85	93	91	0.57
11	Queretaro	3	6	12	8	11	12	8	10	43	63	93	90	0.57
12	Tamaulipas	0	2	1	5	1	1	1	3	26	47	75	75	0.47
13	Sinaloa	0	0	1	0	12	16	10	5	47	55	73	73	0.46
14	Sonora	1	2	1	1	1	2	1	3	24	44	64	63	0.40
15	San Luis Potosi	2	2	3	3	2	2	1	1	16	40	59	57	0.36
16	Puebla	1	2	3	4	2	4	3	3	23	32	57	56	0.35

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Table A8 – OFDI: OFDI: Number of Mexican-owned affiliates abroad by region-year, 2007-2017 *(continued)*

	State	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Δ	%
17	Baja California	0	0	1	1	1	2	1	2	29	44	53	53	0.33
18	Quintana Roo	0	0	0	0	0	1	1	2	19	41	50	50	0.32
19	Campeche	0	0	0	0	0	0	0	14	20	34	34	34	0.21
20	Aguascalientes	0	0	0	0	0	0	1	2	11	22	30	30	0.19
21	Yucatan	0	1	1	2	2	2	2	2	13	21	25	25	0.16
22	Morelos	2	1	1	1	1	0	0	0	13	21	26	24	0.15
23	Hidalgo	0	1	1	1	0	0	0	0	3	12	16	16	0.10
24	Baja California Sur	0	0	0	0	0	0	0	3	4	11	15	15	0.09
25	Tabasco	0	0	0	0	0	0	0	0	9	12	12	12	0.08
26	Guerrero	0	0	0	0	0	0	0	0	1	6	9	9	0.06
27	Nayarit	0	0	0	0	0	2	0	0	3	8	9	9	0.06
28	Colima	0	0	0	0	0	0	0	0	4	6	7	7	0.04
29	Oaxaca	2	3	3	3	3	3	4	4	4	9	9	7	0.04
30	Tlaxcala	0	0	0	0	0	0	0	0	5	5	6	6	0.04
31	Zacatecas	0	0	0	0	0	1	1	1	4	2	6	6	0.04
32	Chiapas	0	0	0	1	0	1	1	1	2	5	5	5	0.03
	National	**685**	**774**	**802**	**985**	**1,207**	**2,178**	**2,679**	**6,479**	**12,190**	**14,063**	**16,527**	**15,842**	**100**

Note: the numbers include firms in all sectors. Source: Authors' own elaboration with data from ORBIS, Bureau Van *Dijk*

Table A9 – Distribution of Mexican-owned affiliates abroad by country of destination

Destination Country	Count	Share	World region	World income group
United States of America	5,086	49.0	North America	High income
Brazil	1,626	15.6	Latin America & Caribbean	Upper middle income
Spain	1,166	11.2	Europe & Central Asia	High income
Germany	389	3.7	Europe & Central Asia	High income
Austria	318	3.1	Europe & Central Asia	High income
United Kingdom	318	3.1	Europe & Central Asia	High income
Netherlands	296	2.8	Europe & Central Asia	High income
Canada	189	1.8	North America	High income
Colombia	131	1.3	Latin America & Caribbean	Upper middle income
France	96	0.9	Europe & Central Asia	High income
Argentina	68	0.7	Latin America & Caribbean	Upper middle income
Peru	63	0.6	Latin America & Caribbean	Upper middle income
Czech Republic	47	0.5	Europe & Central Asia	High income
Rest of the World (68 countries)	597	5.7	NA	NA
Total	**10,390**	**100**	**NA**	**NA**

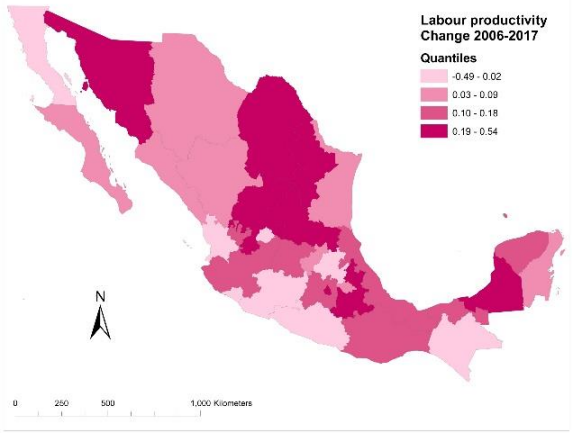
Source: Authors' own elaboration with data from ORBIS, Bureau Van *Dijk*

World income group	Count	Share
High income	8,266	79.5
Middle income	2,124	20.5
Total	**10,390**	**100**

Source: Authors' own elaboration with data from ORBIS, Bureau Van *Dijk*

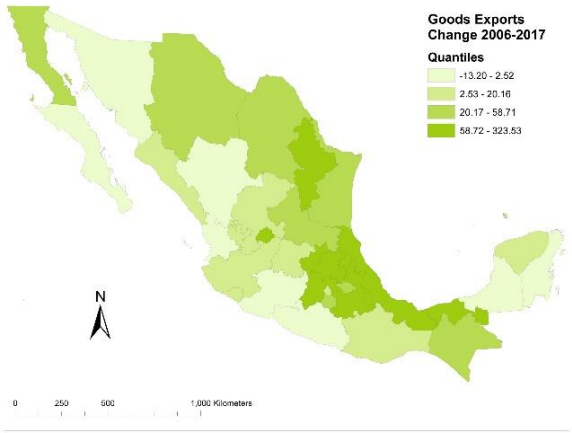
Figure A12 – Maps of changes in OFDI determinants by region

Map A. Labour productivity



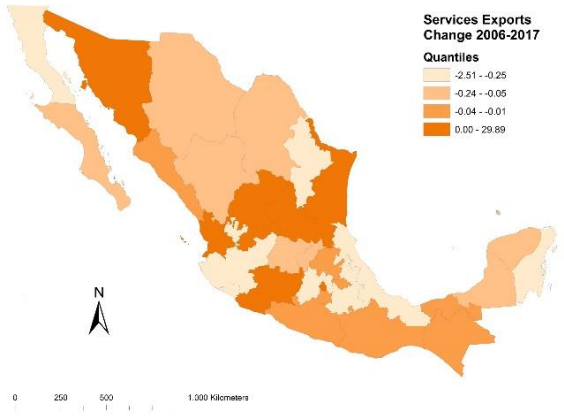
Log Gross Value Added divided by total employment (thousand MXN).

Map B. Total Goods exports



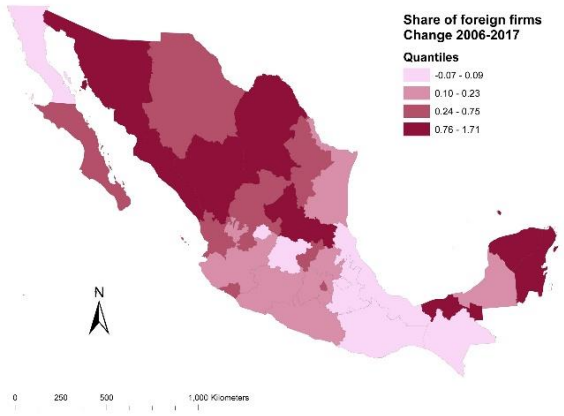
Log total sum of good sales abroad (billion MXN).

Map C. Total Service exports



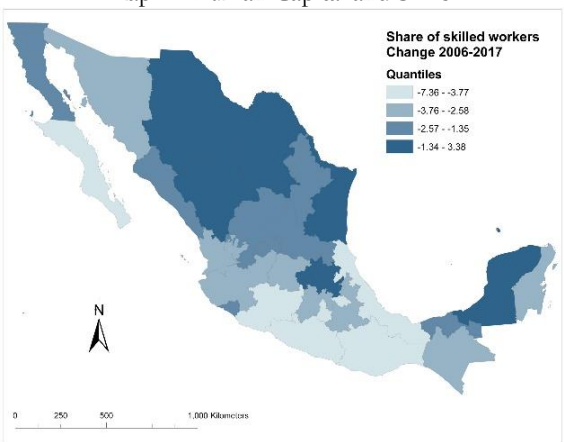
Log total sum of good sales abroad (billion MXN).

Map D. Foreign MNEs



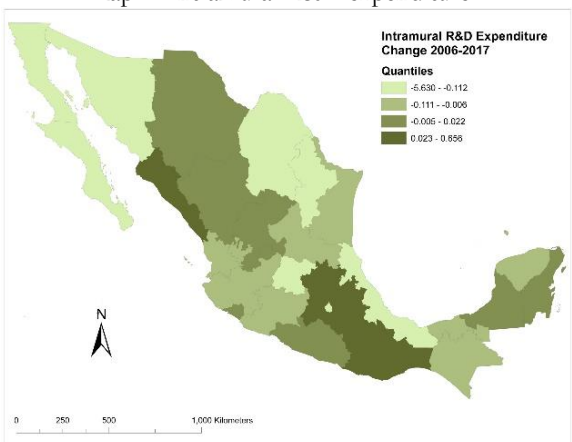
Number of firms with foreign capital relative to total firms (percentage points).

Map E. Human Capital and Skills



Ratio of skilled workers to total employees (percentage points).

Map F. Intramural R&D expenditure



Total intramural R&D expenditure at the state level (billion MXN).

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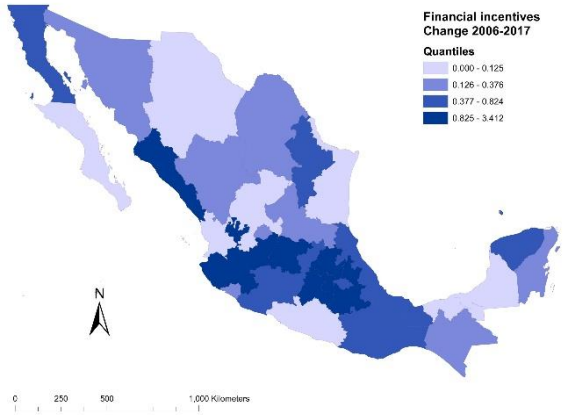
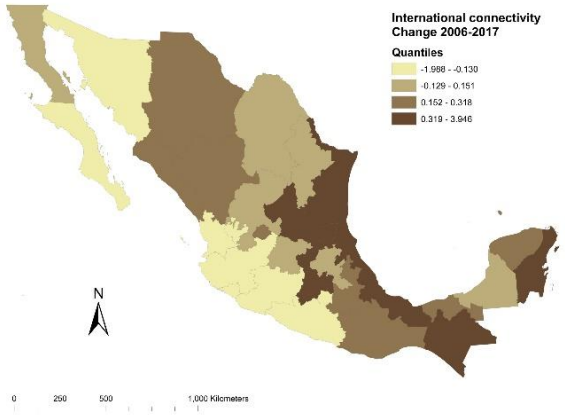
Figure A12 – Maps of changes in OFDI determinants *(continues)*

Map G. Financial incentives



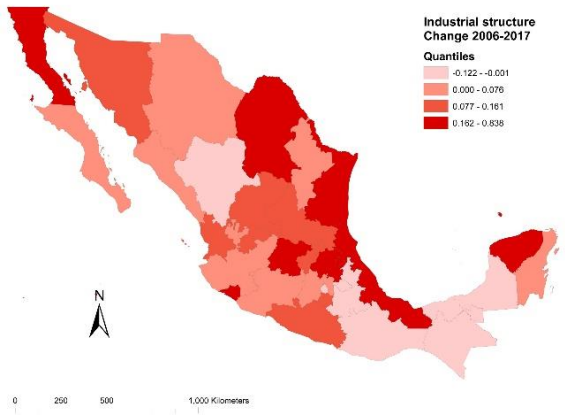
Total sum of financial grants for internationalisation (million MXN).

Map H. International connectivity



Log total flight passengers in state's airports per 100,000 inhabitants.

Map I. Industrial Structure



Herfindahl–Hirschman Index (HHI) to measure sectoral diversity/specialization range [1/8, 1]

Source: Authors' own elaboration on data from Economic Census (INEGI)

Table A10 – Internationalisation policy: Financial incentives by region

State	Σ2013-2017	%
Ciudad De Mexico	41.72	16.25
Jalisco	40.76	15.88
Nuevo Leon	18.08	7.05
Guanajuato	16.44	6.41
Puebla	14.99	5.84
Estado De Mexico	13.89	5.41
Hidalgo	8.95	3.49
Veracruz	8.88	3.46
Yucatan	7.92	3.09
Queretaro	7.90	3.08
Sonora	7.09	2.76
Baja California	7.04	2.74
Sinaloa	6.72	2.62
Michoacan	6.57	2.56
Coahuila	6.23	2.43
Durango	5.25	2.04
Morelos	5.14	2.00
Aguascalientes	4.99	1.95
Oaxaca	4.99	1.94
San Luis Potosi	4.85	1.89
Chihuahua	4.73	1.84
Tlaxcala	3.30	1.28
Chiapas	3.02	1.18
Zacatecas	1.95	0.76
Tamaulipas	1.87	0.73
Quintana Roo	1.01	0.39
Colima	0.98	0.38
Campeche	0.51	0.20
Tabasco	0.41	0.16
Guerrero	0.36	0.14
Nayarit	0.13	0.05
Baja California Sur	0.00	0.00
National	**256.65**	**100.00**

Note: million Mexican pesos.
Source: Authors' own elaboration on data from ProMexico (Secretariat for Economy)

Table A11 –Variables description and sources: OFDI determinants

Variable	Definition & (units)	Source
OFDI		
Number of Mexican firms with affiliates abroad	Count of Mexican independent firms (Global Ultimate Owner and Headquarters) with established affiliates abroad (#).	ORBIS Historical Ownership database (Bureau Van *Dijk),* 2007-2017
Number of Mexican-owned affiliates abroad	Count of Mexican-owned affiliates abroad (#).	ORBIS Historical Ownership database (Bureau Van *Dijk),* 2007-2017
Internationalisation Policy		
Financial incentives	Total sum of financial grants for internationalisation (million MXN).	ProMexico, Secretariat for Economy, Mexican Federal Government, 2013-2017
Structural determinants		
Sector size*	Count of all Mexico-based firms irrespective of their internationalisation status (#).	INEGI, Economic Census (2004, 2009, 2014)
Service exports*	Logarithmic transformation of the total sum of service sales abroad (billion MXN).	INEGI, Economic Census (2004, 2009, 2014)
Good exports*	Logarithmic transformation of the total sum of good sales abroad (billion MXN).	INEGI, Economic Census (2004, 2009, 2014)
Labour productivity*	Log total value added per worker. Gross Value Added divided by total employment (thousand MXN).	INEGI, Economic Census (2004, 2009, 2014)
Share of skilled workers*	Ratio of skilled workers to total employees (percentage points).	INEGI, Economic Census (2004, 2009, 2014)
Share of foreign firms*	Number of firms with foreign capital relative to total firms (percentage points).	INEGI, Economic Census (2004, 2009, 2014)
Industrial structure	Herfindahl–Hirschman Index (HHI) to measure sectoral diversity/specialization (ranging from 1/8 to 1)	INEGI, Economic Census (2004, 2009, 2014)
International connectivity	Total flight passengers in state's airports relative to 100,000 inhabitants.	INEGI, SIMBAD, State and Municipality Database System (2006-2015)
Intramural R&D expenditure	Total intramural R&D expenditure at the state level (billion MXN).	INEGI, ESIDET, Survey on Technology Research & Development (2009-2013)

NOTE: Dependent variable at the state-sector-year level. Independent variables are at the state-sector-year level with the exception of industrial structure, international connectivity and intramural R&D.

* Variables are at the state-sector level and values are linearly interpolated using three 5-year data points

Table A12 – Summary statistics by specification: OFDI determinants

Logit with Correlated Random Effects regressions

	OFDI to all destinations				OFDI to High income				OFDI to Middle income			
Model 1: *Propensity to Internationalise*	mean	SD	min	max	mean	SD	min	max	mean	SD	min	max
Internalisation dummy	0.26	0.44	0	1	0.17	0.37	0	1	0.10	0.31	0	1
Labour productivity (thous. MXN)	161.90	8,042	-0.0	426,169	167.08	8,171	-0.0	426,169	167.08	8,171	-0.0	426,169
Log Labour productivity	5.58	1.32	-3.42	19.87	5.57	1.32	-3.42	19.87	5.57	1.32	-3.42	19.87
Good exports (bil. MXN)	5.12	22.62	0	324.06	5.25	22.96	0	324.06	5.25	22.96	0	324.06
Log Good exports	2.08	5.45	0	19.60	2.08	5.45	0	19.60	2.08	5.45	0	19.60
Service exports (bil. MXN)	1.76	73.83	0	3,895	1.81	75.01	0	3,895	1.81	75.01	0	3,895
Log Service exports	2.43	4.29	0	22.08	2.45	4.30	0	22.08	2.45	4.30	0	22.08
Share of skilled workers (%)	15.43	8.28	0	100	15.52	8.36	0	100	15.52	8.36	0	100
Total intramural R&D expenditure (bil. MXN)	0.63	1.82	0	12.94	0.65	1.85	0	12.94	0.65	1.85	0	12.94
Log Total intramural R&D expenditure	0.29	0.49	0	2.63	0.30	0.49	0	2.63	0.30	0.49	0	2.63
Share of foreign firms (%)	2.13	10.13	0	100	2.15	10.27	0	100	2.15	10.27	0	100
Log Flight passengers per 100,000 inhabitants	9.75	3.00	0	14.09	9.75	3.04	0	14.09	9.75	3.04	0	14.09
Financial incentives (mil. MXN)	0.74	1.88	0	18.39	0.76	1.91	0	18.39	0.76	1.91	0	18.39
Log Financial incentives	5.72	6.77	0	16.73	5.76	6.79	0	16.73	5.76	6.79	0	16.73
Industrial structure HH Index	0.43	0.17	0.15	1	0.44	0.17	0.15	1	0.44	0.17	0.15	1
Sector size	26.80	101.60	0	2,118	27.55	103.09	0.00	2,118	27.55	103.09	0.00	2,118
	N = 2,816				*N = 2,728*				*N = 2,728*			

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Table A12 – Summary statistics *(continued)*

Negative Binomial Fixed Effects regressions

	Full sample				High income sample				Middle income sample			
Model 2: *Extensive margin of internationalisation*	mean	SD	min	max	mean	SD	min	max	mean	SD	min	max
Number of Mexican-owned subsidiaries abroad (#)	32.85	275.91	0	5,781	47.80	309.05	0	4,388	11.97	77.01	0	1,113
Labour productivity (thous. MXN)	2.32	55.37	1.76	2,217	3.89	78.72	0	2,217	0.36	0.22	0	1.64
Log Labour productivity	5.68	1.00	0	14.61	5.73	1.11	0	14.61	5.67	0.86	0	7.40
Good exports (bil. MXN)	8.28	27.58	0	247.41	14.46	36.68	0	247.41	16.24	38.45	0	247.41
Log Good exports	3.32	6.60	0	19.33	4.50	7.51	0	19.33	5.06	7.78	0	19.33
Service exports (bil. MXN)	0.40	6.21	0	199.82	0.77	8.82	0	199.82	0.79	9.12	0	199.82
Log Service exports	2.99	4.57	0	19.11	4.29	5.13	0	19.11	4.20	4.93	0	19.11
Share of skilled workers (%)	15.30	7.41	0	100	16.68	9.40	0	100	16.87	9.12	3.89	100
Total intramural R&D expenditure (bil. MXN)	0.88	2.16	0	12.94	1.47	2.92	0	12.94	1.50	3.02	0	12.94
Log Total intramural R&D expenditure	0.39	0.55	0	2.63	0.57	0.68	0	2.63	0.57	0.69	0	2.63
Share of foreign firms (%)	1.63	5.11	0	100	2.01	5.73	0	100	1.30	3.58	0	40.58
Log Flight passengers per 100,000 inhabitants	10.24	2.45	0	14.09	10.63	1.98	0	14.09	10.31	2.67	0	14.09
Financial incentives (mil. MXN)	0.94	2.21	0	18.39	1.29	2.83	0	18.39	1.31	2.84	0	18.39
Log Financial incentives	5.94	6.92	0	16.73	6.23	7.11	0	16.73	6.28	7.13	0	16.73
Industrial structure HH Index	0.44	0.17	0.15	1	0.43	0.15	0.15	1	0.44	0.14	0.18	1.00
Sector size	43.47	129.14	0	2,118	74.50	175.83	0	2,118	77.92	180.51	0	2,118
	N = 1,672				*N = 825*				*N = 770*			

Continues next page

Table A12 – Summary statistics *(continued)*

Wooldridge correction for selection bias OLS regressions, selected sample

	Full sample				High income sample				Middle income sample			
Model 3: *Selection with unobserved heterogeneity*	mean	SD	min	max	mean	SD	min	max	mean	SD	min	max
Degree of internationalisation (%)	0.02	0.12	0	0.99	0.03	0.15	0	0.99	0.001	0.03	0	0.46
Labour productivity (thous. MXN)	3.80	82.31	0	2,217	5.67	104.13	0	2,217	0.47	0.26	0	1.64
Log Labour productivity	5.78	1.13	0	14.61	5.77	1.25	0	14.61	5.95	0.82	0	7.40
Good exports (bil. MXN)	17.22	39.39	0	247.41	22.02	44.77	0	247.41	29.24	49.69	0	247.41
Log Good exports	5.08	7.87	0	19.33	5.86	8.27	0	19.33	7.20	8.66	0	19.33
Service exports (bil. MXN)	0.89	9.40	0	199.82	1.38	11.86	0	199.82	1.80	14.83	0	199.82
Log Service exports	3.80	5.16	0	19.11	5.21	5.48	0	19.11	4.97	5.17	0	19.11
Share of skilled workers (%)	16.61	10.27	1.44	100	18.16	11.61	1.44	100	18.44	9.77	3.89	100
Total intramural R&D expenditure (bil. MXN)	1.60	3.09	0	12.94	2.27	3.62	0	12.94	2.64	3.77	0	12.94
Log Total intramural R&D expenditure	0.60	0.72	0	2.63	0.80	0.79	0	2.63	0.90	0.82	0	2.63
Share of foreign firms (%)	2.05	5.65	0	58.10	2.32	5.39	0	40.58	1.47	3.25	0	34.87
Log Flight passengers per 100,000 inhabitants	10.56	2.17	0	14.09	10.93	1.70	0	14.09	10.72	2.41	0	14.09
Financial incentives (mil. MXN)	1.59	2.98	0	18.39	1.79	3.30	0	18.39	2.11	3.80	0	18.39
Log Financial incentives	8.89	6.80	0	16.73	7.85	7.19	0	16.73	8.60	7.12	0	16.73
Industrial structure HH Index	0.45	0.16	0.18	1	0.44	0.13	0.18	1	0.44	0.13	0.20	1.00
	N = 727				*N = 454*				*N = 284*			

Table A13 – Negative Binomial with Fixed Effects: Incidence Rate Ratios

Dep. Var.	(1)	(2)	(3)
Count of affiliates abroad	All	High income	Middle income
Labour productivity	0.791***	0.732***	1.221
	(0.0656)	(0.0655)	(0.237)
Goods exports	1.082***	1.067***	1.089***
	(0.0113)	(0.0131)	(0.0197)
Service exports	0.999	0.991	0.989
	(0.0110)	(0.0134)	(0.0152)
Share of foreign firms	1.014	1.008	1.019
	(0.0128)	(0.0137)	(0.0579)
Share of skilled workers	0.970***	0.977***	1.004
	(0.00683)	(0.00735)	(0.0200)
R&D expenditure	0.462***	0.396***	0.734**
	(0.0452)	(0.0426)	(0.105)
Industrial structure	1.680	23.25***	1.466
	(0.809)	(18.94)	(1.185)
International connectivity	0.991	1.068	0.971
	(0.0376)	(0.0554)	(0.0565)
Financial incentives	0.928***	0.859***	1.039
	(0.0180)	(0.0345)	(0.0549)
Observations	1,672	825	770
# of State-sectors	152	75	70
State-sector FE	yes	yes	yes
Year FE	yes	yes	yes
Log-likelihood	-1862	-1283	-761.8

Notes: *** p<0.01, ** p<0.05, * p<0.1. Independent variables on 1-year lags; Incidence Rate Ratios reported. Clustered standard errors in parentheses. Region-sector size is used as the exposure variable. The sum of the subsamples is not equal to the total sample. In this case, the total sample includes observations for which there are affiliates both in high- and middle-income countries. We also estimate column (1) by excluding these, and we obtain the same results

Table A14 – First stage Probit regressions for each year by destination sample

OFDI to All destinations

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Labour productivity	-0.168	-0.00849	0.141	0.100	0.293*	0.288	0.283*	0.229*	0.110	-0.0144	0.0340
	(0.201)	(0.158)	(0.171)	(0.145)	(0.172)	(0.204)	(0.157)	(0.134)	(0.0845)	(0.0730)	(0.0591)
Goods exports	0.102***	0.0772***	0.0826***	0.0987***	0.0902***	0.0819***	0.0918***	0.0946***	0.0933***	0.0663***	0.0711***
	(0.0256)	(0.0190)	(0.0189)	(0.0198)	(0.0182)	(0.0178)	(0.0202)	(0.0228)	(0.0267)	(0.0239)	(0.0268)
Service exports	0.103**	0.0830**	0.0658**	0.0586*	0.0494	0.0904***	0.0752**	0.0461*	0.0201	0.00522	-0.00507
	(0.0435)	(0.0333)	(0.0290)	(0.0314)	(0.0350)	(0.0335)	(0.0299)	(0.0253)	(0.0264)	(0.0254)	(0.0257)
Share of foreign firms	-0.0399*	-0.0231	-0.00930	0.0397**	-0.00182	-0.00110	-0.0634	0.0403**	0.0143	0.0152*	0.0133*
	(0.0212)	(0.0159)	(0.0130)	(0.0199)	(0.0376)	(0.0310)	(0.0648)	(0.0171)	(0.00978)	(0.00892)	(0.00797)
Share of skilled workers	0.0612**	0.0328*	0.0334***	0.0806***	0.0659***	0.0513**	0.0818***	0.0650***	0.00827	0.0144	0.0110
	(0.0255)	(0.0182)	(0.0127)	(0.0278)	(0.0240)	(0.0229)	(0.0197)	(0.0232)	(0.00989)	(0.00970)	(0.00846)
R&D expenditure	2.275***	1.655***	1.813***	1.456***	1.440***	1.384***	1.563***	0.638*	0.719**	0.597**	0.561*
	(0.473)	(0.315)	(0.356)	(0.316)	(0.345)	(0.337)	(0.305)	(0.358)	(0.305)	(0.284)	(0.316)
Industrial structure	1.460	0.325	-0.0803	1.054	-0.0245	-0.504	0.372	1.361	0.492	0.425	0.771
	(0.988)	(0.908)	(1.120)	(0.777)	(1.039)	(1.084)	(0.880)	(1.018)	(0.639)	(0.546)	(0.573)
International connectivity	0.264***	0.0785	0.0276	0.0364	0.148**	0.306***	0.288***	0.431***	0.143***	0.126***	0.146***
	(0.0869)	(0.0703)	(0.0670)	(0.0414)	(0.0597)	(0.0880)	(0.0892)	(0.0976)	(0.0405)	(0.0336)	(0.0340)
Sector Size	0.173**	0.127*	0.196***	0.261***	0.284***	0.266***	0.330***	0.287***	0.211***	0.299***	0.296***
	(0.0776)	(0.0739)	(0.0706)	(0.0731)	(0.0749)	(0.0705)	(0.0678)	(0.0599)	(0.0490)	(0.0491)	(0.0483)
Financial incentives								0.328**	0.161**	0.0461*	0.0673***
								(0.140)	(0.0738)	(0.0250)	(0.0221)
Observations	256	256	256	256	256	256	256	256	256	256	256

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Table A14 – First stage Probit regressions for each year *(continued)*

OFDI to High income countries

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Labour productivity	-0.0970	-0.00132	0.0645	0.0336	0.111	0.102	0.138	0.235	0.291***	-0.0169	0.110
	(0.203)	(0.122)	(0.183)	(0.157)	(0.202)	(0.253)	(0.201)	(0.151)	(0.105)	(0.137)	(0.0704)
Goods exports	0.0658***	0.0518***	0.0732***	0.0922***	0.0875***	0.0733***	0.0683***	0.0582***	0.0466**	0.0469**	0.0402**
	(0.0232)	(0.0201)	(0.0208)	(0.0205)	(0.0223)	(0.0214)	(0.0211)	(0.0225)	(0.0207)	(0.0203)	(0.0185)
Service exports	0.0911**	0.0694**	0.0487*	0.0547	0.0408	0.101***	0.0816***	0.0695**	0.0809***	0.0814***	0.0657***
	(0.0395)	(0.0317)	(0.0294)	(0.0351)	(0.0407)	(0.0373)	(0.0307)	(0.0278)	(0.0269)	(0.0249)	(0.0246)
Share of foreign firms	-0.0145	-0.00788	-0.00624	0.0527***	0.0577***	0.0500***	-0.00180	0.0422***	0.0397***	0.0276**	0.0221**
	(0.0195)	(0.0154)	(0.0134)	(0.0139)	(0.0137)	(0.0176)	(0.0565)	(0.0155)	(0.0116)	(0.0137)	(0.00960)
Share of skilled workers	0.0345	0.0293*	0.0405***	0.0968***	0.0914***	0.0478	0.0664***	0.0332*	0.0202**	0.0284**	0.0169**
	(0.0216)	(0.0163)	(0.0144)	(0.0252)	(0.0347)	(0.0354)	(0.0209)	(0.0192)	(0.0102)	(0.0124)	(0.00829)
R&D expenditure	1.234***	1.047***	1.534***	1.424***	1.577***	1.592***	1.590***	0.673**	0.754***	0.680***	0.894***
	(0.340)	(0.327)	(0.321)	(0.332)	(0.347)	(0.344)	(0.312)	(0.338)	(0.290)	(0.256)	(0.257)
Industrial structure	0.702	0.484	0.487	1.248	1.283	0.784	0.968	0.988	-0.252	-0.0684	0.192
	(0.917)	(0.762)	(1.035)	(0.817)	(0.912)	(1.011)	(0.854)	(1.064)	(0.807)	(0.762)	(0.600)
International connectivity	0.132*	0.0949*	0.160**	0.0663	0.156**	0.383***	0.324***	0.447***	0.187***	0.198**	0.161***
	(0.0690)	(0.0535)	(0.0787)	(0.0556)	(0.0762)	(0.117)	(0.102)	(0.103)	(0.0601)	(0.0939)	(0.0582)
Sector Size	0.104	0.0836	0.202***	0.282***	0.337***	0.293***	0.296***	0.282***	0.325***	0.296***	0.261***
	(0.0796)	(0.0741)	(0.0773)	(0.0823)	(0.0840)	(0.0850)	(0.0760)	(0.0630)	(0.0572)	(0.0599)	(0.0527)
Financial incentives								0.302**	0.120**	0.130*	0.0415
								(0.146)	(0.0592)	(0.0714)	(0.0297)
Observations	248	248	248	248	248	248	248	248	248	248	248

Continues next page

Table A14 – First stage Probit regressions for each year *(continued)*

OFDI to Middle income countries

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Labour productivity	-0.302	0.185	0.657	0.614**	0.206	0.642***	0.364**	0.642***	-0.00615	0.0510	-0.000835
	(0.240)	(0.270)	(0.665)	(0.272)	(0.203)	(0.216)	(0.179)	(0.178)	(0.134)	(0.0946)	(0.0636)
Goods exports	0.171***	0.122***	0.0999**	0.0740***	0.0870***	0.0747***	0.0841***	0.0788***	0.0891***	0.0383**	0.0722***
	(0.0357)	(0.0272)	(0.0410)	(0.0226)	(0.0213)	(0.0250)	(0.0283)	(0.0231)	(0.0192)	(0.0185)	(0.0182)
Service exports	0.0696	0.135**	0.274***	0.110**	0.0352	0.0265	-0.0574	0.0224	-0.00706	0.0446*	-0.00330
	(0.0520)	(0.0549)	(0.0775)	(0.0530)	(0.0418)	(0.0536)	(0.0576)	(0.0301)	(0.0272)	(0.0264)	(0.0247)
Share of foreign firms	-0.513	-0.268	-0.189	-0.478**	-0.0725	-0.0768	0.0168	-0.0758	-0.0276	-0.0842*	-0.0696*
	(0.331)	(0.226)	(0.173)	(0.219)	(0.0680)	(0.0974)	(0.0446)	(0.0879)	(0.0402)	(0.0497)	(0.0357)
Share of skilled workers	0.103***	0.114***	0.0141	-0.000645	0.113***	0.0725**	0.0924***	0.0835***	0.0592***	0.0369***	0.0258**
	(0.0362)	(0.0364)	(0.0573)	(0.0324)	(0.0320)	(0.0345)	(0.0235)	(0.0253)	(0.0186)	(0.0142)	(0.0103)
R&D expenditure	2.080***	0.996**	0.970**	1.142***	0.688**	0.736**	1.154***	1.088**	0.883***	0.928***	0.758***
	(0.475)	(0.406)	(0.472)	(0.315)	(0.290)	(0.328)	(0.315)	(0.496)	(0.301)	(0.248)	(0.230)
Industrial structure	0.212	-2.427	-4.292*	0.0285	-2.309*	-1.280	-2.712**	-2.503	0.471	0.323	0.616
	(1.396)	(2.210)	(2.257)	(1.275)	(1.228)	(1.355)	(1.310)	(2.126)	(1.136)	(0.593)	(0.585)
International connectivity	0.0507	-0.0824	-0.155	0.0256	0.0984	0.199**	0.0893	0.219	0.119*	0.138	0.0864**
	(0.117)	(0.0962)	(0.113)	(0.0577)	(0.0789)	(0.0978)	(0.113)	(0.164)	(0.0677)	(0.101)	(0.0405)
Sector Size	0.291**	0.341*	0.496**	0.207	0.314**	0.331***	0.372***	0.410***	0.188**	0.243***	0.236***
	(0.143)	(0.187)	(0.199)	(0.129)	(0.124)	(0.0888)	(0.0732)	(0.0803)	(0.0811)	(0.0775)	(0.0538)
Financial incentives								0.349**	0.299**	0.0738*	0.0744**
								(0.171)	(0.143)	(0.0420)	(0.0349)
Observations	248	248	248	248	248	248	248	248	248	248	248

Table A15 – OFDI and Determinants: Correlation Matrix

	Variables	1	2	3	4	5	6	7	8	9	10	11	12
1	Affiliates abroad	1											
2	Degree of internationalisation	0.17***	1										
3	Labour productivity	0.045**	-0.24***	1									
4	Good exports	0.097***	-0.0067	0.16***	1								
5	Service exports	0.045**	-0.024	0.045**	0.27***	1							
6	Share of skilled workers	0.066***	0.49***	0.038**	-0.049***	0.16***	1						
7	Intramural R&D expenditure	0.22***	0.30***	-0.024	0.034*	0.21***	0.23***	1					
8	Share of foreign firms	0.0010	0.16***	-0.34***	-0.035*	-0.054***	-0.037**	0.064***	1				
9	Flight passengers	0.074***	0.081***	0.039**	-0.0058	0.088***	0.083***	0.15***	0.061***	1			
10	Financial incentives	0.10***	0.049***	0.100***	0.0039	-0.19***	-0.042**	0.051***	0.050***	-0.0021	1		
11	Industrial structure	-0.016	-0.019	0.071***	0.020	0.0064	-0.028	0.010	-0.064***	-0.40***	0.16***	1	
12	Sector Size	0.42***	0.054***	0.094***	0.26***	0.16***	0.070***	0.43***	-0.017	0.12***	0.16***	-0.0038	1

Legend: * p<0.10, ** p<0.05, *** p<0.01
N = 2,816

4. Chapter IV: Outward FDI and skill downgrading in Mexican regions

4.1. Introduction

Domestic firms increasingly invest abroad. The relocation of economic activity is bound to have some effect in the composition of employment at home and the potential consequences may be either positive or negative (Agarwal, 1997; Molnar et al., 2007). Despite the growing body of literature devoted to studying the employment effects of outward foreign direct investment (OFDI) on the home economy, evidence on the net effects is still inconclusive and mainly focused on developed economies (S. O. Becker et al., 2013; Ekholm & Hakkala, 2005; Head & Ries, 2002; Slaughter, 2000). The net home employment composition effects are contingent on a variety of factors, such as type of industry, investment motives and competitive context of host economies, as well as labour market and macroeconomic conditions (Agarwal, 1997). Importantly, the investment motives of OFDI – which are related to the characteristics of the host location— will offer different predictions on its effects since they largely determine the relationship between employment in the parent company and its foreign affiliates and, in particular, about the potential home employment composition effects (Molnar et al., 2007).

In the case of developed countries, although the empirical literature is not conclusive, evidence suggests that whilst OFDI directed to less developed countries is associated with increases in the intensity of skilled labour at home, the effects on skills when OFDI flows to similarly developed countries is rather mixed (Blomström et al., 1997; Braconier & Ekholm, 2000; Brainard & Riker, 1997; Fors & Kokko, 2001; Lipsey, 1999). Nonetheless, since OFDI has been generally thought of as an outcome of economic development (Dunning & Narula, 1996), very little attention has been paid to the OFDI home effects when the investing multinational enterprises are from less advanced economies (Knoerich, 2017). This void is much at odds with the relatively recent expansion of cross-border investments spurring from emerging economies and principally led by the BRICS (e.g. Holtbrügge & Kreppel, 2012; Mathews, 2002b; Padilla-Pérez & Gomes Nogueira, 2015, 2016; Sauvant, 2005) in unison with the increasing importance and complexity of emerging market multinationals (EMNEs) in the global investment landscape (Goldstein & Pusterla, 2010) and their participation in global value chains (Giuliani et al., 2005).

As discussed in Chapter *III*, EMNEs might be at a relative disadvantage in the global markets (Buckley et al., 2007; Child & Rodrigues, 2005). Therefore, investment motives of EMNEs entering more or similarly developed countries will substantively differ from that of their developed country counterparts as they might pursue the acquisition of new knowledge and capabilities in high-income countries (Hoskisson et al., 2004), or they might seek to realise economies of scale and scope in markets with more similar levels of development and institutions (Wright et al., 2005). Evidence on OFDI employment effects in the context of emerging economies is still scant (Debaere et al., 2010), and whether the destination country of OFDI matters for the skill composition of employment in the home country, very much remains an empirical question, especially in the context of emerging economies. Furthermore, the OFDI employment composition effects have seldom been considered at the regional scale. Nonetheless, some evidence suggests that when differences in the degree of internationalisation of subnational labour markets are considered, heterogeneity across industries and regions lead to regional imbalances within a country (Elia et al., 2009; Federico & Minerva, 2008; Gagliardi et al., 2015; Mariotti et al., 2003).

Our primary objective goes beyond national trends as we attempt to explain the subnational variation in employment and skill intensity due to OFDI changes within the regional labour markets in which Mexican MNEs operate. This paper addresses two questions in turn. First, we investigate whether increasing OFDI is associated with changes in the skill composition of local labour markets by shifting the relative demand for certain skills within region-industries. In other words, the extent to which changes in OFDI lead to skill downgrading or upgrading in the relevant local labour markets. Second, we enquire whether the effects on labour demand for different skills vary according to the country of OFDI destination.

Mexico represents a good case to study the home employment effects of outward FDI. It offers particularly interesting insights for three main reasons. First, as we have seen in the Chapters *I* and *II*, as an emerging economy it is still an important recipient of inward FDI; in the meanwhile, many Mexican firms are becoming important investors abroad (Chapter *III*). Second, not unlike Latin American economies, the Mexican labour markets are still very segmented into formal and informal sectors (Perry et al., 2009), and the skills distribution remains highly skewed towards the lower end. Third, the bulk of Mexico's overseas investments is to high-income countries, with an increasing share to middle-income countries; thus, different types of OFDI are expected to have heterogeneous effects at home.

The sample period we used, from 2007 to 2017, includes the transformation of a significant number of Mexican firms that have engaged in a process of internationalisation by establishing affiliates abroad. Results herein suggest that the internationalisation of firms has significant effects on local labour demand. Moreover, the level of development of the destination country has different effects on the composition of home employment: OFDI to high-income economies is associated with skill downgrading in the relevant region-industry. The contributions of this paper are threefold. First, this paper contributes to the rather thin body of literature on the home skill composition effects when investing firms are from emerging countries. Second, by using disaggregated data the paper tries to assess the OFDI employment effects, on the relevant environment, defined both at the sector and regional levels. Third, by considering the country of destination, we are able to estimate separate effects for different types of OFDI attending to different internationalisation strategies. The findings are consistent with the evidence put forward in Chapter *III* that Mexican firms might be relocating the more knowledge-intensive activities to more developed countries.

The remainder of the paper is organised as follows. Section 4.2 offers an overview of theory and evidence on home skill composition effects of OFDI, placing particular attention to divergences in the literature among developed and emerging economies and emphasising on the regional dimension, followed by a set of testable hypotheses for the Mexican case. Section 4.3 lays the ground for the analysis by describing skills and OFDI trends and stylised facts for regions and sectors of origin. Section 4.4 describes the empirical strategy alongside threats to internal validity. Section 4.5 describes the dataset and construction of the variables. Section 4.6 discusses the findings and provides evidence on the consistency and robustness of our results. Section 4.7 concludes.

4.2. Background Literature

Domestic firms may invest at home or abroad. Outward FDI implies that some of the economic activity production and employment takes place abroad instead of at home. Four main effects have been stated to exist for home economies (Barba Navaretti & Venables, 2004; Dunning & Lundan, 2008; Lipsey, 2002); output and employment levels, compositions of skills, technological upgrade, and productivity spillovers. To a certain extent, OFDI home effects depend on whether home and foreign activities are substitutes and complements. The focus of this paper is, in general, employment effects, and in particular changes in the composition of skills. Put differently, we ask to what extent OFDI to different host countries substitutes or

complements different types of labour and lead to changes in the skill composition in the home economies. These overseas investment decisions might have positive or negative effects on the employment composition at home depending on a myriad of factors; namely type of industry, investment motives, competitive context at home and abroad, as well as labour markets and macroeconomic conditions (Agarwal, 1997). In order to make predictions about the possible effects of OFDI on home country labour markets, it is important to first broadly distinguish between different investment motives for OFDI[70], since each will impact differently on the relationship between employment in the parent company and its foreign affiliates and on the overall home employment change (Molnar et al., 2007)

Both the International Economics[71] and the International Business[72] literature are largely based on observations of MNEs in developed countries and assume that firms will internationalise on the basis of competitive advantage that will allow them to compensate for the additional costs and risks associated with operating abroad (Child & Rodrigues, 2005). The expansion of emerging-to-developed and emerging-to-emerging FDI flows, together with the increasing size and complexity of EMNEs (Goldstein & Pusterla, 2010), especially from East Asian countries since the 1990s, spurred a competing set of theories that has posed that firms based in emerging or developing economies are at a relative disadvantage in the global markets (Buckley et al., 2007; Child & Rodrigues, 2005). Furthermore, the participation of EMNEs in Global Value Chains (GVC) has become increasingly common as a channel for technological catch-up (Amighini et al., 2010; Pietrobelli & Rabellotti, 2011). EMNEs represent a very unique case and OFDI from emerging economies is a relatively new phenomenon. The literature has devoted considerably less attention to the features of internationalisation strategies concerning (i) firms from emerging economies entering developed economies, and (ii) firms from emerging economies entering other emerging countries (Wright et al., 2005). We aim to fill in this gap by

[70] Two strands of literature have studied the drivers of OFDI by multinational enterprises; International Economics and International Business. We compare both literatures along the paper.

[71] International Economics has distinguished between vertical and horizontal FDI by including proximity to demand and lower factor costs as determinants of investment flows across international boundaries (Barba Navaretti & Venables, 2004; Caves, 1974; Markusen, 2002). Contemporary firms engage in a mixture of both kinds of outward investment, suggesting that the organisation of MNEs has become increasingly more complex, and the distinction between horizontal and vertical FDI is rarely clear cut (Neary, 2009; Yeaple, 2003). Nonetheless, this dichotomous categorisation will allow us to distinguish between broad types of OFDI according to the level of economic development of the investments' destination: high-income or middle-income countries

[72] International Business scholars have identified different MNE activities based on the motivation of the investments according to the locational advantage offered by the host economy (Dunning, 1993; Dunning & Lundan, 2008). Classifying MNEs according to their activities has become increasingly difficult and thus any empirical study incurs in the risk of oversimplification. Nonetheless, in order to tackle the issue at hand we borrow a simplified version of MNEs' activities classification that broadly fits Mexican OFDI. A complete summary can be found in (Iammarino & McCann, 2013).

providing evidence on home employment and skill effects when Mexican OFDI is directed towards more developed (high-income) and equally developed (middle-income) countries.

4.2.1. Home skill composition effects

The investment motive of OFDI will offer predictions regarding whether production in foreign affiliates is a substitute or a complement to home-country production by the parent firm or by other home-country firms (Lipsey, 2004). OFDI may have both job-diverting and job-creating effects in the home labour market. Beyond the net effects on levels of employment, the relocation of activities to foreign locations will tend to have a skill composition effect at home. The effect of overseas investment on the skill intensity of the domestic workforce will depend on the type of OFDI, and ultimately on the stage of production relocated overseas as well as the relative factor abundance, both at home and abroad (Agarwal, 1997; Molnar et al., 2007).

Vertical FDI flows will prevail when countries differ in terms of market size and skill endowments, therefore fragmenting the stages of production across locations according to factor price differentials (Barba Navaretti & Venables, 2004; Caves, 1974; Markusen, 2002). This type of investment has been considered to arise from efficiency-seeking MNEs, aiming to integrate global value chains across locations often at different stages of economic development (Dunning, 1993; Dunning & Lundan, 2008). Typically, OFDI from a home country with a high relative endowment of high-skilled workers will relocate lower-skilled labour-intensive activities. This is likely to increase employment in high-skilled activities at home such as business services and headquarters, at the expense of low-skill jobs (Helpman & Krugman, 1985), and might lead to skill upgrading.

Strategic-asset seeking MNES the firm's motive is to strengthen its technological capabilities by acquiring overseas firms thus gaining access to knowledge-intensive assets (Dunning, 1993; Dunning & Lundan, 2008). Further theoretical work shows that a technologically-lagging firm, may choose to enter a market via FDI in order to access positive spillover effects arising from close locational proximity to a technological leader in the host country (Fosfuri & Motta, 1999; Siotis, 1999). Evidence has confirmed that R&D expenditure differentials across countries may explain FDI flows (Cantwell, 1995; Cantwell & Janne, 1999), thus confirming that technology sourcing may be a motive for OFDI. In this case, to the extent that high skill- and knowledge activities are undertaken in foreign affiliates, a reverse effect on skill is possible and the demand for high-skilled labour might be decreased leading to skill downgrading at home, at least in the short run (Grossman & Helpman, 1991).

Horizontal FDI flows will dominate when both home and host countries have similar market size and labour skill endowments, hence producing similar outputs in both locations to save in export costs and exploit demand differentiation (Barba Navaretti & Venables, 2004; Caves, 1974; Markusen, 2002). MNEs are driven to establish presence abroad to exploit markets, industry structures, and institutional settings in locations with similar levels of economic development (Dunning, 1993; Dunning & Lundan, 2008). The effects of this type of OFDI might have ambiguous effects on skill intensity at home, and will depend on the scope and stage of the production process of the parent companies being replicated abroad (Agarwal, 1997; Head & Ries, 2002). One possibility is that foreign affiliates replicate all parent firm activities, hence employment creation for all types of workers will tend to be weaker at home. A second possibility is that affiliates abroad only undertake the final stage of the production process to meet foreign market growth; exports of intermediate goods and services produced at home will rise, leading to an increase in the demand for workers employed in these stages. Still, a third possibility exists if instead goods and services produced by foreign affiliates are imported back home, in which case domestic employment in such activities will decrease.

Most empirical evidence on skill composition effects in the home economy is mainly for developed countries. By large these studies measure skill intensity by computing the wage bill share of different types of workers relative to total wages at different levels of aggregation or the analogous contribution in terms of employment (see for a review of empirical literature Crinò, 2009). These effects have been found to depend on the degree extent of complementarity or substitutability of employment at home or abroad, which in turn depends on the income level of the OFDI destination country (Harrison et al., 2007; Harrison & McMillan, 2006). Whereas most findings suggest that OFDI directed to less developed countries is associated with increases in the intensity of skilled labour at home –at the expense of the unskilled— the evidence on home skill effects is rather mixed when OFDI flows to similarly developed countries (Blomström et al., 1997; Braconier & Ekholm, 2000; Brainard & Riker, 1997; Fors & Kokko, 2001; Lipsey, 1999).

At different levels of aggregation evidence seems less conclusive. For instance, at the industry level, Slaughter (2000) found that MNE employment transfer to foreign affiliates did not contribute to skill upgrading in the USA, thence suggesting that OFDI does not substitute for low-skilled-labour-intensive home industries. In a similar vein, Spanish OFDI to non-EU developing countries led to no significant changes in the share of skilled labour, whereas investment to similarly developed EU countries shows a positive effect on skilled employment (Bajo-Rubio & Díaz-Mora, 2015). At the micro level, in general evidence shows that OFDI to

less developed economies lead to a positive effect on the share of high-skilled workers at the expense of low-skilled employment, while OFDI to similarly developed countries do not have significant effects in the skill intensity of the domestic labour demand (Ekholm & Hakkala, 2005; Hakkala et al., 2010; Hummels et al., 2014; Laffineur & Gazaniol, 2019). At the firm level, evidence is somewhat consistent with the result that OFDI to less developed economies leads to skill upgrade (S. O. Becker et al., 2013; Castellani et al., 2008; Head & Ries, 2002).

4.2.2. Emerging economy home skill composition effects

As mentioned briefly before and at length in Chapter *III*, EMNEs represent a very unique case and OFDI from emerging economies is also a relatively new phenomenon. Whilst predictions on skill composition effects are linked to the motivation of the investment, these are largely based on MNEs from developed countries, which are bound to be different from their emerging country counterparts (Child & Rodrigues, 2005; Hoskisson et al., 2013; Wright et al., 2005), and therefore the home skill composition effects might take different forms.

EMNEs aiming to improve their competitiveness are likely to enter developed countries for acquiring new resources, knowledge and capabilities (Hoskisson et al., 2004). Therefore, OFDI towards in more advanced countries, via the acquisition of firms that possess sophisticated technologies and knowledge, might ensue from the need to address a relative weakness in the innovation systems at home (Luo & Tung, 2007). Furthermore, EMNEs will pursue investment in developed economies due to the possible benefits that accrue to firms entering these hosts: enhanced learning opportunities, lower levels of institutional risk and greater market potential (Yamakawa et al., 2008). This might also reflect upgrading efforts in GVC by integrating different stages of production across different locations (Giuliani et al., 2005). The employment effects of this type of OFDI on the home country could potentially lead to a contraction in the demand for high-skilled labour, resulting in skill downgrading, at least in the short-run. Nonetheless, since these investments are made to tap into the knowledge of the host locations, the eventual result could translate into faster technical change and productivity growth in the home country and a higher level of economic activity and employment (Amiti & Wei, 2005; Grossman & Helpman, 1991). Although this might only hold for the individual parent firm as its technological capabilities improve, the 'reverse spillover' effect to the wider home environment is not automatic as it requires substantive efforts and resources from all the incumbent firms in order to materialise (Chen et al., 2012).

At the same time, EMNEs might also invest strategically in other emerging economies (Cuervo-Cazurra & Genc, 2008). It has been argued that EMNEs may have a competitive disadvantage

in entering developed countries, but may be at an advantage in entering economies with similar economic environments and institutions (Hu, 1995). This might be due to their resources being more readily applicable in settings similar to home, hence facing lower 'liability of foreignness cost (Zaheer, 1995). EMNEs may be more adept at operating in riskier institutional environments (Cuervo-Cazurra & Genc, 2008), while being able to successfully realise economies of scale and scope in these emerging markets (Wright et al., 2005). As suggested above for the case of developed country horizontal/market-seeking OFDI, the outcome is ambiguous since the effects of this type of investment again depend on the extent of delocalisation of economic activity, structural features of local labour markets and industries.

As far as developing or emerging countries go, even less evidence can be found on OFDI and its effects on home employment and skills, with a few exemptions that we found in the extant literature. Evidence from a low-cost transition economy shows that OFDI to countries with similar economic development levels, lead to expansion of Estonian employment (Masso et al., 2007). In a similar way, China's OFDI to other similarly or less developed economies, had a positive effect on home employment growth during the 1982-2007 period (Liu & Lu, 2011). Additionally, some evidence has been put forward on the case of small developing economies: survey results from Padilla-Pérez and Gomes Nogueira (2016) show that investing abroad has had a positive effect on employment growth in Costa Rica. With market-seeking as their main strategy, Costa Rican firms are increasing their operations at home. Finally, South Korean OFDI to more advanced countries do no show a consistent tendency and, in most instances, there is no significant impact on employment (Debaere et al., 2010). However, when considering South Korean investments to Japan, the labour demand has shifted away from high-skilled towards low-skilled workers (Ahn et al., 2008).

4.2.3. 'Home' region skill composition effects

As it was stressed in Chapter *III*, the influence of the home subnational region may shape firms' internationalisation strategies. The evidence we put forward, suggests that firms' response to local structural and policy determinants vary when engaging in different internationalisation strategies. In general, OFDI home effects have rarely been considered at the regional level, perhaps due to lack of measures of regional degree of internationalisation (Castellani & Pieri, 2016). By the same token, the regional employment and skill composition effects of OFDI have received considerably less attention (Mariotti et al., 2003), despite the fact that such level of aggregation allows to capture the total effect of OFDI, which includes the direct effect on the parent company and the indirect effect on the relevant industry and business environment. By

combining the region and industry dimension, a 'region-industry' can be defined as the ensemble of firms operating in the same industrial sector, which is constituted by interdependent sectors that belong to the same industrial *filière* and are collocated in the same geographical region (see Elia et al., 2009; Mariotti et al., 2003). Moreover, spatial heterogeneity in economic outcomes within a country is a common feature around the world and local labour markets are characterised by differences in wages, productivity and innovation (Moretti, 2010). Furthermore, employment shocks tend to be persistent over time, and they are often region- and industry-specific (T. E. Clark, 1998).

By considering local labour markets, Gagliardi et al. (2015) have documented that the relocation of UK employment abroad generates significant job losses in routine occupations in regions with higher OFDI irrespective of whether the destination of the investments are developed or emerging economies. However, OFDI to these host countries had a positive effect on the generation of high-skilled jobs. Furthermore, by adopting a region-industry unit of analysis, Marriotti et al. (2003) show that for the Italian case in in the period 1985-95, increases in foreign employment to less developed economies, chiefly characterised by lower labour costs, reduced the demand for domestic employment. Interestingly, for the subsequent five-year period (1996-2001) and with a slightly different methodology, Federico and Minerva (2008) found no evidence suggesting a negative impact of OFDI, including towards less developed countries, on domestic employment growth. On the contrary, employment increased more in local areas with higher overseas investment. Conversely, Elia et al. (2009) find that both OFDI to high- and low- income countries have a negative impact on the demand for low-skilled workers. Furthermore, the effect is also negative for high-skilled workers, when the overseas investment goes to high-income countries.

4.2.4. Hypotheses

Empirical evidence on OFDI home employment effects in the developed world is far from conclusive suggesting that the net effects are case-specific and contingent on a variety of factors. Moreover, results seem to be sensitive to the level of aggregation. In sum, there seems to be a serious imbalance on the availability of evidence regarding OFDI employment and skill composition effects in general at the regional level, and even more so when the investments originate in less developed or emerging countries. The multinational phenomenon has a relatively young trajectory in economies at earlier stages of development; particularly, for Mexican MNEs, this trend kickstarted only in the early 2000s. This also means that disaggregated data might not be readily available for some of these countries. To the best of our

knowledge, this is the first paper to look at the employment composition effects of OFDI in Mexico and the wider Latin American region. Furthermore, we go beyond national trends and zoom in to a fine-grained level and study region-sector labour markets.

Taken all together, we draw on the theoretical work and extant empirical evidence on OFDI home effects and EME's behaviour to elaborate a set of testable hypotheses regarding our expectations for Mexican subnational region-sectors, these are summarised in Figure 19 below. The main purpose of this paper is to investigate to what extent domestic employment with different skill levels is being substituted through increasing investment abroad in different types of destination, and whether these changes have skill downgrading or upgrading effects in the relevant local labour markets and industrial sectors. Considering that Mexico is a middle-income country, we formulate the following hypotheses:

H1: Middle- to high-income OFDI. OFDI to high-income economies might embody strategic asset-seeking (or technology-sourcing) internationalisation strategies by Mexican MNEs pursuing active participation in GVC. In as much as the bulk of knowledge-intensive stages of the production process are carried out abroad, the demand for high-skilled labour at home will tend to decline, whereas the demand for low-skilled labour will increase. This type of OFDI will have an overall skill downgrading effect:

H1A. Increases in OFDI to high-income countries will decrease the intensity of high-skilled labour in the relevant region-sector labour market.

H1B. Increases in OFDI to high-income counties will increase the intensity of low-skilled labour in the relevant region-sector labour market.

Figure 19 – Diagram: Expected signs on estimated OFDI employment effects

	High-skilled labour	**Low-skilled labour**
OFDI from middle- to high-income	(–)	(+)
OFDI from middle- to middle-income	(?)	(?)

H2: Middle- to middle-income OFDI. OFDI to middle-income economies might reflect Mexican MNEs engaging in market-seeking internationalisation strategies in order to realise economies of scale and scope in similarly developed countries. Skill effects at home will depend on the extent of the relocation of production stages. If investments replicate all activities along the value chain, then demand for both low- and high-skilled labour will

decline at home, but relative labour demands will remain unchanged; neither upgrading nor downgrading of skills. If, however, only the final production stage is relocated to serve the foreign market, and upstream activities are concentrated at home, then demand for high-skilled labour will rise at the expense of low-skilled; this could result in skill upgrading. This type of OFDI will have ambiguous effects on the relative demand for skills:

H2A. Increases in OFDI to emerging middle-income countries will increase/decrease the intensity of high-skilled labour in the relevant region-sector labour market.

H2B. Increases in OFDI to middle-income countries will increase/decrease the intensity of low-skilled labour in the relevant region-sector labour market.

The following section lays the ground for the analysis by providing some stylised facts of the Mexican context at the region and industry sector levels and describing the recent temporal trends.

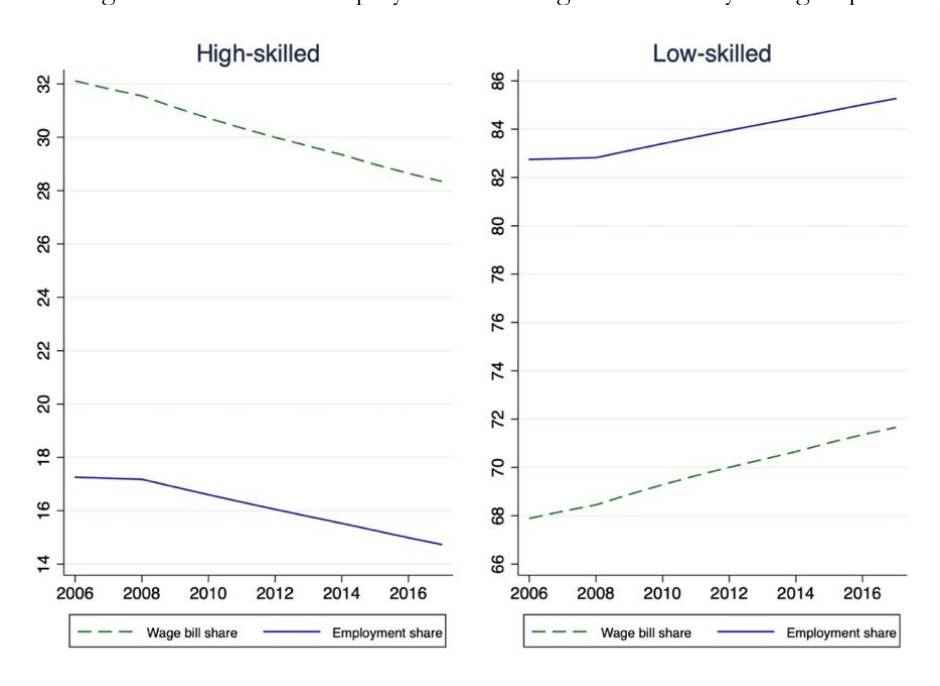
4.3. Skills and OFDI: stylised facts and trends

4.3.1. Skills

Trade liberalisation since the late 1980s brought about the expansion of the export-oriented (manufacturing) industries that were more reliant on skilled labour. This in turn, induced a higher demand for high-skilled labour relative to lower skills (Cortez, 2001; Meza, 1999). Increases in skilled-biased FDI in the wake of NAFTA, further increased the relative wages for high-skilled workers (Feenstra & Hanson, 1997). The rapid economic restructuring tended to favour the demand for higher-order skills, such as professionals and managers (Cragg & Epelbaum, 1996). However, during the late 1990s and especially in the early 2000s, the relative wage for high-skilled labour began a downward trend (Airola & Juhn, 2008). Two effects are possibly behind this trend. First, initial increases in the high-skill premium lead to a rising supply of these type of workers, thus lowering their relative wages (Montes Rojas, 2006). Second, Mexico's North American trading partners are more high-skill intensive. Increasing trade with these countries might have caused a demand shift towards low skilled workers (Robertson, 2004). Figure 20 plots national employment and wage bill shares both for high and low skilled workers from 2006 to 2017. A quick glance reveals that the proportion of low-skilled employment has been steadily rising, while the share of high-skilled jobs declined in almost 2.5 percentage points during the same period. Similarly, the share of the wage bill has increased for low-skilled workers, whereas high-skill workers have seen their wage share diminish in 3.8

percentage points during this decade.

Figure 20 – Mexico: Employment and Wage bill shares by skill group



Source: Author's own elaboration with data from INEGI. Note: Wage bill share is the proportion of skilled/unskilled wages over total wages; employment share is calculated analogously

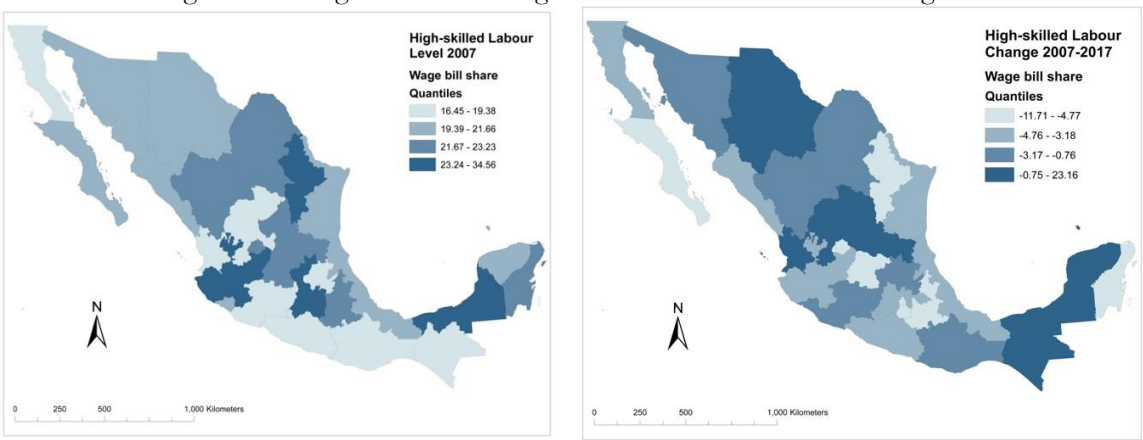
Despite some improvements, workers still have low educational levels (Cortez, 2001). Mexico's educational attainment increased steadily after the 1970s. A relatively rapid catch up until the 1990s was the result of increases in the coverage of basic education and the reduction of primary school dropout rates (López-Acevedo, 2006). However, educational attainment has continued to lag behind, thus remaining below the international trend line. Only 63 percent of the adults have attained lower secondary education; and the proportion of those who have attained at least upper secondary education is as little as 37 percent (OECD, 2014).

Our primary objective goes beyond these national trends as we attempt to explain the subnational variation in employment and skill intensity due to OFDI changes within the regional labour markets in which Mexican MNEs operate. The spatial distribution of labour by skill group across Mexican regions[73] is highly unequal. We first look at wage bill shares to approximate the intensity of high-skilled labour relative to total wages. At the beginning of our study period, the highest wage bill shares for high-skilled workers where located largely in some

[73] By region we refer to *estado*. There are 32 *estados* including Ciudad de Mexico. These constitute the second administrative level above municipalities and below federal government. A labelled map of these regions can be found in Figure A10 in the Appendix, Chapter *III*.

of the most developed regions, including Ciudad de Mexico, Jalisco, Nuevo Leon and Querétaro (see panel (a) of map in Figure 21).

Figure 21 – Wage bill share for *high-skilled* labour across Mexican regions

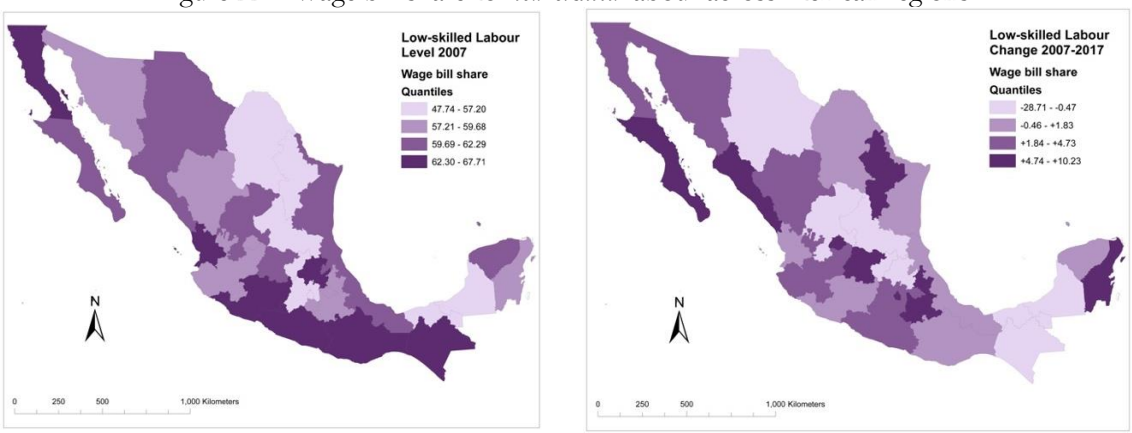


(a) Base year level 2007 (b) Change 2007-2017

Source: Authors' own elaboration on data from INEGI (2004, 2009, 2014)

Ten years later, only 10 out of 32 regions of the Republic experienced increases in this share, while the rest experienced declines (panel (b) in Figure 21); high-performing Nuevo Leon and Ciudad de Mexico had among the largest contractions in the intensity of high-skilled labour, but also mid-performing regions like Guanajuato and Aguascalientes suffered declines in this ratio. The corresponding wage bill shares for low-skilled labour follow the opposite patterns —since the sum of both shares equals 100— both for levels in the baseline year and changes throughout the decade (see the complement maps in Figure 22).

Figure 22 – Wage bill share for *low-skilled* labour across Mexican regions



(a) Base year level 2007 (b) Change 2007-2017

Source: Authors' own elaboration on data from INEGI (2004, 2009, 2014)

If we turn to employment shares by skill-group, the spatial distribution of these also follows a similar pattern to that of wages; however, changes between 2007 and 2017 are smaller in magnitude. High-skilled employment shares declined in most of the regions, with the exception of Campeche, Chihuahua and Durango (map in Figure A13, Appendix). The corresponding employment shares for low-skilled labour follow the opposite patterns (map in Figure A14, Appendix). In sum, the average region experienced skill downgrading; i.e. increases in the relative demand of low-skilled employment at the expense of high-skilled labour.

We now look at the sectoral trends at the national level, bearing in mind that our primary unit of analysis is the region-sector. In order to capture inter-industry heterogeneity, we disaggregate our variables into 13 macrosectors.[74] Table 14 gives a detailed characterisation of macrosectors in terms of total employment and shares of high-skilled employment and wages. The figures for low-skilled workers are omitted since they are the complement of high-skilled labour. We first turn to the sectors' importance in terms of total employment levels and growth (columns 1 to 3). National job growth was 14.5 percent between 2007 and 2017.

The largest macrosectors in terms of employment are Specialised and General services, each with around one fifth of the total employment; both experiencing employment growth during the study period. As a whole, the Services sector accounts for around 40 percent of the national employment in 2017. Low-tech and Medium-high-tech manufacturing each account for roughly 10 percent of the total employment. While the former shrank during the ten-year period, the latter grew in terms of jobs.[75] Medium-low tech and High-tech manufacturing both slightly decreased in size but maintained a relatively stable share of 5.2 and 3.5 percent respectively. In 2017; manufacturing as a whole accounted for 28 percent of total employment; Retail trade decreased to 13.6 percent of the employment, while Wholesale trade grew to 7.2 percent (together they add up to one fifth of the national employment). The main feature of the last decade is an increase in the importance of job creation in the Services sector at the expense of Manufacturing activities.

[74] A full list of the industries each macrosector contains can be found in Table A16 in the Appendix. Since we are interested in explaining variation in skill-intensity, in this paper, we breakdown manufacturing into four categories according to technological intensity, in order to capture greater heterogeneity within the manufacturing sector. We have 13 macrosectors as opposed to 8 in Chapter *III*.

[75] It is worth mentioning that this macrosector includes the automobile industry, which is a relevant industry for the country in terms of GVA and exports.

Table 14 – Employment and skill intensity by macrosector: Levels and changes 2007-2017

				High-skilled labour					
	Total employment share			Employment share			Wage bill share		
	2007	2017	Δ	2007	2017	Δ	2007	2017	Δ
Macrosector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Specialised Services	17.3	21.8	4.5	22.9	20.5	-2.4	40.2	32.4	-7.8
General Services	18.2	18.9	0.7	15.2	7.2	-7.9	25.2	13.1	-12.0
Retail Trade	14.9	13.6	-1.2	13.5	8.2	-5.3	19.7	14.8	-4.9
Low-tech Manufacturing	12.5	10.2	-2.3	14.6	14.1	-0.5	29.7	27.1	-2.6
Medium-high-tech Manufacturing	7.7	8.9	1.2	19.3	16.2	-3.0	42.0	31.1	-10.9
Wholesale Trade	6.3	7.2	0.9	21.0	21.2	0.3	27.7	30.8	3.0
Medium-low-tech Manufacturing	5.5	5.2	-0.2	16.5	16.3	-0.1	35.2	33.5	-1.7
Transportation and Warehousing	4.5	4.3	-0.2	21.5	21.2	-0.4	23.3	24.7	1.3
High-tech Manufacturing	3.6	3.5	-0.1	13.5	16.1	2.7	22.7	31.8	9.1
Construction	5.3	2.7	-2.6	14.1	17.7	3.6	27.1	22.1	-5.0
Utilities	2.9	1.6	-1.3	18.4	16.7	-1.7	22.9	13.9	-9.0
Mining, Quarrying, and Oil and Gas Extraction	0.9	1.3	0.4	20.4	19.9	-0.5	48.2	61.3	13.0
Agriculture, Forestry, Fishing and Hunting	0.4	0.7	0.3	8.9	5.6	-3.3	14.5	10.2	-4.3

Source: Author's own elaboration on data from INEGI (2004, 2009, 2014)

Notes: Columns (1)-(2) show the macro-sectors shares of national employment, column (3) its changes. Columns (4)-(6) are the employment share of high-skilled labour and its changes, while columns (7)-(9) are the corresponding wage bill shares. Data in descending order by change by total employment share in 2007.

Regarding the reliance of these macrosectors on high-skilled labour, we look at wage bill (columns 7 to 9) and employment shares (columns 4 to 6) of high-skilled workers and their change. In 2017, the largest high-skilled wage bill shares in were in the Mining and oil extraction, all subsectors of Manufacturing, Specialised services Wholesale trade; while the lowest shares were in Agriculture, General services, Utilities and Retail trade. High-skilled wage bill shares for labour declined for all macrosectors, with the exception of Mining and Oil extraction, High-tech manufacturing, Wholesale trade, Transportation and warehousing. Regarding the employment shares, the largest high-skilled employment shares are found in Wholesale trade, Transportation and warehousing, Specialised services and Mining and oil extraction. On the opposite end, the lowest shares are found in Agriculture, General services, Retail trade and Low-tech manufacturing. High-skilled employment shares declined for all macrosectors except for Construction, High-tech manufacturing and Wholesale trade.

In sum, the high-skill intensity has declined for most of the macrosectors, both in terms of employment and wage bill shares. This means that, with some exceptions, employment and wage growth have been driven by increaseseas in the low-skilled labour intensity. From Table 14, it can be inferred that most of the inter-industry restructuring in the past decade has been via adjustment in wages, as suggested by the considerably larger changes in wages compared to employment.

4.3.2. Outward FDI

Mexican outward FDI stocks have been rising steadily since the early 2000s. In 2016, the outward FDI stock was around 150 billion US dollars. Not only has the investment of Mexican firms abroad has risen substantially in the last two decades, but its relative importance to the country's GDP has also increased reaching 14.2 percent of GDP in 2016 (see Figure 15 in Chapter *III*). At present, there are no publicly available government figures on regional outward FDI in Mexico. Like in Chapter *III*, we use the ORBIS (Bureau Van Dijk) historical ownership database to construct our measure of regional OFDI, as the number of affiliates established abroad owned by parent companies based in Mexican regions. Details on the cleaning of the raw data and construction of the variable are given in subsection 4.5.2.

OFDI regional trends were described at length Chapter *III*. We just briefly summarise the main features. In 2007, Ciudad de Mexico and Nuevo Leon concentrated 92 percent of the affiliates abroad. Ten years later, many more regions increased their absolute internationalisation (see maps in Figure A15 in the Appendix). The spatial distribution, although still highly concentrated is far more spread; whilst 41 percent of the affiliates abroad are owned by parent firms located

in Ciudad de Mexico, the next 44 percent is owned by Nuevo Leon and Jalisco, with the remaining 15% distributed among 29 regions. Even though their share in the total number of affiliates is relatively small, we can identify new regional players that have become more competitive over time and are striving to engage in active internationalisation by increasing their overseas investments. Notable examples are Guanajuato, Queretaro, Puebla and Durango.

The distribution of affiliates abroad at the national level by macrosector of origin can be seen in Table 15, which shows the count of firms established abroad during the 2007-2017 period, both in levels and change[76]. In 2017, the macrosector with the largest share is Specialised services with 47 percent of the affiliates abroad. Manufacturing all together accounts for 44.7 percent, with highest shares in Medium-low- (26.8) and Low-tech (13.8) manufacturing activities. Wholesale trade represents 3.4 percent of the affiliates abroad and Medium-high-tech manufacturing adds 3.7 percent. These five macrosectors concentrate 94.7 percent of the investment overseas, as measured by the number of affiliates abroad in 2017. The largest absolute changes in OFDI were mainly driven by the internationalisation of firms within these macro-sectors.

Table 15 – Affiliates abroad by macrosector of origin: Levels and change, 2007-2017

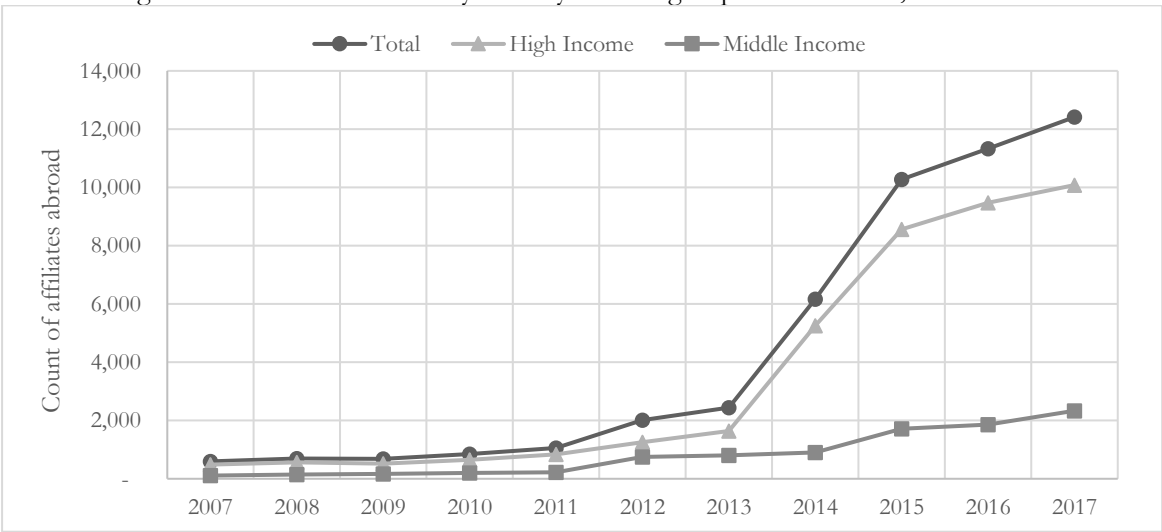
Macrosector	**Count 2007**	**Count 2017**	**Change**
Specialised Services	62	5,831	5,769
Medium-low-tech Manufacturing	354	3,326	2,972
Low-tech Manufacturing	39	1,710	1,671
Medium-high-tech Manufacturing	8	464	456
Wholesale Trade	12	425	413
Transportation and Warehousing	5	149	144
Retail Trade	7	122	115
General Services	5	96	91
Construction	19	98	79
Mining, Quarrying, and Oil and Gas Extraction	80	132	52
High-tech Manufacturing	6	48	42
Agriculture, Forestry, Fishing and Hunting	0	10	10
Utilities	0	4	4
Total	**597**	**12,415**	**11,818**

Source: Author's own elaboration on data from ORBIS, Bureau Van *Dijk*
Notes: Descending order by Change

[76] Data on OFDI might slightly differ from that one used in Chapter *III* since we were able to recover some information from the ORBIS database when disaggregating Manufacturing in technological intensity groups.

Finally, we are also interested in asking whether OFDI employment and skill effects at home differ according to the destination of the investments. In other words, we study the link between employment growth at home and MNEs' decisions to invest in either more or equally advanced economies. We characterise the type of OFDI by world income group-country of destination.[77] Mexico is considered a (upper) middle-income economy; destination countries are grouped into high-income (more advanced) and middle-income (equally advanced). An average of 80 percent of the Mexican-owned foreign affiliates have established presence in high-income countries, mainly the United States, Spain, Germany, Austria and United Kingdom (for individual country shares see Table A9 in the Appendix, Chapter *III*). Middle income countries are host to an average of 20 percent of these affiliates. The main recipient countries are primarily Latin American; Brazil, Colombia, Argentina, Chile and Peru. Our measure of OFDI exhibits an increasing trend (see Figure 23). This increase is mainly driven by foreign affiliates located in high-income countries. However, the number of overseas firms in middle-income countries has been steadily rising since 2012.[78]

Figure 23 – Affiliates abroad by country-income group of destination, 2007-2017



Source: Author's own elaboration on data from ORBIS, Bureau Van ***Dijk***

[77] This criterion groups countries in four brackets of GNI per capita The World Bank establishes the different thresholds for every fiscal year. We use the 2017 Gross National Income in US Dollars thresholds: Low income (<= 1,025); Lower middle income (1,026 - 4,035); Upper middle income (4,036 - 12,475); and high income (> 12,475). We end up with two distinct groups; high income and middle income. We combine Lower middle and Upper middle income into one category due to very few firms going to Lower middle income countries. Finally, although some affiliates are established in Low income countries, but they had missing values and hence were excluded.

[78] We validate our data with an additional external source. We compare our ORBIS data with the regional distribution of Mexican OFDI stock across host countries in the International Trade Centre (ITC) Market Analysis Tool. Reassuringly, we confirm the regional distribution and the temporal trends.

4.4. Empirical Strategy

4.4.1. Model Specification

OFDI implies the relocation of employment and the moving of certain stages of production abroad. According to the literature reviewed above, the type of investment will have differentiated effects on the relative demand for some skill groups at home. A widely used approach to empirically assess the relationship at hand is estimating the conditional demands for high- and low-skilled employment at home (R. B. Davies & Desbordes, 2015; Ekholm & Hakkala, 2005; Elia et al., 2009) or the relative demand for high-skilled workers alone (Head & Ries, 2002; Slaughter, 2000). Since OFDI from developed countries has been assumed to shift the relative demand for skilled labour outwards, this effect has been usually modelled as a skilled-bias technological change (Crinò, 2009).

We borrow from these empirical studies and use a cost minimisation problem for the typical firm as the underlying theoretical model. Consider a firm operating in sector k, located in region s in a given time period t. For simplicity in the model derivation we omit said subscripts. The optimisation problem facing the firm can be stated as follows,

$$\min_{\boldsymbol{x}} \mathcal{C} = \sum_{i=1}^{n} x_i w_i$$

$$\text{s.t.} \quad Y = f(x_1, \dots, x_n)$$

where the total cost $\mathcal{C}$ is the sum of inputs x_i multiplied by their respective price w_i for all factors of production $i = 1,2, \dots n$. The objective function is linear, additive and homogeneous in prices. The total cost function is subject to a level of output Y, which, in turn, is a function of the inputs. Optimising this problem yields a dual minimum cost function which indicates the cost of production when the cost-minimising combination of inputs $\boldsymbol{x}^*$ is used:

$$\mathcal{C}^* = f(Y, w_1, \dots, w_n)$$

It is a function of the level of output and the factor prices. Without loss of generality, we aggregate the individual firm's cost function across all firms in sector k, region s and year t. Then, we work out the first order partial derivatives of the short-term translog cost function[79] by differencing with respect to the price of input i, which by the Shepherd's lemma, yields the cost share or conditional demand for input i;

$$\frac{\partial \ln(\mathcal{C}^*)}{\partial \ln(w_i)} = x_i(w_i, Y) = S_i$$

[79] See Technical note on translog cost functions at the end of the Appendix.

Thus, we obtain the following expression for the relative demand of high-skilled labour, $\mathcal{H}$:

$$\mathcal{S}_{\mathcal{H}} = \alpha_{\mathcal{H}} + \beta_{\mathcal{H},\mathcal{L}} \ln\left(\frac{w_{\mathcal{H}}}{w_{\mathcal{L}}}\right) + \beta_{\mathcal{H},\mathcal{Y}} \ln \mathcal{Y} + \beta_{\mathcal{H},\mathcal{K}} \ln \mathcal{K} + \sum_{z=1}^{Z} \beta_{\mathcal{H},z} \ln z$$

Analogously, we obtain the relative demand for low-skilled labour, $\mathcal{L}$:

$$\mathcal{S}_{\mathcal{L}} = \alpha_{\mathcal{L}} + \beta_{\mathcal{L},\mathcal{H}} \ln\left(\frac{w_{\mathcal{H}}}{w_{\mathcal{L}}}\right) + \beta_{\mathcal{L},\mathcal{Y}} \ln \mathcal{Y} + \beta_{\mathcal{L},\mathcal{K}} \ln \mathcal{K} + \sum_{z=1}^{Z} \beta_{\mathcal{L},z} \ln z$$

The outcome variables $\mathcal{S}_{\mathcal{H}}$ and $\mathcal{S}_{\mathcal{L}}$ are the wage bill share of high- and low-skilled workers respectively. As in Adams (1999), we assume for region-sectors a quasi-fixed cost function with two variable inputs; low-skilled labour $\mathcal{L}$ and high-skilled labour $\mathcal{H}$. Because of their slower rate of adjustment capital $\mathcal{K}$ is considered to be a quasi-fixed factor. Output $\mathcal{Y}$ represents the scale of the region-sector. Finally, vector $z = 1, \dots, Z$ includes a number of shift factors that can affect total costs and thus optimal skills labour demand. For our purposes, said vector includes our main regressor, OFDI, plus total goods exports, total service exports and a proxy for technology.

As mentioned before, our unit of analysis is the 'regional industry' defined in subsection 4.2.3. For region s, sector k and year t, we estimate the following augmented cost (wage) share equations;

$$\mathcal{S}^{\mathcal{H}}_{skt} = \alpha^{\mathcal{H}}_{sk} + \beta^{\mathcal{H}}_{1} \ln \mathcal{OFDI}_{skt-1} + \beta^{\mathcal{H}}_{2} \ln\left(\frac{w_{\mathcal{H}}}{w_{\mathcal{L}}}\right)_{skt-1} + \beta^{\mathcal{H}}_{3} \ln \mathcal{Y}_{skt-1} + \beta^{\mathcal{H}}_{4} \ln\left(\frac{\mathcal{K}}{\mathcal{Y}}\right)_{skt-1} + \sum_{z=1}^{Z} \beta^{\mathcal{H}}_{z} \ln z_{skt-1} + \delta_t + u^{\mathcal{H}}_{skt}$$

$$\mathcal{S}^{\mathcal{L}}_{skt} = \alpha^{\mathcal{L}}_{sk} + \beta^{\mathcal{L}}_{1} \ln \mathcal{OFDI}_{skt-1} + \beta^{\mathcal{L}}_{2} \ln\left(\frac{w_{\mathcal{H}}}{w_{\mathcal{L}}}\right)_{skt-1} + \beta^{\mathcal{L}}_{3} \ln \mathcal{Y}_{skt-1} + \beta^{\mathcal{L}}_{4} \ln\left(\frac{\mathcal{K}}{\mathcal{Y}}\right)_{skt-1} + \sum_{z=1}^{Z} \beta^{\mathcal{L}}_{z} \ln z_{skt-1} + \delta_t + u^{\mathcal{L}}_{skt}$$

We estimate the two equations separately. Because only one of the two share equations is independent, since the second share is one minus the first, we are thus prevented from estimating them as a system of equations.[80] In the equations above, the coefficients $\beta_1^{i=\mathcal{L},\mathcal{H}}$ will capture the effect of OFDI on the relative demand of either group of skills. A positive estimated association means that increases in outward FDI will lead to increases in the type of skill

[80] In the literature, empirical analysis in this factor demand framework has been commonly done by applying seemingly unrelated equations econometric estimation (e.g. Adams, 1999; Ahn et al., 2008; Driffield et al., 2009; Ekholm & Hakkala, 2005; Elia et al., 2009). In this case, the equations are related because the error terms $u^{\mathcal{H}}_{skt}$ and $u^{\mathcal{L}}_{skt}$ are correlated, making the outcomes correlated as well (Cameron & Trivedi, 2005).

demand; whereas a negative association indicates the opposite, i.e. decreases in the type of skill intensity. The wage regressor accounts for the variation in the wage bill share due to region-sectors substituting away from more expensive factors. Coefficients $\beta_2^{i=\mathcal{L},\mathcal{H}}$ will be positive or negative depending on the average elasticity of substitution between high-skilled and low-skilled labour being below or above one.[81] The output regressor controls for industry scale; positive estimates of $\beta_3^{i=\mathcal{L},\mathcal{H}}$indicate that as output increases, the wage bill share of the skill group increases. The capital variable is the value of domestic assets, we modify the capital variable and divide it by output to capture the intensity of investment (as in Slaughter, 2000). This capital-to-output variable accounts for changes in the wage bill shares due to total domestic capital investment. A positive (negative) estimated coefficient $\beta_4^{i=\mathcal{L},\mathcal{H}}$, indicates capital-skill complementarity (substitutability), whereby investment intensity stimulates (deters) demand for certain skills. The vector $\beta_z^{i=\mathcal{L},\mathcal{H}}$ includes goods and services exports and a proxy for technology — expenditure in Information and Communication Technologies (ICT). Both goods and service exports may reduce or increase the demands of certain skills at home. In general, exports in manufactured goods are likely to increase the demand for low-skilled workers, whereas service exports will rise the demand for high-skilled labour.[82] Finally, our proxy for technology is meant to capture variations in the wage bill share due to technical change. In as much as expenditure in ICT captures the technological level of a region-sector, positive (negative) associations indicate technology-skill complementarity (substitutability).

4.4.2. Endogeneity concerns

The fitting of these equations will pose some threats to the internal validity of the estimated coefficient on OFDI. We address two of them in turn. Firstly, omitted variable bias is present if we exclude time-varying characteristics of region-sectors correlated with the outcome variables. For example, the volume of exports might also have an impact on the demand for different types of labour. Therefore, in z we include total goods exports, total service exports

[81] If the elasticity of substitution between skilled and unskilled is less than one, the two factors are gross complements, hence the estimated coefficient is positive. Conversely, if the elasticity of substitution is greater than one, the factors are gross substitutes, and the estimated coefficient is negative. Berman et al. (1994) argue for not including relative wages in the equations to estimate, due to endogeneity between the relative wage rate and the wage bill shares. We show in Table A20 in the Appendix that our main results are robust to the exclusion of the relative wage rate regressor. We, however, prefer to keep it in our estimations as the relative price of factors is bound to explain some of the variation in relative demand for factors.

[82] The relationship between skills and exports has been explored at length in the International Trade literature and it is boiled down to differences in the skill intensity of productive activities (e.g. Feenstra & Hanson, 1996). However, the inclusion of the export covariates in our specification is to account for the relationship between exports and investment activities (e.g. Helpman et al., 2004). The relationship between OFDI and skills is mediated by exports, since there is a substitute or complementary relationship among exports and OFDI. Empirical evidence can be found, for example, in Chow (2012).

and a proxy for technology. Moreover, omitting time-invariant characteristics of region-sectors is likely to introduce further bias if unobserved heterogeneity is correlated with the independent variables. For instance, sectors might be more or less reliant on certain types of labour; low-tech manufacturing is less skill intensive than high-tech, therefore might have higher share of high-skilled workers to begin with. Such heterogeneity in technology across units is captured by the region-sector fixed effects, since it can also vary within the same industry in different locations. Furthermore, a set of year dummies will capture shocks to the wage bill shares that are common to all region-sectors; examples of this are changes in the macroeconomic environment or general employment trends.

Secondly, there exists the possibility that the skill shares affect the outward investment flows. A reverse causality may arise if firms are motivated to invest abroad if they are not able to source their skills requirements locally. An upward bias might exist if region-sectors with higher shares of high-skilled labour are more propense to OFDI. Conversely, a downward bias will arise if firms in those region-sectors are less prone to internationalisation. We tackle this endogeneity problem in two ways. First, we partially mitigate the simultaneity by using covariates in one-year lags. Admittedly, there is a certain degree of simultaneity between skills and OFDI, however, it is hardly likely that changes in current skill shares explain changes in OFDI in the past. Importantly, these lags allow to take into account the time that investment decisions take to materialise in changes in the relative labour demands at home.[83] Second, we deploy an instrumental variable (IV) approach to rule out any remaining endogeneity concern. Unfortunately, we are prevented from using standard IVs because an external instrument for our OFDI regressor would have to be region-sector specific, as well as time-varying. However, the generalised method of moments (GMM) allows to partial out the endogenous variation with persistent panel data by using higher-order lags of OFDI to instrument for one-year lags (Blundell & Bond, 2000).

[83] The reasoning for using one-year lags unfolds in two parts. First, at the micro-level, a firm decides to invest abroad in year $t-1$, the ensuing employment decisions should take effect in no more than a year's time. Second, we observe the level of OFDI for a region-sector in $t-1$, so once all firms have taken their internationalisation decisions, we should observe changes in relative demands the following year. We then analyse the lag structure of the estimated coefficients on OFDI and confirm that the largest effect on relative skill demand takes place in year $t-1$. The estimated coefficients and their 95% confidence interval, for the different lags (including the contemporaneous effect) are shown in Figure A16 in the Appendix. We confirm our choice of one-year lags as the coefficients reach a maximum (minimum) effect.

4.5. Data and variables

4.5.1. Description of the database.

Data is collected from two main sources. On the one hand, the measure of OFDI is extracted from the ORBIS database from Bureau van *Dijk*. The historical ownership database contains year-to-year information of the ownership links between a subsidiary and its parents or shareholders from 2007 to 2017. On the other hand, the number of low- and high-skilled workers and their respective average wages, as well as the aggregate inputs such as capital, technology and other economic variables, are sourced from the Economic Censuses from the national statistics agency in Mexico (INEGI). Census rounds are collected every 5 years. The time frame of our analysis is determined by the ownership database. Such period overlaps with the 2003, 2008 and 2013 Census rounds. To exploit as much information as possible, we use linear interpolation to get the values of the intermediate years. This widely used technique assumes linear trends of the variables and smoothens the changes within the five-year lapses. We use the 1998 Census in order to incorporate previous region-sector trends in the interpolation calculation. The resulting database is a panel of 32 region by 13 macro-sectors during an 11-year period, yielding a total sample size of 4,567 observations. We lag the right-hand side one year to minimise the simultaneous determination of economic variables. Details on the definitions, units of measurement and source of our variables can be found in Table A17 (in Appendix).

4.5.2. Construction of the variables.

Summary statistics for the variables in levels and changes are reported in Table A18 and Table A19 in the Appendix. Our outcome variables are the wage bill shares (as in Hansson, 2005; Head & Ries, 2002) of high-skilled ($\mathcal{S}_{\mathcal{H}}$) and low-skilled ($\mathcal{S}_{\mathcal{L}}$) workers in sector k, located in region s in a given time period t. INEGI considers high-skilled employees those that performed tasks within administration, accounting, professional services, management, planning and executive supervision. Conversely, low-skilled employees are those performing tasks related to sales, machinery and equipment operation, production line supervision, auxiliary tasks such as packaging, warehousing, maintenance, cleaning and transportation. We acknowledge that this represents a coarse classification of the type of jobs, and ideally, we would prefer to focus on tasks or occupations, but we are constrained by data availability. Nonetheless this classification is akin to production and non-production workers (e.g. Autor et al., 2003; Head & Ries, 2002; Slaughter, 2000), as it captures to some extent the knowledge intensity embodied in the types of jobs.

The main variable of interest, OFDI, intends to capture the financial resources that are not invested domestically but are instead directed to production abroad. To this end, we use the ORBIS historical files that contain year-to-year information of the ownership links between a subsidiary and its parents or shareholders (see subsection 3.3.1, Chapter *III*, for an explanation of the construction of the variable). The count of affiliates abroad by region and year will constitute the basis of our measure of OFDI at the 32-region (s) and 13-macrosectors (k) level for the 2007-2017 period. The variable is thus defined as the logarithmic transformation of the count for region-sector in every year.[84] Ideally, we would use a more nuanced measure of OFDI, such as the number of employees or total assets in foreign affiliates. Unfortunately, this information has a substantive amount of missing values, for this reason we prefer to use the number of shareholders or foreign affiliates. Nonetheless, this proxy for OFDI has also been used in the empirical literature (e.g. Laffineur & Gazaniol, 2019). Furthermore, we rest assured that the national totals for these variables and the national OFDI stocks reported by UNCTAD, follow a very similar temporal trend rendering it a fair proxy.

The relative wage rate is computed by dividing average wages for high-skilled employees by the corresponding average wage for low-skilled workers; w_H/w_L. Output Y is measured in terms of gross value added expressed at current prices for each year in its logarithmic form and it controls for the region-sector scale. Capital-to-output is the ratio of current capital stock to total output and it captures capital intensity. To proxy for technological change in each region-sector we use the expenditure in ICT, since the higher the expenditure in this technologies the higher the reliance on knowledge intensive assets (R. B. Davies & Desbordes, 2015; Gagliardi et al., 2015).

4.6. Results and discussion.

4.6.1. Baseline specification

We first provide a set of univariate regressions to test the general correlation between OFDI and the relative demand for each group of skills. In Table 16, we report the pooled OLS estimates on both high- and low-skilled wage bill shares; we progressively introduce region-sector and year fixed effects. Three main take-aways arise from these correlations. Firstly, the reversal of the coefficients on OFDI from the introduction of region-sector fixed effects. It

[84] The natural logarithm is applied to the count of affiliates plus one, since the domain of the function is defined for strictly positive numbers. These values represent 15.5 percent of the observations.

would be amiss to omit time-invariant technological differences across region-sectors since they play an important role in explaining the variation in wage-bill shares. More specifically, a large percentage of the variation in the shares is due to differences across region-sectors (see Rho interclass correlation coefficient for models in columns 2 and 5). Second, the inclusion of year shocks common to all region-sectors only increases the magnitude of the OFDI point estimates, suggesting that omitting national trends would also be incorrect. Third, without further demand shift factors, a decrease in the wage bill share of a particular group of workers is almost mirrored by an increase in the share of the other.

Table 16 – OFDI on wage bill shares: Baseline estimates

Dep. Var. Wage bill shares	High-Skilled			Low-skilled		
	(1)	(2)	(3)	(4)	(5)	(6)
OFDI	0.0322***	-0.00874**	-0.0113***	-0.0285***	0.00900***	0.0135***
	(0.00831)	(0.00342)	(0.00400)	(0.00830)	(0.00343)	(0.00429)
Observations	4,576	4,576	4,576	4,576	4,576	4,576
R-squared	0.045	0.002	0.006	0.027	0.002	0.013
F-statistic	15.02	6.534	3.202	11.81	6.903	3.659
Rho		0.713	0.716		0.659	0.665
Region-Sector FE	no	yes	yes	no	yes	yes
Year FE	no	no	yes	no	no	yes

Notes: Independent variables in one-year lags, Cluster Standard errors in parentheses,
*** p<0.01, ** p<0.05, * p<0.1

4.6.2. Main specifications

In this section we report the econometric results for the full specifications. The equations for high- and low-skilled wage bill shares are estimated separately by OLS with fixed effects. To test the propositions outlined in subsection 4.2.4, we introduce the OFDI variable first considering all affiliates abroad, then breaking it down to affiliates in high-income and middle-income economies separately. Although there are sufficient theoretical reasons to believe that unobserved region-sector specific heterogeneity is correlated with the independent variables, we confirm that fixed effects estimates are consistent and efficient by running Hausman tests for all specifications. The outcome variables are in levels, while all independent variables are log transformed, thence, coefficients can be expressed as semi-elasticities. While the overall fit of the regressions is not all too high, the economic effects of OFDI are non-negligible, we discuss these in turn. Table 17 below reports the results for the fixed effects full specification.

Table 17 – OFDI on wage bill shares: Fixed Effects

	All		High-income		Middle-income	
	High-Skilled	Low-skilled	High-Skilled	Low-skilled	High-Skilled	Low-skilled
	(1)	(2)	(3)	(4)	(5)	(6)
OFDI	-0.00482*	0.00499				
	(0.00292)	(0.00305)				
OFDI HI			-0.00567**	0.00588**		
			(0.00288)	(0.00298)		
OFDI MI					-0.00391	0.00516
					(0.00524)	(0.00549)
Relative wage rate	0.164***	-0.136***	0.164***	-0.136***	0.165***	-0.136***
	(0.0217)	(0.0209)	(0.0217)	(0.0209)	(0.0217)	(0.0210)
GVA	-0.00451*	0.0248***	-0.00450*	0.0248***	-0.00457*	0.0249***
	(0.00254)	(0.00572)	(0.00254)	(0.00572)	(0.00254)	(0.00573)
Product exports	1.76e-05	0.000180	9.29e-06	0.000188	4.61e-05	0.000161
	(0.000866)	(0.00127)	(0.000867)	(0.00127)	(0.000864)	(0.00127)
Service exports	0.00192**	-0.00282***	0.00191**	-0.00281***	0.00196**	-0.00285***
	(0.000828)	(0.000874)	(0.000826)	(0.000872)	(0.000839)	(0.000884)
Capital intensity	0.00186	0.0355**	0.00191	0.0354**	0.00200	0.0352**
	(0.0158)	(0.0168)	(0.0158)	(0.0168)	(0.0159)	(0.0170)
ICT	-0.00211	0.0181***	-0.00211	0.0181***	-0.00209	0.0181***
	(0.00392)	(0.00639)	(0.00392)	(0.00639)	(0.00392)	(0.00640)
Observations	4,576	4,576	4,576	4,576	4,576	4,576
R-squared	0.204	0.321	0.205	0.321	0.204	0.321
F	6.721	10.97	7.003	11.14	6.542	10.71
Rho	0.714	0.806	0.714	0.806	0.711	0.805
Number of state-sectors	416	416	416	416	416	416

Notes: Independent variables in one-year lags; Clustered Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

In general, increasing OFDI is associated with a decrease in the wage bill share of high-skilled workers, although the effect is barely significant (column 1). Conversely, increases in the number of affiliates abroad, rises the demand for low-skilled employees, albeit the coefficient is not statistically significant (column 2). More interesting results emerge when we breakdown OFDI by destination revealing heterogeneity in the effects on skill composition and their significance across internationalisation strategies. Increasing OFDI to high-income countries might lead to decreases in the relative demand for skilled workers (column 3). Specifically, a 10% increase in the number of affiliates abroad is associated with a decrease of 0.05 percentage points in the wage bill share of high-skilled workers. Consequently, this change is mirrored by an increase of the same magnitude in the analogous wage bill share for low-skilled labour (column 4).

This evidence suggests that OFDI to more advanced economies results in skill downgrading at home, thus confirming general hypothesis 1: In as much as Mexican OFDI relocates more skill-intensive activities to high-income economies, the demand for high-skilled labour will tend to decline at home. At the same time, this leads to increasing region-sector specialisation in the low-skill intensive segments of production, thus the share of these workers is likely to rise. Case study findings suggest that Mexican MNEs of the most recent wave of OFDI have incurred in the acquisition of new technologies and innovative capacities by acquiring R&D centres or buying firms with higher technological expertise in developed countries (Basave Kunhardt, 2016). To the extent these is a general trend for internationalising firms in Mexico, this type of OFDI has a local downgrading effect if firms are increasing the relative demand for low-skilled employment at the expense of high-skilled.

This finding is hard to place relative to the wider literature. On the one hand, this type of OFDI might be akin to that observed from developed countries, whereby production is relocated abroad on the basis of relative factor abundance at home and abroad (Barba Navaretti & Venables, 2004), but in the opposite direction; namely OFDI from less developed (middle-) to more developed (high-income) economies. Furthermore, it could also be characterised as efficiency-seeking, since MNEs might aim to integrate global value chains across locations often at different stages of economic development (Dunning & Lundan, 2008). On the other hand, the motivation of this type if investment is different in the context of emerging economies. OFDI directed towards more advanced countries, might ensue from the need to address a relative weakness in the innovation systems at home (Luo & Tung, 2007). It has been argued that the long-term result could be faster technical change and productivity growth in the home country and a higher level of economic activity and employment (Amiti & Wei, 2005). However, evidence for this ten-year period do not support this line of argument, since we find that

increases in the number of affiliates abroad lead to skill downgrading in the relevant region-sector.

Regarding OFDI towards middle-income economies, estimates point out that the effect on skill composition is not significant (columns 5 and 6). Thus, we also confirm general hypothesis 2; there is no compelling evidence to favour either skill downgrading or upgrading when OFDI flows to equally developed countries This finding echoes some evidence indicating that market-seeking (or horizontal) OFDI might have no significant effects on the composition of skills at home (Ekholm & Hakkala, 2005; Hakkala et al., 2010). This could be accrued to the possibility that overseas investments might replicate all activities along the value chain to serve other markets, and therefore leaving the relative labour demands unchanged (Head & Ries, 2002).

Although our unit of analysis is the region-sector, we turn to region' average changes across sectors to give a more nuanced picture of the regional dimension of the employment effects of internationalisation. For instance, the three best economically performing regions, Ciudad de Mexico, Nuevo Leon and Jalisco, experienced the largest increases in number of affiliates to high-income economies, and also had the largest decreases in the wage-bill share of high-skilled workers. In a similar vein, mid-performing region like Guanajuato and Veracruz, that also had relatively high increases in their internationalisation rate, also experienced sizable decreases in the intensity of high-skilled labour. More precisely, the average sector located in these regions, underwent a relative skill down-grading due to increases in OFDI to high-income countries. We can make a similar argument for the macro-sectors' averages across regions. The largest relative increases in the number of foreign affiliates were in the Specialised services and Medium-low-tech manufacturing; the same sectors had among the largest decreases in the relative demand for high-skilled labour.

Control shift factors have in general the expected effects on high-skilled and low-skilled wage bill shares. The estimated direction of the coefficients is consistent across specification regardless of the OFDI breakdown; although with slight changes in the point estimates, they preserve their significance in most cases. Regarding the wage regressor, it is likely that there is simultaneous determination with the dependent variable; we show in Table A20 in the Appendix, that our estimates on the effect of OFDI are robust to the exclusion of this regressor.[85] The relative demand for high-skills is negatively associated with increases in output, though the effect is just precisely estimated. Conversely, relative demand for low-skilled labour

[85] We do not attach any economic interpretation to the estimated coefficient of the wage regressor since the direction of the correlation arises by construction. We do so, however, in the employment share equation in subsection 4.6.4

responds positively to output increases, perhaps due to the predominance of low-tech manufacturing production and low-skilled service activities. Furthermore, domestic capital investment in the region-sector does not seem to stimulate the demand for high-skilled labour; whereas capital deepening rises the demand for low-skilled labour suggesting a complementary relationship between capital and this type of skills. In the same vein, increases in the proxy for technology have a nil effect on high-skill wage bill shares and a positive and significant effect on low-skill shares; this might be indicative that low-skill workers are complementary to the use of ICT. Regarding the export covariates, while the expansion of product exports does not seem to affect relative demand for either type of workers, an increase in service exports is associated with a rise in the share of high-skilled workers with an accompanying reduction in the analogous share for low-skilled workers.

4.6.3. Instrumental variables

We apply an instrumental variable approach to address the endogeneity between skill and OFDI. Our estimates might be biased if decisions to engage in active internationalisation are jointly determined with the relative labour demands. Following the literature on the home effects of OFDI (see Baumgarten et al., 2013; Becker et al., 2013; Laffineur & Gazaniol, 2019, among others), we test the exogeneity of OFDI by using second order lags of the number of affiliates as instruments for the one year lags. This method is inspired on Blundell and Bond (2000), in the context of persistent panel data.[86]

Estimates for the IV models are reported in Table 18. We first run three diagnosis tests for the relevance of our instruments: the exclusion of the instruments, weak identification, and underidentification. All the statistics for the first-stage regressions reveal that our instruments are sufficiently relevant.[87] Unfortunately, we are unable to test for the exogeneity since our equations are exactly identified.

[86] The idea is that the IV estimation is a special case of GMM. The exogeneity of the instruments means that there are sufficient moment conditions that will be satisfied at the true value of the population parameter β. See Baum et al. (2018) for an explanation on the exogeneity conditions.

[87] (i) *Exclusion of the instruments test* (Sanderson-Windmeijer multivariate F): we reject the null hypothesis under which the endogenous regressor is unidentified. (ii) *Weak identification test* (Cragg-Donald Wald F): we reject the null hypothesis that the first stage equation is weakly identified. (iii) *Underidentification test* (Kleibergen-Paap Wald rk LM chi2): we reject the null that that matrix of reduced form coefficients has rank=K1-1, is underidentified.

Table 18 – OFDI on wage bill shares: Instrumental Variables with Fixed Effects (GMM IV)

	All		High-income		Middle-income	
	High-Skilled	Low-skilled	High-Skilled	Low-skilled	High-Skilled	Low-skilled
	(1)	(2)	(3)	(4)	(5)	(6)
OFDI	-0.00506	0.00586				
	(0.00381)	(0.00388)				
OFDI HI			-0.00632*	0.00730**		
			(0.00360)	(0.00358)		
OFDI MI					-0.00273	0.000966
					(0.00937)	(0.0102)
Relative wage rate	0.157***	-0.134***	0.157***	-0.134***	0.157***	-0.134***
	(0.0217)	(0.0224)	(0.0216)	(0.0224)	(0.0217)	(0.0225)
GVA	-0.00468*	0.0228***	-0.00468*	0.0228***	-0.00471*	0.0229***
	(0.00251)	(0.00573)	(0.00251)	(0.00573)	(0.00251)	(0.00573)
Product exports	0.000684	-0.000506	0.000668	-0.000489	0.000722	-0.000568
	(0.00107)	(0.00149)	(0.00107)	(0.00149)	(0.00107)	(0.00149)
Service exports	0.00111*	-0.00204***	0.00108*	-0.00200***	0.00122*	-0.00221***
	(0.000648)	(0.000725)	(0.000641)	(0.000718)	(0.000672)	(0.000745)
Capital intensity	0.00115	0.0356*	0.00125	0.0355*	0.00106	0.0358**
	(0.0157)	(0.0183)	(0.0157)	(0.0183)	(0.0156)	(0.0181)
ICT	-0.00300	0.0183***	-0.00300	0.0183***	-0.00296	0.0183***
	(0.00408)	(0.00650)	(0.00408)	(0.00651)	(0.00407)	(0.00650)
Observations	4,160	4,160	4,160	4,160	4,160	4,160
R-squared	0.191	0.296	0.191	0.296	0.190	0.296
Number of region-sectors	416	416	416	416	416	416
Sanderson-Windmeijer F	344.73	344.73	460.32	460.32	136.66	136.66
Cragg-Donald Wald F statistic	2520.17	2520.17	3062.97	3062.97	1784.12	1784.12
Kleibergen-Paap Wald rk LM chi2	25.18	25.18	22.56	22.56	18.08	18.08

Notes: Independent variables in one-year lags. Instruments for the endogenous OFDI are the second order lags of the same variable.
Cluster Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

There are no major qualitative changes in the results. However, estimated coefficients on OFDI to high-income countries increase in magnitude. This suggests that the OLS estimates present a downward bias, in particular, for OFDI to high-income countries. Intuitively, this stems from region-sectors with lower shares of high-skilled workers engaging more actively in internationalisation. Once we partial-out the endogeneity, the point estimates increase for both high- and low-skilled wage bill shares, with the former being slightly less significant.

4.6.4. Robustness checks

To verify the robustness of our results we use employment shares instead of wage bill shares as the outcome variables. This method is used by Ekholm and Hakkala (2005) and Hijzen et al. (2005). The rationale is that in the presence of labour market rigidities, employment shares may reveal more about a shock since wages do not fully adjust. In addition, there might be simultaneity bias between wage bill shares and wages that leads to upward biased estimates in cost share regressions. Results are reported in Table 19. We do not find any important differences compared to the results based on wage bill shares. Increasing internationalisation via OFDI towards high-income countries is associated with decreases in the share of high-skilled employment. Conversely, the estimated effect is positive for low-skilled employment shares. The effects of OFDI towards middle-income economies remains insignificant. Control shift factors do not change either. Output expansion and ICT expenditure increases lead to rises in the demand for low-skilled labour. High-skilled relative labour demand seems to be mostly positively driven by the rise in the export of specialised services. The coefficients on the wage regressor show how region-sectors substitute away from more expensive types of labour; increases in the relative average wage rate (rising price of high-skilled labour) is associated with decreases in the employment share or relative demand of these workers, the opposite holds for low-skilled labour demand. It is important to note that the specifications reported in Table 19, in particular those for high-skilled workers, account for only a small portion of the variation in the change of employment shares (R-squared), it is clear that there are other factors that determine the demand for skills.

Table 19 – OFDI on employment shares: Robustness checks OLS with FE

	All		High-income		Middle-income	
	High-Skilled	Low-skilled	High-Skilled	Low-skilled	High-Skilled	Low-skilled
	(1)	(2)	(3)	(4)	(5)	(6)
OFDI	-0.00498*	0.00514**				
	(0.00261)	(0.00254)				
OFDI HI			-0.00524**	0.00545**		
			(0.00264)	(0.00253)		
OFDI MI					0.000402	0.000842
					(0.00510)	(0.00483)
Relative wage rate	-0.0319*	0.0605***	-0.0319*	0.0606***	-0.0312*	0.0600***
	(0.0177)	(0.0205)	(0.0177)	(0.0205)	(0.0177)	(0.0205)
GVA	0.00139	0.0189***	0.00139	0.0189***	0.00134	0.0190***
	(0.00280)	(0.00512)	(0.00280)	(0.00512)	(0.00280)	(0.00512)
Product exports	0.000251	-5.39e-05	0.000250	-5.29e-05	0.000324	-0.000117
	(0.000737)	(0.00105)	(0.000739)	(0.00105)	(0.000734)	(0.00105)
Service exports	0.00256***	-0.00347***	0.00256***	-0.00346***	0.00267***	-0.00355***
	(0.000759)	(0.000760)	(0.000761)	(0.000760)	(0.000769)	(0.000768)
Capital intensity	0.00445	0.0329	0.00447	0.0328	0.00426	0.0330
	(0.0208)	(0.0213)	(0.0208)	(0.0213)	(0.0206)	(0.0213)
ICT	-0.00303	0.0190***	-0.00303	0.0190***	-0.00302	0.0190***
	(0.00433)	(0.00603)	(0.00433)	(0.00603)	(0.00432)	(0.00603)
Observations	4,576	4,576	4,576	4,576	4,576	4,576
R-squared	0.030	0.298	0.030	0.298	0.029	0.297
F	2.913	15.74	3.031	15.80	4.339	16.03
Rho	0.635	0.745	0.634	0.745	0.630	0.741
Number of region-sectors	416	416	416	416	416	416

Notes: Dependent variables are employment shares; Independent variables in one-year lags;
Clustered Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.7. Conclusion

In the context of increasing OFDI by Mexican firms, mainly towards high-income countries but with rising number of affiliates in middle-income countries, Mexico is also experiencing a downward trend in the average share of high-skill workers across regions and macro-sectors. In this paper, we assessed the extent to which changes in OFDI lead to skill downgrading or upgrading in the relevant local labour markets, and whether the effects on local labour demand for different skills vary according to the country of OFDI destination. The results herein suggest that increasing region-sector OFDI directed towards high-income countries, is substituting away from the usage intensity of high-skilled labour; on average, decreasing the expected share of high-skilled employment, whilst raising that of low-skilled workers. The effects of OFDI towards middle-income economies remained insignificant across specifications, suggesting no effect on the skill composition at home.

OFDI directed towards more advanced countries, might arise from the need to address a relative weakness in the innovation systems at home (Luo & Tung, 2007), we find support for this in Chapter *III*. However, the evidence put forward for this ten-year period suggests that, on average, region-sectors are experiencing skill-downgrading effects from this type of OFDI, which might hinder the availability of human capital across regions and sectors. Meanwhile, despite the steadily rising OFDI towards middle-income countries, the skill composition effects of this type of OFDI were insignificant throughout specifications; this could be indicative of market-seeking investment to similarly developed countries that might replicate the whole range of stages of production to serve a foreign market, and thus having neither skill downgrade nor upgrade home effects.

Two broad implications stem from our findings, and they are closely connected with the findings in Chapter *II* pertaining Inward FDI and the level of education of the workforce: increasing inward FDI might result in decreasing level of educational attainment for workers, thus hindering the potential knowledge spillovers from inward FDI. Despite Mexico's heavy reliance on inward FDI, it has also significantly increased its outward investments, hence the first implication revolves around the potential technology transfers from OFDI and regional knowledge transfer mechanisms. Ultimately, EMNEs' goal of knowledge-seeking investments in developed countries is to improve technological capabilities at home (Child & Rodrigues, 2005). Some studies have investigated to what extent such OFDI does in fact generate positive knowledge spillover effects that augment the technological capabilities of EMNEs (Chen et al.,

2012).[88] For a technology transfer to occur there must be internal transfer mechanism (Sanna-Randaccio & Veugelers, 2007); the success of this efforts largely depend on the parent firm's ability to absorb and deploy the knowledge gained (Cohen & Levinthal, 1990). At the wider regional scale, however, the effects of such knowledge spillovers via OFDI will effectively depend on the degree of relational capital[89] in the region as it will determine the extent of cooperation between domestic firms and effectiveness of the local labour market as a knowledge transfer mechanism (Capello & Faggian, 2005). This in turn, constitutes the basis of collective learning through local interactions (Camagni, 1995; Capello, 1999). A region-sector wide skill downgrading process will most certainly do not enhance the potential technological capabilities via OFDI at home. As it has also been posited, the alignment between the local stage of economic development and the quality of human capital is a necessary condition for the latter to spur regional growth (e.g. von Tunzelmann, 2009).

The second interrelated implication pertains the improvement of local learning capabilities at the regional level and upgrading. The human capital of the workforce is a crucial factor facilitating the adoption of new and more productive technologies (Nelson & Phelps, 1966). In the context of the increasing geographical dispersion of production, emerging economies face fiercer competition. The process of 'upgrading' as producing more efficiently or transition to more skill-intensive activities (Porter, 1990), has been applied to a regional scale in the literature of global value chains (Gereffi, 1999; Kaplinsky, 2000). Participating in a global value chain has become a widespread strategy to enhance competitiveness (Giuliani et al., 2005); by increasing the skill content of their activities, regions may be able to move up the value chain (Humphrey & Schmitz, 2002). The development of indigenous technological capabilities is particularly important for long-term sustainable growth (Iammarino et al., 2008): although many countries in Latin America, Mexico included, reached the middle-income band, as early as the 1960s and 1970s, a great majority have remained there ever since (Agénor et al., 2012). In order to compete in the global economy while improving welfare, Latin American countries must develop value-added and knowledge-intensive activities to generate broad-based upgrading and productivity growth (Paus, 2011).

Our paper contributes to the scant empirical evidence on OFDI home skill composition effects when OFDI originates in emerging economies, while considering the relevant business environment and local labour market in which Mexican MNEs operate –i.e. the region-industry.

[88] This effect has also been studied for developed countries MNEs (e.g. Driffield & Love, 2003)

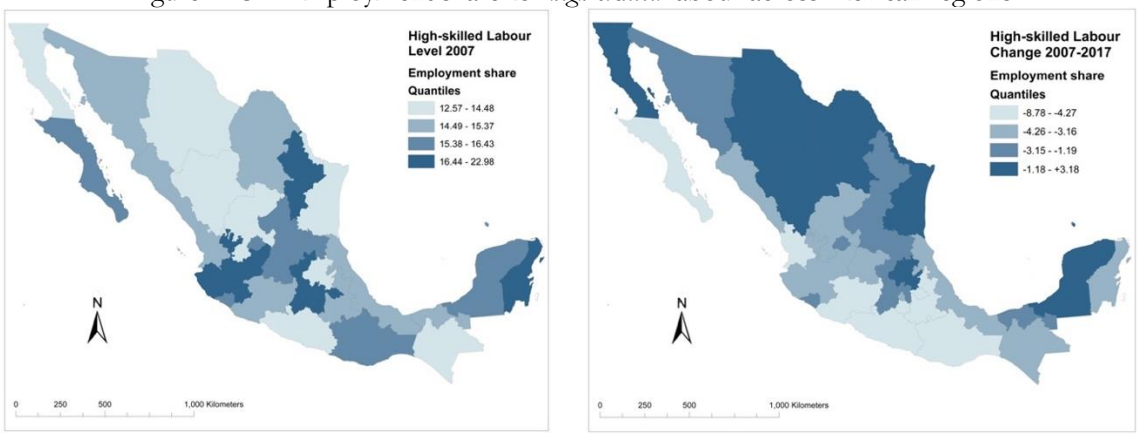
[89] Relational capital can be understood as "the set of all relationships – market, power and cooperation – established between firms, institutions and people that stem from a sense of belonging […]" (Capello & Faggian, 2005: 77).

Like any empirical study, ours is not without limitations. First, our main independent variable is proxy of OFDI, as such it might not be fully capturing the extent of OFDI, for example, in terms of employment or total assets abroad. Nonetheless, this variable has also been used in the related literature. Second, we are aware that the high-skilled/low-skilled dichotomous categorisation of worker skills is not necessarily reflecting the knowledge intensity of job tasks; the availability of better data would allow researchers to focus on more meaningful occupational tasks. Lastly, perhaps the level of aggregation at the 32-state level is too broad, thus hiding some heterogeneity of local labour markets within the borders. We prefer to use this level to minimise the loss of data, which obviously comes at the cost of the identification of local labour markets.

Outward FDI in Mexico is a relatively recent phenomenon, as such, there is not enough evidence on its effects in the home region. Further research should be conducted in some respects. First, the full extent of OFDI effects should be evaluated in the Mexican case, for example, whether increasing Mexican OFDI leads to productivity gains and regional output growth (e.g. Cozza et al., 2015; Driffield & Chiang, 2009; Navaretti & Castellani, 2004), as well as attesting the occurrence of technology transfers from the affiliates abroad to the parent companies (e.g. Chen et al., 2012; Driffield & Love, 2003). Second, for policy-making purposes, it is important to consider the simultaneous effects of inward and outward FDI since they might be associated with different outcomes according to the skill content of their activities (Driffield et al., 2009). Moreover, inasmuch as both OFDI and exports are interrelated internationalisation strategies, evidence has shown that the both outward FDI and trade should be considered together to ascertain the benefits associated to outward-oriented economic policies (Cuadros et al., 2004).

4.8. Appendix

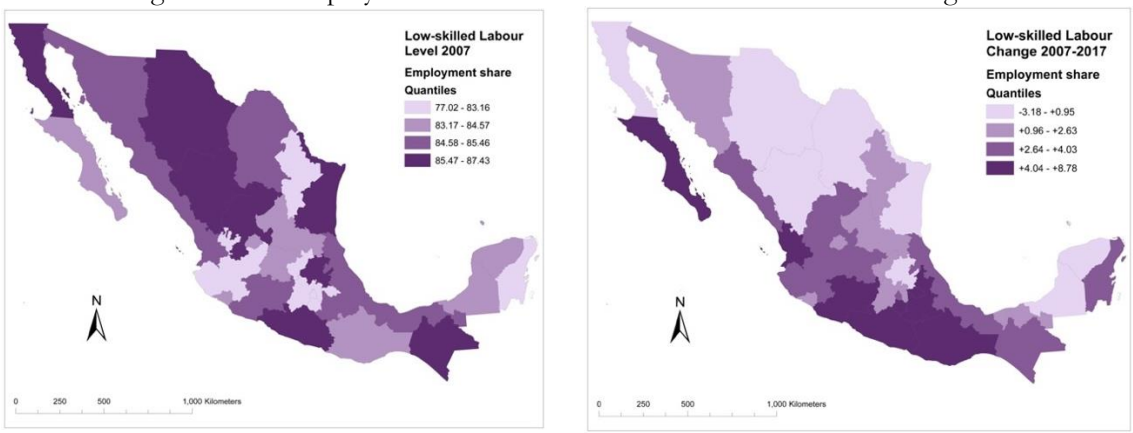
Figure A13 – Employment share for *high-skilled* labour across Mexican regions



(a) Base year level 2007 (b)Change 2007-2017

Source: Authors' own elaboration on data from INEGI

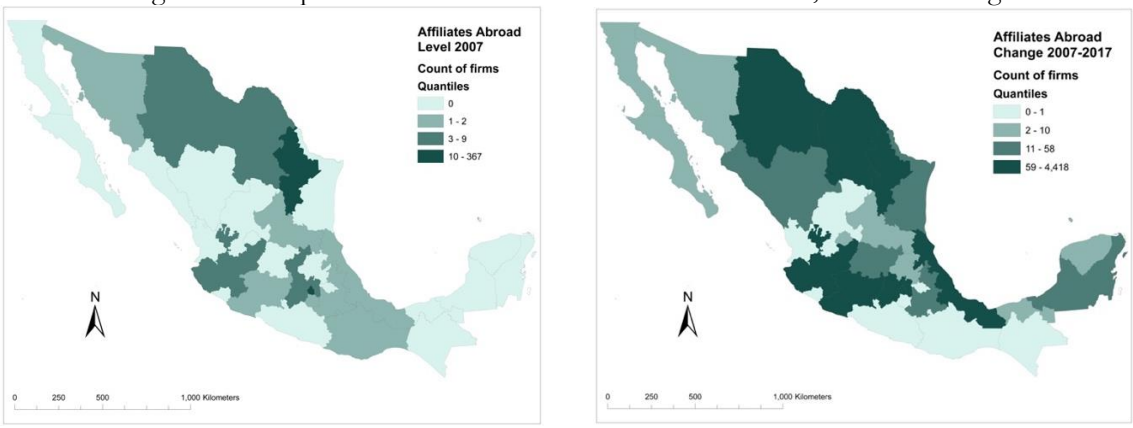
Figure A14 – Employment share for *low-skilled* labour across Mexican regions



(a) Base year level 2007 (b)Change 2007-2017

Source: Authors' own elaboration on data from INEGI

Figure A15 – Spatial distribution of OFDI: Affiliates abroad, level and change



(a) Base year level 2007 (b) Change 2007-2017

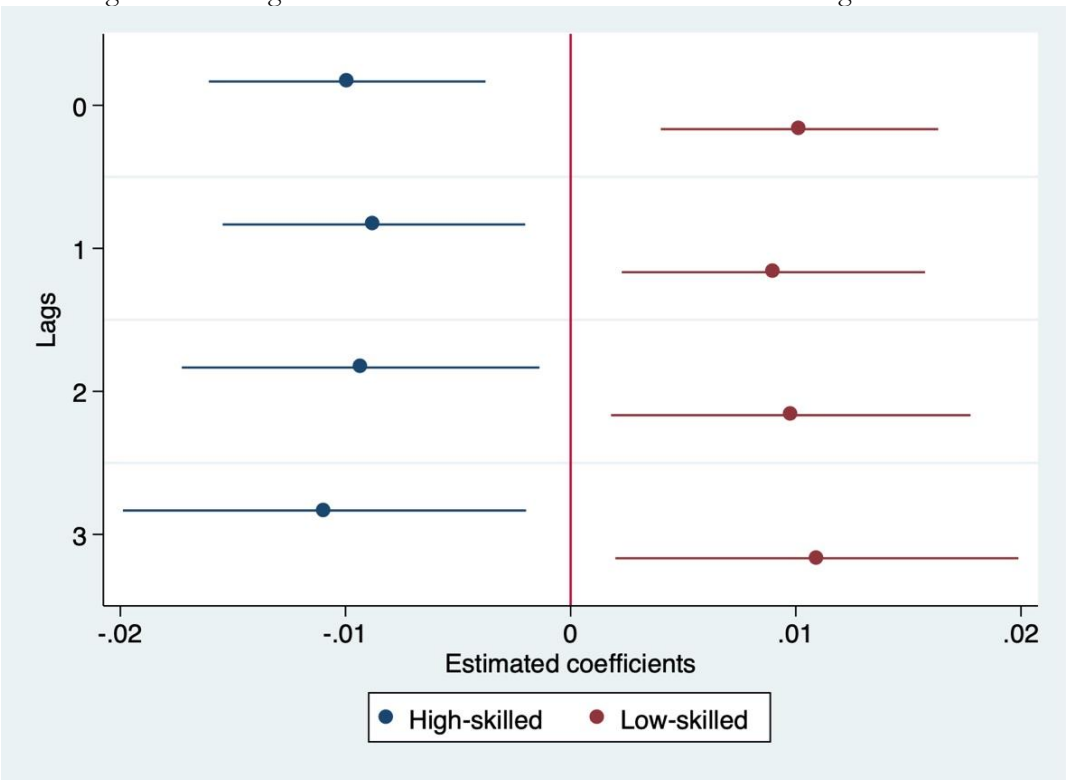
Source: Author's own elaboration on data from ORBIS, Bureau Van ***Dijk***

Table A16 – List of industries by macrosector

Macrosector	Industries	Number of 4-digit industries
Agriculture, Forestry, Fishing and Hunting	Agriculture, Forestry, Fishing and Hunting	19
Mining, Quarrying, and Oil and Gas Extraction	Mining, Quarrying, and Oil and Gas Extraction	5
Utilities	Utilities	3
Construction	Construction	10
Low-tech Manufacturing	*Manufacturing of furniture and recycling; Wood, pulp, paper, paper products, printing and publishing; Food products, beverages and tobacco; Textiles, textile products, leather and footwear*	31
Medium-low-tech Manufacturing	*Building and repairing of ships and boats; Rubber and plastic products; Coke, refined petroleum products and nuclear fuel; Other non-metallic mineral products; Basic metals and fabricated metal products*	23
Medium-high-tech Manufacturing	*Electrical machinery and apparatus; Motor vehicles, trailers and semi-trailers; Chemicals excluding pharmaceuticals; Railroad equipment and transport equipment; Machinery and Equipment*	22
High-tech Manufacturing	*Aircraft and spacecraft; Pharmaceuticals; Office, accounting and computing machinery; Radio, TV and communications equipment; Medical, precision and optical instruments*	9
Wholesale Trade	Wholesale Trade	19
Retail Trade	Retail Trade	29
Transportation and Warehousing	Transportation and Warehousing	29
Specialised Services	*Information; Finance and insurance; Real estate and rental and leasing; Professional, scientific, and technical services; Management of companies and enterprises; Administrative and support and waste management and remediation services*	53
General Services	*Educational services; Health care and social assistance; Arts, entertainment and recreation; Accommodation and food services; Other services (except public administration)*	54

Source: author's own elaboration. Classification of macro-sectors is done on the basis of the North American Industry Classification System (NAICS 2013). Manufacturing industries are broken down by their technological and knowledge intensity using the United Nations International Standard Industrial Classification of All Economic Activities (ISIC Rev. 3.1)

Figure A16 – Lag structure of the estimated effect of OFDI on wage bill shares



Note: Coefficients correspond to univariate regressions of OFDI on wage bill shares. 95% confidence intervals shown.

Table A17 – Variables description and sources

Variable	Definition & [units]	Source
Dependent variable		
Wage bill shares	Defined as the share of high-skilled and low-skilled wages relative to total wage bill respectively. [Share]	INEGI, Economic Census (2004, 2009, 2014)
Main explanatory variable		
OFDI: Number of Mexican-owned affiliates abroad	Logarithmic transformation of the number of Mexican-owned affiliates abroad. Total and by income group of destination; middle- and high-income. [Count +1]	ORBIS Historical Ownership database (Bureau Van ***Dijk),*** 2007-2017
Control shift factors		
Relative wage rate	Logarithmic transformation. Calculated as the ratio of skilled to unskilled average wages. Average wages are calculated by dividing total wages for each skill group divided by total employees in the group. [Ratio]	INEGI, Economic Census (2004, 2009, 2014)
Output	Logarithmic transformation of GVA. The gross value added is defined as the value of production added during the productive process by the factors of production (labour, capital and the organization) onto the raw material. It is gross because capital consumption has not been deducted. [Billion MXN]	INEGI, Economic Census (2004, 2009, 2014)
Service exports	Logarithmic transformation of the total sum of service sales abroad. Includes all professional and technical services provided by the economic unit to foreign customers. [Billion MXN]	INEGI, Economic Census (2004, 2009, 2014)
Good exports	Logarithmic transformation of the total sum of good sales abroad. Includes all manufactured goods produced by the economic unit and sold in foreign markets. [Billion MXN]	INEGI, Economic Census (2004, 2009, 2014)
Capital-to-output ratio	Capital stock is the present value (or replacement cost) of all fixed assets –whose life of service is above one year— property of the economic unit, with a productive capacity (billion MXN). Logarithmic form of the ratio obtained by dividing capital stock by total output. [Ratio]	INEGI, Economic Census (2004, 2009, 2014)
ICT	Logarithmic transformation of the total present value of ICT, Information and Communication Technology equipment. Includes all ICT related equipment and hardware that is not integrated in the production process, i.e. in machinery and equipment [Billion MXN]	INEGI, Economic Census (2004, 2009, 2014)

NOTE: All variables are at the region-sector level and values are linearly interpolated using three 5-year data points

Table A18 – Summary statistics for levels: OFDI skill effects

Levels	(1) mean	(2) sd	(3) min	(4) max
Outcome				
Wage bill share by skill category				
High-skilled wage bill share	0.249	0.128	0.0	0.985
Low-skilled wage bill share	0.740	0.146	0.0	1.0
Main regressor				
OFDI				
Total Affiliates abroad (count)	10.605	149.898	0.0	5,519
Log total affiliates abroad	0.302	0.926	0.0	8.616
Affiliates abroad in HI (count)	8.590	127.313	0.0	4,400
Log affiliates abroad in HI	0.247	0.847	0.0	8.390
Affiliates abroad in MI (count)	2.015	31.127	0.0	1,119
Log affiliates abroad in MI	0.156	0.620	0.0	7.021
Shift factors				
Log relative wage rate (ratio H- to L-skilled)	1.022	0.342	0.0	5.640
Log output	14.358	2.790	0.0	20.356
Log product exports	3.885	6.402	0.0	18.483
Log service exports	2.090	4.070	0.0	16.985
Log capital-output-ratio	0.524	0.402	0.0	4.595
Log ICT expenditure	10.747	2.840	0.0	17.126
N = 4,576				

Table A19 – Summary statistics for changes: OFDI skill effects

Change (deviation from the mean)	(1) mean	(2) sd	(3) min	(4) max
Outcome				
Wage bill share by skill category				
High-skilled wage bill share	-0.0001	0.0674	-0.3955	0.5703
Low-skilled wage bill share	0.0001	0.0839	-0.8411	0.3347
Main regressor				
OFDI				
Total Affiliates abroad (count)	0.764	115.62	-1,287.75	4,180.25
Log total affiliates abroad	0.0130	0.4206	-2.2852	5.0623
Affiliates abroad in HI (count)	0.618	101.14	-910.33	3,468.66
Log affiliates abroad in HI	0.0109	0.3999	-2.2691	5.0410
Affiliates abroad in MI (count)	0.145	21.71	-377.41	711.58
Log affiliates abroad in MI	0.0074	0.2906	-2.0798	3.8672
Shift factors				
Log relative wage rate (ratio H- to L-skilled)	-0.0003	0.2288	-1.4258	4.3769
Log output	-0.0098	1.2002	-15.3809	8.7367
Log product exports	-0.0146	1.0456	-11.2060	10.2627
Log service exports	-0.0961	2.4528	-9.9221	7.5136
Log capital-output-ratio	-0.0003	0.2195	-1.8900	2.7552
Log ICT expenditure	0.0019	0.9282	-9.6280	5.7978
N = 4,576				

Table A20 – OFDI on wage bill shares: OLS Fixed Effects excluding wage regressor

	All		High-income		Middle-income	
	High-Skilled	Low-skilled	High-Skilled	Low-skilled	High-Skilled	Low-skilled
	(1)	(2)	(3)	(4)	(5)	(6)
OFDI	-0.0103***	0.00950**				
	(0.00393)	(0.00378)				
OFDI HI			-0.0113***	0.0106***		
			(0.00380)	(0.00363)		
OFDI MI					-0.0132*	0.0129*
					(0.00682)	(0.00689)
GVA	-0.000764	0.0217***	-0.000762	0.0217***	-0.000889	0.0218***
	(0.00408)	(0.00498)	(0.00408)	(0.00498)	(0.00407)	(0.00499)
Product exports	-0.000805	0.000858	-0.000811	0.000866	-0.000792	0.000853
	(0.00104)	(0.00144)	(0.00104)	(0.00144)	(0.00104)	(0.00144)
Service exports	0.00148	-0.00246**	0.00147	-0.00245**	0.00150	-0.00247**
	(0.000963)	(0.000950)	(0.000960)	(0.000947)	(0.000975)	(0.000960)
Capital intensity	-0.00102	0.0378**	-0.000951	0.0378**	-0.000362	0.0372**
	(0.0157)	(0.0151)	(0.0157)	(0.0151)	(0.0159)	(0.0155)
ICT	0.00248	0.0143**	0.00247	0.0143**	0.00252	0.0143**
	(0.00474)	(0.00599)	(0.00474)	(0.00599)	(0.00473)	(0.00601)
Observations	4,576	4,576	4,576	4,576	4,576	4,576
R-squared	0.009	0.235	0.009	0.235	0.008	0.235
F	2.499	10.10	2.686	10.24	2.284	9.961
Rho	0.713	0.791	0.713	0.790	0.710	0.789
Number of state-sectors	416	416	416	416	416	416

Notes: Independent variables in one-year lags; Wage regressor is excluded; Clustered Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Technical note

It is convenient to use a translog cost function for the econometric estimation of the parameters of interest. The advantage of the translog functional form is it imposes fewer restrictions on factor substitutability than either CES, Cobb–Douglas, or Leontief production technologies. This function can be expressed as a Taylor's series expansion to the second term in its general form;[90]

$$\ln C^* = \nu_0 + \nu_y \ln Y + \sum_i \nu_i \ln w_i + \frac{1}{2}\sum_i \sum_j \gamma_{ij} \ln w_i \ln w_j + \sum_i \gamma_{iy} \ln w_i \ln Y + \sum_i \gamma_{iu} u_i \ln w_i + u_C$$

where $\boldsymbol{\nu}$ are the first order conditions and $\boldsymbol{\gamma}$ are second order conditions or cross-derivatives[91]. Taking the first order partial derivatives of the short-term translog cost function by differencing with respect to the price of input i, which by the Shepherd's lemma, yields the cost share or conditional demand for input i to estimate;

$$\frac{\partial \ln(C^*)}{\partial \ln(w_i)} = x_i(w_i, Y) = S_i$$

[90] It is a functional form in its own right if the remainder is neglected and if we assume all derivatives and cross-derivatives to be constant. This latter constraint is imposed if the parameters are estimated in regression equations (Binswanger, 1974).

[91] Note that the cross-derivatives $\gamma_{ij} = \gamma_{ji}$ are symmetric. Hence, we multiply the cross-product sum by 0.5.

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