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FULL ARTICLE

FDI and the growing wage gap in Mexican municipalities

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Abstract

Inward foreign direct investment (FDI) has generally been linked to higher wages, but evidence remains sparse on the overall effects of FDI on average wages, the wage gap between skilled and unskilled labour, and inter-industry heterogeneity. We address these issues for Mexican municipalities and industries for a period of increasing FDI and sectoral change that saw growing wage inequality. By combining two non-experimental techniques we find that FDI in Mexico was associated with higher wages, mostly for skilled workers—but also for unskilled ones—and a widening gap between them. Effects vary both between and within industries depending on location, and they either wax or wane when the initial or incremental effects are considered.

KEYWORDS
foreign direct investment, industries, Mexico, municipalities, wage inequality

JEL CLASSIFICATION
F23, J31, C14

1 | INTRODUCTION

The entry of foreign firms affects local wages, as indicated by a wide body of scholarly research on the impact of foreign direct investment (FDI) on local labour markets. In general, inward FDI has been associated with higher wages in the host economy. However, the evidence on the overall impact of FDI on 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). The relationship between inward FDI and changes in wages is rooted in the differences between foreign and domestic firms in the host region or industry. Multinational enterprises (MNEs) may possess some firm-specific advantage conferring them a superior level of technology and knowledge, leading to higher marginal labour productivity (Dunning, 2001; Markusen, 2002). They also typically pay higher wages than their domestic counterparts (Caves, 1974; Lipsey & Sjöholm, 2004; Markusen, 2002). But how exactly does FDI affect wages in a host economy? MNEs can drive up inequalities in the host economies, either by direct or indirect action, or by inaction (Narula & van der Straaten, 2021). This paper addresses questions regarding the impact of FDI on wages that have attracted limited attention in the scholarly literature to date.

First, increasing FDI may result in higher average wages in those industries and regions where they operate (Feliciano & Lipsey, 2006). The net average wage effects depend on whether or not MNEs introduce a foreign-wage premium and on the reaction of domestic firms' wages in the region–industry following inward FDI (Ietto-Gillies, 2012). A second issue dominating the FDI debate is the association between foreign presence and widening of the wage gap between skilled and unskilled workers (Feenstra & Hanson, 1997; Taylor & Driffield, 2005). Generally speaking, the localized average effects of MNE activity, in the form of FDI, depend on the industry and the technological and organizational context in which the investment takes place (Ietto-Gillies, 2012; Lipsey, 2004). Moreover, given the predominant role of FDI in developing and emerging countries, the distributional effects on employment and wages can potentially be large (Helpman et al., 2008). We address these issues for Mexican municipalities and industries during a period of rapidly rising FDI flows in Mexico; 1998–2008.

Mexico constitutes a good case for studying the effects of FDI for three reasons. First, during the 2000s, the country became one of the largest recipients of FDI inflows worldwide, ranking 15th in 2008 (UNCTAD, 2014). Not only were FDI inflows following an increasing trend—averaging 24 billion US dollars annually between 1998 and 2008 (Ministry of Economics, 2014)—but the value of inward FDI stock as a percentage of GDP increased from 12.1% in 1998 to over 25% in 2008 (UNCTAD, 2014). Second, the decade from 1998 to 2008 witnessed major changes in the sectoral composition of aggregate inward FDI. While the manufacturing sector continued to take up a sizeable share of FDI inflows (45% on average), services gained importance, amounting to an average of 37% over the 10-year period (Secretaria de Economia, 2014).

Third, there are marked regional inequalities across the country. The distribution of foreign investment has been extremely uneven. Only five states out of 32 (excluding Mexico City) had 64% of the accumulated FDI stock in 2008. Moreover, the wage gap between skilled and unskilled workers varies significantly across regions and tends to be negatively correlated with availability of regional human capital (Bernard et al., 2010). The uneven distribution of factors of production has an influence on patterns of economic activity: subnational effects of FDI are likely to be more severe in emerging economies like Mexico, which are experiencing substantial inward FDI, sectoral change, large initial territorial disparities, and significant variation in regional relative wages.

Against this background, it seems pertinent to explore the heterogeneous effects of FDI on average wages across economic sectors and subsectors at the local (municipality) level, and assess whether FDI reduces, enhances, or perpetuates the wage gap between different types of workers.

The contribution of this paper is twofold. First, while previous research has dwelt on the relationship between FDI and wages in Mexico at the firm level based on industrial survey data, this is the first study to address the question at the municipality–industry level, exploiting census data. Furthermore, most previous empirical exercises focused on early periods of FDI. Our study includes a decade-long period from 1998 to 2008 that experienced increasing foreign presence and rapid sectoral change. Simultaneously, the wage gap between skilled and unskilled workers either rose or remained unaltered. 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 methods as the identification strategy for the effect of FDI on wage differentials between skilled and unskilled workers, accounting for industry heterogeneity.

The results are in line with evidence suggesting that FDI is associated with higher wages mostly for skilled workers—oftentimes for the unskilled as well—and with a widening gap between them. However, the effects of FDI vary significantly when the analysis is conducted at a finer level of industrial aggregation. The wage impact of FDI coming into Mexico also waxes or wanes when the initial or incremental effects are considered.

The rest of the paper is laid out as follows. Section 2 presents a discussion of the theory on the link between FDI and wage inequalities and extant evidence. The geography of FDI and wages in the Mexican case is described in Section 3. The empirical strategy is outlined in Section 4, from the quasi-experimental setting and identification issues to the data, variables, and subsamples. Section 5 reports and discusses the results. Finally, Section 6 draws implications and policy areas, as well as considering avenues for future research.

2 | FDI AND WAGE INEQUALITY: THEORY AND EVIDENCE

The entry and presence of foreign firms has labour market effects in the host locations. Most research on the effect of MNE activities, through FDI and host economy wage dynamics, relies on the underlying *cost minimization problem* of the firm, in which businesses find the optimal level of inputs that minimizes the cost of production, obtaining conditional demands for different types of labour and thereby modifying relative wages in the host economy (see the seminal work of Feenstra & Hanson, 1997). While evidence on the foreign wage premium is fairly robust,[1] the evidence regarding the overall effects of FDI on: (i) average wages; and (ii) 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 (e.g., Lipsey, 2004; Tsai, 1995). In this paper we address these two questions in turn.

First, we ask whether increasing FDI leads to higher or lower average wages in the regions and industries where they operate. The overall average wage effects of FDI 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 effect) (Ietto-Gillies, 2012). A higher degree of foreign ownership can affect average 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). For instance, a positive average effect could be a combination of higher foreign and domestic wages, but could also arise in the absence of indirect effects or domestic wage spillovers (Lipsey, 2004). If foreign firms offer higher wages (direct) and labour markets are segmented by industry and location, an increase in foreign presence will raise average wages but not necessarily domestic firms' wages (Feliciano & Lipsey, 2006). Moreover, a positive direct effect may be cancelled out by a negative indirect effect, for example, if domestic companies have to compete on the basis of wage reductions (Ietto-Gillies, 2012; UNCTAD, 1994). Finally, the average effect could also be nil if MNEs poach the best workers or acquire domestic firms with the best workers without paying higher wages (Driffield & Girma, 2003).

Generally speaking, the localized average effects—direct and indirect—of multinational activity in the form of FDI depend on the industry and technological and organizational context in which the investment takes place (Ietto-Gillies, 2012). Evidence in this regard is at best mixed. For example, Feliciano and Lipsey (2006) found that FDI had no significant effect on USA manufacturing and retail trade wage levels, while the effect was positive and significant in other low-skilled non-manufacturing industries. In the Mexican case, Villarreal and Sakamoto (2011) reported that FDI was associated with higher overall regional wages. They also found evidence of positive wage spillovers as domestic firms increased their wages in labour markets with higher MNE presence. By the same token, Sharma and

[1]Evidence on the foreign wage premium is plentiful both for developed and developing countries. In general, foreign firms pay higher wages than their domestic counterparts. This differential can be partly explained by the industry composition of FDI, skewed toward relatively higher-wage industry sectors. However, the differential is present within industries, in most industries, and in most countries (Lipsey, 2004). For evidence in developed countries, see for instance the cases of the 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 the cases of Brazil (Arbache, 2004), Indonesia (Lipsey & Sjöholm, 2004), Venezuela (Aitken et al., 1996), East Asian countries (Te Velde & Morrissey, 2004), and Sub-Saharan Africa (Coniglio et al., 2015).

Cardenas (2018) show that FDI had a positive correlation with regional average hourly wages in Mexico (between 2005 and 2015). Conversely, Waldkirch (2010) discovered either negative or no effect of FDI on average wages in Mexican industrial sectors during the period 1994–2004, while Kato-Vidal (2013) reports a negative effect of FDI on overall wages across Mexican regions between 1993 and 2010. Based on the theoretical literature and existing evidence, we formulate the following testable hypothesis.

H1. *FDI and average wages*. FDI is associated with higher wages, both for skilled and unskilled labour, in host region–industries.

Second, we assess whether the presence of foreign firms may affect wage inequality between skilled and unskilled labour. An increase in FDI in a local labour market, holding everything else constant, may raise overall productivity and increase the labour demand for a given supply of productive factors, initiating a wage differential in the location (Lipsey, 2004; Lipsey & Sjöholm, 2004). Because MNEs are usually technologically more advanced, they have an important influence on changes in the wage gap between skilled and unskilled workers (Figini & Görg, 1999; Markusen & Venables, 1997). Typically, foreign presence will raise wages for the skilled at the expense of the unskilled, although the effect on the latter may be ambiguous (Markusen & Venables, 1998). Hence, an accumulation of FDI is usually associated with an expansion of the demand for skilled labour, and therefore a widening local wage differential between skilled and unskilled workers (Bandick & Hansson, 2009; Feenstra & Hanson, 1997; Waldkirch, 2010). What is more, if the demand for skilled labour is further transmitted to the domestic sector, the wage gap between skilled and unskilled labour will widen further at the expense of the unskilled (Driffield & Taylor, 2000).

The evidence here is also mixed. For instance, in China, inward FDI is found to be associated with a growing wage gap (Chen et al., 2011). Similarly, while inward FDI substantially raised wage differentials in Thailand, the effects on the wage gap were less clear in Singapore, Hong Kong, the Philippines, and Korea (Te Velde & Morrissey, 2004). The results for Mexico also go in both directions. Feenstra and Hanson (1997) showed that FDI in the *maquiladora*[2] industry had an inequality-enhancing effect during the early period between 1975 and 1988, as skilled workers experienced wage increases across states, while wages for unskilled workers grew only slightly. Aitken et al. (1996) revealed that FDI was associated with overall higher wages between 1984 and 1990, both for skilled and unskilled workers, with a larger effect on the former, thus exacerbating wage inequality. By looking at a longer period, Airola (2008), however, found little evidence that *maquiladora* employment during 1984–2000 led to rising inequalities across Mexican regions. Finally, FDI in Mexico has also been associated with significant inter-industry wage differentials. Noria (2015) finds that the relationship between FDI and inter-industry wage differentials is positive and significantly strong, but only at low levels of foreign investment. Based on the extant literature, we formulate the next testable hypothesis.

H2. *FDI and wage gap*. Increasing inward FDI widens the wage gap between skilled and unskilled labour in host region–industries.

Despite the considerable number of empirical studies assessing the relationship between FDI and wages, few attempts have been made to deal with the selection bias that threatens the validity of the estimates of these effects: an upward bias will occur if foreign presence is higher in municipalities with higher initial wages. In trying to disentangle the relationship between FDI and wages, we implement a quasi-experimental approach to examine whether average wages and wage differentials—once we have accounted for observable characteristics of industries and regions—can be solely attributed to foreign presence. Finally, our quasi-experimental design allows us to test the temporal effects of FDI on average wages, an issue that has not received sufficient attention (Girma & Görg, 2007).

[2]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 regions along the northern border were constituted as a platform for the export of manufactured goods assembled in Mexico with raw material and components imported duty-free in plants largely owned by foreign capital (Lopez Villafañe, 2004).

Initial FDI is likely to have strong effects on wages due to: (i) the immediate introduction of a foreign wage premium by MNEs in the host location; and (ii) positive domestic wage spillovers. However, incremental FDI may not result in further large rises in wages, as both MNEs' and domestic firms' wages adjust in time. Based on this reasoning, we formulate the following testable hypothesis.

> **H3.** *FDI temporal effects*. Initial FDI wage effects will be larger than cumulative effects in host region–industries.

The bottom line is to assess whether different types of FDI have wage inequality–increasing or reducing effects at the subnational level and between skilled and unskilled employees, and whether these effects wax or wane in time. The next section lays the ground for the analysis.

3 | GEOGRAPHY OF MEXICAN INWARD FDI AND WAGES

Mexico has become one of the largest recipients of FDI inflows. In 2008, it ranked 15th world-wide, and maintained this position until at least 2018, when inward FDI as a share of GDP reached 42.2% (UNCTAD, 2014, 2018). The study period witnessed major changes in the sectoral composition of aggregate inward FDI, as shown in Figure 1. While manufacturing attracted the bulk of foreign investment during the 1980s and 1990s, its importance diminished on average relative to the share of investment in services. During the 10-year period between 1998 and 2008, the share of manufacturing investment dropped from to 65 to 31%, alongside an increase in the share of services from 15 to 38% (see Table 1). However, in the following decade ending in 2018, the share of manufacturing FDI inflows bounced back to pre-2000s levels, while the share of services declined again.

These recent trends are worth exploring, since FDI wage effects are likely to be heterogenous across industrial sectors and locations. Further disaggregation into subsectors reveals a more detailed picture of the distribution of

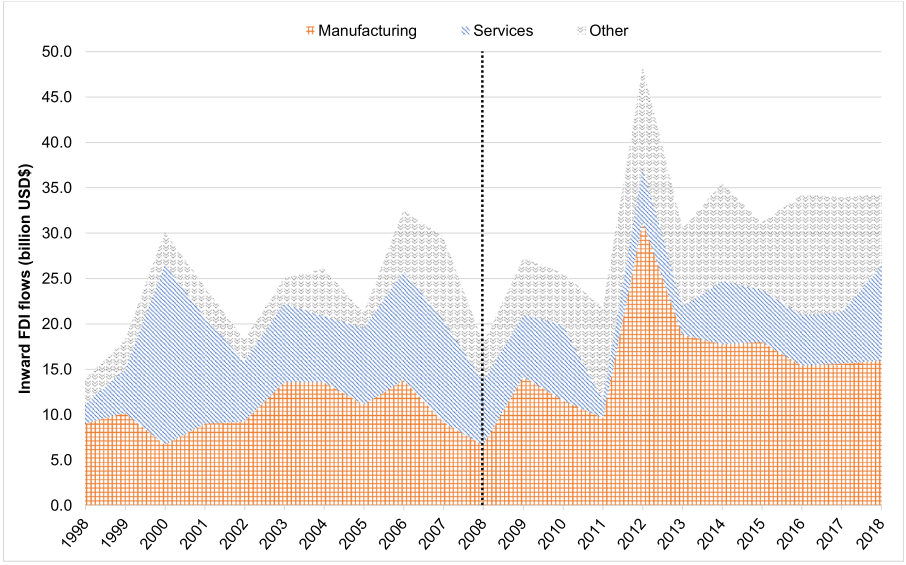


FIGURE 1 Sectoral composition of FDI inflows in Mexico, 1998–2018 *Source*: Authors, with data from the Ministry for Economics, *Secretaría de Economía, Gobierno de México* (2020).

TABLE 1 Share of total FDI inflows into Mexico by sector and subsector, 1998–2008

Sector	1998	2003	2008	Average 1998–2008
Manufacturing	65.3	54.3	31.3	45.8
Chemical	5.9	23.4	8.2	8.8
Electronics	16.4	5.9	5.0	8.2
Automobile	19.2	12.8	6.7	10.2
Food and beverages	8.2	5.4	5.2	8.2
Services	15.0	34.7	38.1	37.2
Real estate and finance	4.6	23.6	30.6	24.9
Business support and media	5.4	7.8	5.2	7.9
Tourism	7.7	4.6	6.4	6.2
Other	19.7	10.9	30.6	17.1

Notes: Figures shown represent percentages relative to total FDI. The first three columns are shares of total FDI inflows for selected years, while the fourth column shows the average shares of FDI inflows in the relevant period.
Source: Authors, with data from Ministry for Economics, *Secretaría de Economía*, *Gobierno de México* (2010).

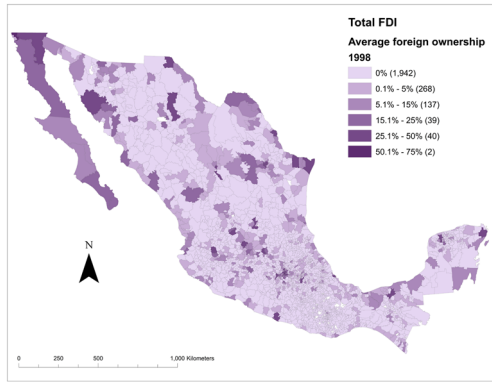
FDI in Mexico as depicted in Table 1, which shows the share of total FDI inflows. According to these figures, the top FDI-recipient manufacturing industries in terms of their relative proportion of total FDI were the automobile, chemical, electronics, and food and beverage industries. The top FDI-recipient services were real estate & finance, business support and media, and tourism.

FDI inflows into Mexico hide an extremely uneven regional concentration of foreign investment at the municipality[3] level (Figure 2). In 1998, FDI was concentrated in the northern regions, some central areas, Mexico City and nearby areas, southern oil-producing municipalities, and tourist destinations. A decade later, the uneven distribution of FDI remained relatively unchanged. There were, however, significant increases in the number of municipalities with higher percentages of foreign ownership, especially around the 5 and 25% threshold. Finally, the spatial distribution of manufacturing and services FDI individually exhibit distinct patterns (see maps in Figure A1 and Figure A2 in the Appendix). While FDI in manufacturing was concentrated in the traditionally industrial northern and central regions, foreign investment in services was located in and near large and medium sized cities and tourist destinations.

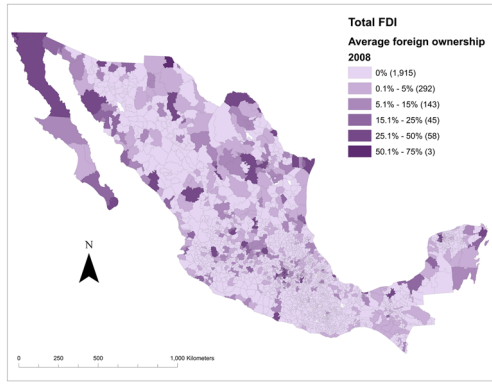
The skilled–unskilled wage gap was also unevenly distributed across the country. The maps in Figure 3 show the spatial extent of relative average wages computed as the ratio of skilled to unskilled wages; the higher the ratio (darker shade), the wider the wage inequality. In 1998, wage disparities did not follow a clear pattern, as darker shades were scattered up and down the country. At the turn of the decade, the map for 2008 shows that the overall dispersion of relative wages decreased. Nonetheless, a closer inspection reveals that this was due only 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 north to south.

Marked differences in wage inequality trends are in evidence when wages are broken down by sector. The distribution of relative wages between skilled and unskilled workers in the manufacturing sector was highly polarized in 1998 (see maps in Figure A3 in the Appendix). Ten years later, despite an overall compression around the mean, the distribution of the wage gap remained virtually the same, with some northern border and south-eastern municipalities seeing an increased wage gap between workers by type. Wage differentials in the service sector tell a completely different story (see maps in Figure A4 in the Appendix). At the beginning of the period the distribution of

[3]This administrative unit represents the third tier of government in Mexico, below the state and federal administrations. It is the equivalent of US counties. Mexico has 2,457 *municipios*. Population sizes range from 100 to 1.8 million inhabitants. The smallest *municipio* is 4.3 km^2. The largest occupies 53,304 km^2. Over 80% of the country's population resides in 47% of its municipalities.



1998



2008

FIGURE 2 Total FDI in Mexico: Average foreign ownership by municipality, 1998–2008 *Source*: Authors, with data from *Censos Económicos* (INEGI, 1999, 2009).

relative wages was rather compact, with only a few municipalities having large inequalities. However, by 2008 the dispersion of relative wages had increased significantly. No discernible geographical pattern can be identified, but the largest wage inequalities in the services sector were prevalent in municipalities with medium-sized cities and tourist destinations.

4 | EMPIRICAL STRATEGY

4.1 | Identification

In this paper we address the question of whether inward FDI leads to higher average wages and widening differentials between skilled and unskilled workers across economic sectors and subsectors at the municipality level. More specifically, we ask whether a foreign presence within industries shapes wages in FDI-recipient municipalities. The most salient and problematic feature of the FDI–wage relationship is reverse causality. It is empirically difficult to disentangle the location determinants of FDI from its effects on the local economy (Ietto-Gillies, 2012). On the one hand, FDI influences the local labour market of the host economy via labour demand. On the other hand, initial wages may play a role as locational determinants of multinational activity, as they often are a proxy for skills.

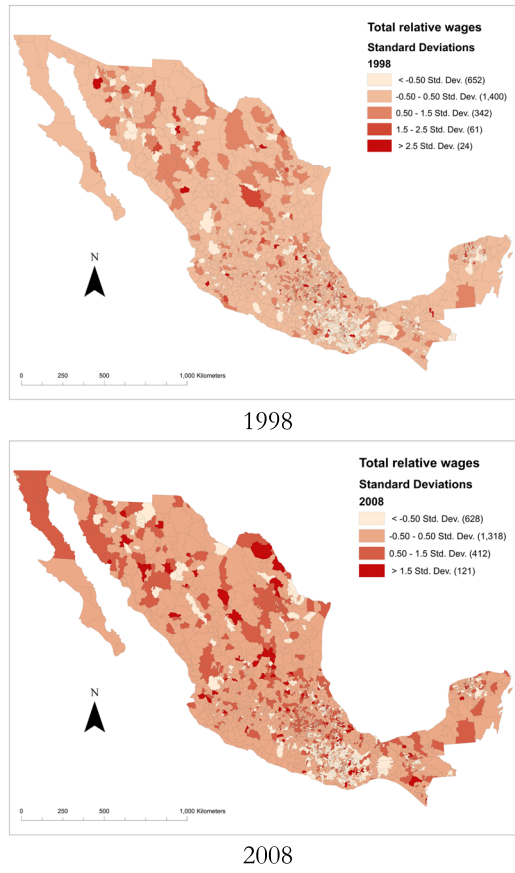


FIGURE 3 Total relative wages in Mexico: Average relative wages by municipality, 1998–2008 *Note*: The variable plotted is the average relative wages as the ratio of skilled to unskilled wages for all sectors. *Source*: Authors, with data from *Censos Económicos* (INEGI, 1999, 2009).

Because of this, disentangling the endogenous relationship is the main challenge of any quasi-experimental approach that might attempt to identify the effects of FDI on wages.

A positive association between FDI and wages can hide a selection bias driven by foreign firms' investment decisions. Broadly speaking, high wages could be either a consequence of 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); previous presence of established exporting industries (Villarreal & Sakamoto, 2011); or simply traditional Marshallian externalities in the form of specialized labour pools and local suppliers. These scenarios illustrate potential reverse causality of wages and FDI. Hence, simple OLS or even fixed effects estimators suffer from selection bias. We therefore 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 region–industries.

To measure the 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 municipality–industries, we omit the industry subscript in the interests of clarity. The treatment effect

of FDI on wages in municipality i is simply the difference $w^1_{it+\delta} - w^0_{it+\delta}$. During $t+\delta$, the period following FDI inflows, the first term is observed wages in municipality i under foreign presence, while the second is observed wages in the same municipality without foreign presence. We are interested in the average treatment effect on the treated municipality (ATET), defined as the expected value of the difference in wages for those municipalities that received FDI in time t:

$$E\{w^1_{it+\delta} - w^0_{it+\delta} | FDI_{it} = 1\} = E\{w^1_{it+\delta} | FDI_{it} = 1\} - E\{w^0_{it+\delta} | FDI_{it} = 1\}. \quad (1)$$

However, for a given municipality, we can only observe either $w^1_{it+\delta}$ or $w^0_{it+\delta}$ in time $t+\delta$. To solve this problem of *unobservability*, 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. For this counterfactual to be valid, the control units must have the same pre-treatment characteristics (Dehejia & Wahba, 2002). Specifically, it is assumed that conditional on observable characteristics $X_{it-\delta}$ of the municipalities, FDI flows are not determined by unobservable factors.[4] A valid comparison group is constructed by matching each FDI-recipient region to one non-FDI-recipient region that is similar along some predetermined observable characteristics. To this end, the propensity score pairs municipalities on the conditional probability of receiving the treatment (Rosenbaum & Rubin, 1983). In this setting, the conditional probability of receiving FDI is given by $Pr(FDI_{it} = 1 | X_{it-\delta}) = F[X_{it-\delta}]$, which is a function of the pre-treatment characteristics $X_{it-\delta}$.The choice of covariates $X_{it-\delta}$ is motivated by the literature on the locational determinants driving FDI decisions made by firms seeking to establish operations abroad, which in turn affects the probability of foreign investment flowing into a given host region. Locational advantages can be understood as industry-specific trade-offs between scale economies and market access, and between scale of integration and factor cost differentials (Barba Navaretti & Venables, 2004). Therefore, pre-treatment covariates are factors influencing firms' investment decisions and hence correlated with FDI flows and wages. The selection and construction of the variables is presented in greater detail in subsection 4.2.

The propensity score estimator is a good approximation of the effect of FDI on wages if, conditional on the probability of receiving FDI, potential wages are independent of the incidence of foreign ownership (Angrist & Pischke, 2008).[5] 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 ATET is given by:

$$E\{w^1_{it} - w^0_{it} | FDI_{it} = 1\} = \frac{1}{P(FDI_{it} = 1)} E\left[\frac{(FDI_{it} - p(X_{it-\delta}))\boldsymbol{w_{it}}}{1 - p(X_{it-\delta})}\right]. \quad (2)$$

The estimation of (2) requires a consistent estimator of the propensity score (Angrist & Pischke, 2008). We use a logit model to estimate the conditional probability $P(FDI_{it} | X_{it-\delta})$.[6]

Finally, even when controlling for selection on observable characteristics, there may still be unobserved time-invariant differences in wages across municipality groups. Thus, propensity score matching is combined with the difference-in-difference technique (Heckman et al., 1997) to eliminate unobserved heterogeneity between municipality groups by using the change in wages before and after FDI (Blundell & Costa Dias, 2000).[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 municipalities would have done in the absence of FDI inflows. Therefore, $\boldsymbol{\Delta w_i} = w_{it+\delta} - w_{it-\delta}$ can be plugged into the sample analogue of (2) instead of w_i:

[4]The identification assumption requires that the condition of *selection on observables* $w^0_{it+\delta} \perp\!\!\!\perp FDI_t \mid X_{it-\delta}$ be fulfilled .

[5]If the assumption of *selection on observables* (footnote 4) holds, then it follows that $w^0_{it+\delta} \perp\!\!\!\perp P(FDI_{it} | X_{it-\delta})$.

[6]The estimation of (2) requires that there is a positive probability of either being treated $FDI_{it} = 1$ or not $FDI_{it} = 0$. Therefore, the *common support* assumption implies that a match can be found for all treated municipalities providing the basis of the comparison (Smith & Todd, 2005):
$0 < P(FDI_{it} = 1 | X_{it-\delta}) < 1$

[7]The identification assumption (footnote 5) is now stated in terms of the before/after evolution of wages instead of levels: $w^0_{it+\delta} - w^0_{it-\delta} \perp\!\!\!\perp P(FDI_{it} | X_{it-\delta})$.

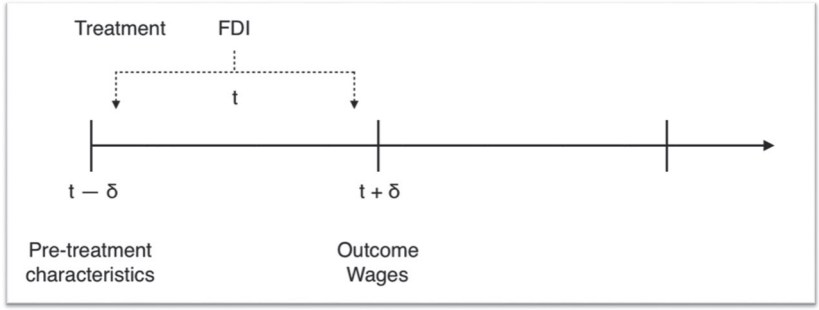


FIGURE 4 Temporal definition of treatment *Source*: Authors.

$$ATET = \frac{1}{N_1}\sum_{i=1}^{N} \Delta w_i \cdot \frac{FDI_{it} - \widehat{p}(X_{it-\delta})}{1 - \widehat{p}(X_{it-\delta})}, \tag{3}$$

which constitutes the difference-in-difference propensity score matching estimator of the average treatment effect in FDI recipient municipalities on wages that we are interested in estimating. The treatment is represented schematically in Figure 4.

Matching on pre-treatment covariates is done in period $t-\delta$. Inward FDI takes place any year during period δ, while the outcomes (wages) are measured in the period following the treatment, $t+\delta$. The treatment is repeated for different municipality groups in two time periods; G1: 1998–2003 and G2: 2003–2008. The units of analysis are municipality–industry groups. To account for industry heterogeneity, we estimate the FDI effects by sector and subsectors separately.

4.2 | Data, variables, and subsamples

To address the questions at hand, we use data for Mexican municipalities from the Economic and Population Censuses, both collected by Mexico's National Institute for Statistics (INEGI). The data related to foreign ownership can only be obtained under certain confidentiality principles and by request.[8] The rest of the variables are from the INEGI website.[9] The dataset consists of data aggregated at the municipality level by three-digit industrial subsector according to the North American Industrial Classification System (NAICS, 2013). Economic Census data are available at five-year intervals for 1998, 2003, and 2008.[10]

The analysis encompasses subsamples of the dataset to allow for heterogeneous effects of FDI. The first division corresponds to the industrial scope (see Table A1 in the Appendix for further details). Estimates 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 the service sector. Further analysis is conducted by disaggregating sectors into their main subsectors; food and beverages, automobile, electronics, chemical, real estate & finance, business support & media, and tourism. The second division comprises the different wage groups. Foreign ownership effects are evaluated separately for two different wage groups, skilled and unskilled workers. The third division corresponds to the temporal dimension of FDI 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.

[8]Wherever there are three or fewer economic units in the industry–municipality observation, data are concealed for reasons of confidentiality.
[9]Available at: https://www.inegi.org.mx/microdatos/
[10]Economic Census data refer to the fiscal year before the information is published (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 as the base year. Average wages are calculated as total remuneration relative to total employment in the corresponding wage group. The difference in wages is given by $\Delta w_i = w_{it+\delta} - w_{it-\delta}$. This represents 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. Although coarse, these broad categories are closely related to the knowledge intensity of the respective 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. We test differences in the temporal effects of FDI by defining two treatment variables. First, we construct a dichotomous 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 $t+\delta$; $FDI^{\rightarrow} = 0$ if the municipality has no foreign presence during the same period. We also calculate a second treatment variable that measures the incremental effect of FDI on wages for municipalities with existing foreign presence: $FDI^{\rightrightarrows} = 1$ if foreign presence increases between $t-\delta$ and $t+\delta$, and $FDI^{\rightrightarrows} = 0$ if there is no change or the change is negative. We evaluate these treatment effects on two groups of municipalities: the first group, G1, for the period from 1998 to 2003, and the second group, G2, from 2003 to 2008. The number of treated and untreated municipalities varies depending on the subsample considered.

The pre-treatment covariates[11] in $t-\delta$ are related to both FDI and wages. 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, and input requirements (Harris & Robinson, 2002). To address these factors, 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, measured by the development index *per capita*. Furthermore, large firms generally pay higher wages. To account for any size effect, we include capital stock in the form of the log of total fixed assets (Hollister, 2004). FDI may flow 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 for this reason. To control for the fact that FDI may 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, we control for the initial average skilled and unskilled wages in their logarithmic form to control for the fact that FDI may flow into regions with higher skills and consequently higher wages (Almeida, 2007).

4.3 | Balancing of covariates

For the identification assumption to hold, the pre-treatment covariates should be balanced across groups of municipalities in the data (Rosenbaum & Rubin, 1983). To construct the control group, we use *k*-nearest neighbours with replacement as the matching technique and choose to match the *two* nearest neighbours of each treated municipality.[12] We provide below some tests to confirm that the matching is balanced enough for consistent estimators. These are conducted for all subsamples for which we estimate a propensity score in the results section. We can verify that there were no pre-existing significant differences across treated and control municipalities before FDI flows.

[11]Descriptive statistics for all pre-treatment covariates are provided in Table A2 in the Appendix by FDI presence in the pre-treatment period.

[12]The choice of *k* entails a trade-off between bias and precision. Selecting a high number of neighbours introduces bias in the estimate because, by definition, the subsequent matches are further away from the treated unit than the first match (Stuart, 2010). However, choosing $k > 1$ reduces the variance due to a larger matched sample and because the propensity scores are averaged by the *k* closest matches. In addition, we choose to match *with replacement*, due to the difficulty of finding a "close enough" control municipality. Matching with replacement leads to bias reduction since it decreases the distance in the propensity score between control and treated units, even if the control municipalities have been matched more than once (Dehejia & Wahba, 2002). Matching without replacement will increase bias because treatment units are forced to match with municipalities that are not necessarily the most similar in terms of the propensity score.

TABLE 2 Balancing tests from matched data for all industries. Pre-treatment period 1998

	Means				T-test		
Variable	Treated (1)	Control (2)	% Bias (3)	% Bias reduction (4)	*t*-stat (5)	P-value (6)	Variance ratio (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

Notes: 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.

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 control municipalities.

The means for the matched sample—shown in the first two columns of Table 2—are fairly balanced across groups. This is summarized by the standardized bias reported in column (3) and 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). For most of the covariates this value is smaller than ± 10%, meaning that for the matched sample, the differences in means across groups are small. All biases are smaller than 20% and the mean bias is 15%.[13]

The appropriateness of the balancing is further confirmed in column (4), which displays the bias reduction in terms of improvement from the raw to the matched sample. After matching on observables, almost all pre-treatment covariates present a bias reduction of more than 90%, which increases our confidence in the matching procedure (the exception being exports, with a bias reduction of 44%). 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% 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 indicate the similarity across groups in terms of the spread of each distribution. The closer to one, the greater the similarity in the dispersion of the distributions for treated and control municipalities. For most of the covariates, this ratio is close to one.[14] Municipalities attracting FDI are more similar to one another, hence the smaller dispersion around the mean. Balancing tests on the standardized bias and variance ratios (columns (3) and (7)) are visually summarized in Figure A5 in the Appendix. Finally, the common support is imposed, and the analysis restricted to the control municipalities that fall within the distribution of the treated units, to ensure overlap between the distribution of propensity scores of control and treatment groups (Heckman et al., 1997).

[13]Only a bias greater than 20% can be considered large and hence problematic (Rosenbaum & Rubin, 1985). The only notable exception is exports, with a bias of 25%. This is not surprising, since the sample includes a pool of manufacturing and services sectors. In fact, the standardized bias in exports is closer to zero in the subsamples for manufacturing and individual industrial subsectors.

[14]However, for labour productivity and skilled wages, the variance for the control group is usually larger than that of the treated municipalities. This again may be explained by the composition of the sample.

5 | ANALYSIS AND DISCUSSION

5.1 | Analysis of results

Once the balance in the covariates has been guaranteed for the conditional propensity score, the estimates of the ATET of FDI on wages for treated municipalities (Equation 3) are given in Table 3 for the initial effect and in Table 4 for the incremental effect. Treated municipalities in groups G1 and G2 are not the same, meaning that the effects of FDI on wages correspond to different sets of locations and should not be thought of as a time trend. Insofar as the identification assumptions hold in the dataset, the coefficients can be interpreted, with caution, as the unbiased estimated effects of FDI on wages in treated municipalities. Since these are expressed in logarithmic form, point estimates can be read as a percentage change in the corresponding average wages.

Table 3 contains the 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 $t-\delta$.

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)
G1: 1998–2003			
All industries	0.323 (0.090) **	0.045 (0.045)	1,756 (128)
Manufacturing	0.779 (0.170) ***	−0.016 (0.070)	1,449 (89)
Automobile	0.601 (0.257) **	0.255 (0.065) ***	56 (12)
Electronics[a]	-	-	-
Chemical	1.450 (0.637) **	0.511 (0.326)	81 (10)
Food and Beverages	0.417 (0.193) **	0.038 (0.066)	1,487 (50)
Services	0.276 (0.118) **	0.205 (0.071) ***	1,435 (69)
Real estate and Finance	−0.038 (0.209)	0.043 (0.207)	402 (40)
Business support and media	0.362 (0.151) **	0.285 (0.201)	828 (60)
Tourism	0.508 (0.140) ***	0.160 (0.081) **	1,284 (52)
G2: 2003–2008			
All industries	0.450 (0.102) ***	0.115 (0.045) **	1,766 (75)
Manufacturing	0.617 (0.135) ***	0.198 (0.059) ***	1,452 (58)
Automobile	0.680 (0.673)	0.049 (0.113)	44 (7)
Electronics[a]	-	-	-
Chemical	0.085 (0.297)	−0.212 (0.180)	81 (14)
Food and beverages	1.089 (0.315) ***	0.360 (0.073) ***	1,507 (21)
Services	0.575 (0.152) ***	0.194 (0.066) ***	1,535 (59)
Real estate and finance	0.329 (0.164) **	0.103 (0.091)	490 (23)
Business support and media	1.255 (0.342) ***	0.440 (0.156) ***	990 (23)
Tourism	0.235 (0.176)	0.060 (0.064)	1,308 (50)

Notes: *** 1%, ** 5%, * 10% level of significance; N = Sample size; T = Treated municipalities on common support; AI = Abadie-Imbens robust standard errors. Treatment municipalities are not the same for each period. Group G1 are treatment and control municipalities in the period 1998–2003; Group G2 are municipalities in the following period 2003–2008.

[a]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.

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)
G1: 1998–2003			
All industries	0.178 (0.046) ***	0.024 (0.022)	2,168 (341)
Manufacturing	0.323 (0.071) ***	0.0005 (0.033)	1,702 (215)
Automobile	0.200 (0.155)	0.088 (0.118)	114 (30)
Electronics	0.072 (0.105)	−0.089 (0.094)	66 (28)
Chemical	0.295 (0.106) ***	0.064 (0.108)	186 (59)
Food and Beverages	0.244 (0.106) **	−0.016 (0.047)	1,602 (82)
Services	0.252 (0.080) ***	0.073 (0.042) *	1,601 (163)
Real estate and finance	0.162 (0.110)	0.008 (0.076)	475 (100)
Business support and media	0.306 (0.090) ***	0.166 (0.070) **	944 (102)
Tourism	0.353 (0.129) ***	0.148 (0.121)	1,360 (95)
G2: 2003–2008			
All industries	0.220 (0.056) ***	0.099 (0.027) ***	2,226 (291)
Manufacturing	0.455 (0.086) ***	0.091 (0.041) **	1,747 (141)
Automobile	0.138 (0.309)	0.120 (0.081)	110 (20)
Electronics	−0.258 (0.184)	0.291 (0.094) ***	62 (26)
Chemical	0.183 (0.100) *	0.024 (0.066)	182 (48)
Food and beverages	0.330 (0.145) **	0.071 (0.071)	1,648 (59)
Services	0.294 (0.034) ***	0.066 (0.046)	1,731 (151)
Real estate and finance	0.168 (0.069) **	0.009 (0.033)	600 (70)
Business support and media	0.434 (0.157) ***	0.017 (0.123)	1,123 (80)
Tourism	0.186 (0.042) ***	0.036 (0.051)	1,428 (100)

Notes: *** 1%, ** 5%, * 10% level of significance. N = Sample size. T = Treated municipalities on common support. AI = Abadie-Imbens robust standard errors. Treatment municipalities are not the same for each period. Group G1 are treatment and control municipalities in the period 1998–2003; Group G2 are municipalities in the following period 2003–2008.

For all industries, we find evidence in favour of hypothesis H1. In the period following the entry of new FDI, regional average wages were significantly higher in treated municipalities than in those that did not receive FDI. Although skilled wages were significantly higher in both groups, unskilled wages rose significantly only in one group and remained unaffected in the other. These differences in the aggregate may be attributed to heterogeneity between and within industries.

Regarding hypothesis H2, there is evidence to support that initial FDI shocks are connected with a widening of the wage gap, when all industries are considered. For example, in group G1, while skilled wages increased by 32.3%, there was no significant increase in unskilled wages. Considering that mean skilled wages were almost 22.5% higher than unskilled wages in the pre-treatment period (from Table 2), FDI further broadened the initial average wage gap in treated municipalities to 55%. These coefficients, however, consider FDI in all industries, hiding considerable 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.

We first turn to the results for manufacturing. FDI in this sector is associated with higher average wages for both groups of workers, but more persistently for skilled workers. Given the initial wage differentials, manufacturing in

FDI leads to an increase in the wage gap at the expense of unskilled labour (see Table A3 in the Appendix). Nonetheless, these higher average wages can still be driven by specific industries, as manufacturing encompasses a wide range of economic activities with different levels of technology and knowledge intensity, which in turn, rely on different worker skills to varying degrees.

For the automobile industry, both skilled and unskilled wages were higher or remained unchanged in treated municipalities. This suggests that FDI within the automobile industry targeted different stages of the production chain with varying degrees of skill requirement in different regions. In the chemical subsector, unskilled workers did not experience any significant foreign wage premium, while skilled wages significantly rose only in one group of treated municipalities. In the food & beverages industry, there is consistent evidence of higher wages for skilled workers but unskilled wages either increased or remained unchanged. The lack of consistency in the estimates of average wage effects in different manufacturing industries reinforces the idea of a wide heterogeneity of FDI effects on wages even within the same industry in different locations.[15]

Next, we turn to the results for services. Overall, the service sector exhibited consistently significant initial higher average wages, both for skilled and unskilled workers. FDI in this sector was also associated with a widening of the wage gap between worker groups (from Table A4 in the Appendix). With regard to the inter-industry heterogeneity of the services sector, for the real estate and finance subsector, skilled wages were higher (or remained unchanged) following FDI inflows. Unskilled wages, in contrast, did not change in either group. This indicates that this industry requires, on average, a less unskilled labour force. In the business support and media subsector, the effect of initial FDI was consistently positive and significant for skilled workers, whereas unskilled wages remained unchanged in one case and increased in the other. Heterogenous effects are expected since industries within this subsector are wide-ranging in terms of their skill requirements; from cleaning support to scientific and technical assistance for businesses (Table A1). Finally, tourism is another special case, due to the widely diverse nature of the economic activities it encompasses, ranging from passenger transportation to entertainment, to hospitality and accommodation services. Wage effects were either positive or insignificant for both skilled and unskilled workers. Taken all together, the estimated coefficients for different service subsectors suggest that even though services are on average more knowledge-intensive and rely more on skilled rather than unskilled workers, FDI in this sector also increased average unskilled wages.

Up to this point, we have discussed the estimates corresponding to the initial effect of FDI on wages in recipient municipalities that transitioned from no foreign firm presence to FDI. We now turn to the incremental effect that $FDI^{\rightrightarrows}$ had on average wages and wage differentials. In other words, we examine whether increasing foreign investment was associated with further higher average wages and changes in the wage gap in recipient municipalities that already had an established foreign presence in the pre-treatment period. These results are presented in Table 4.

Overall, increases in foreign ownership resulted in 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 exhibited the same pattern as their counterparts in Table 3, but with lower magnitudes. This constitutes evidence in favour of hypothesis H3, suggesting that subsequent arrival of MNEs was associated with lower increases in wages when compared to initial FDI shocks. An explanation is that after initial wage increases, as both domestic and foreign firms' wages adjust, additional FDI does not drive wages up further, as cost-minimizing firms attempt to keep labour costs low.

However, estimates on individual subsectors display diverse results. For instance, incremental FDI inflows into the automobile industry were not significantly associated with higher average wages for either group of workers. Put differently, after an initial increase in average wages—driven by foreign wage premia introduced by new MNEs arriving in the local labour market—wages did not escalate further significantly with the subsequent entry of MNEs in the industry.

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

In the electronics industry, no evidence is found of higher wages for skilled workers, implying that the activities being offshored into the country were largely concentrated in low-skill–intensive stages of the electronics value chain. Incremental FDI in both the chemical and food and beverage industries was associated with increasing average wages for skilled workers in both groups, suggesting the presence of skill-intensive activities. Within service sectors, only business support and media had one case of increasing unskilled wages.

5.2 | Discussion of results

Our results highlight four general trends for inward FDI wage effects in Mexican municipalities for the period of study. First, there is sufficient evidence in favour of hypothesis H1. By and large, FDI was associated with higher average wages, both for skilled and unskilled workers, in FDI-recipient municipalities and industries. This is in line with previous findings for Mexico (Aitken et al., 1996; Sharma & Cardenas, 2018; Villarreal & Sakamoto, 2011). Nonetheless, in some instances the FDI effects are statistically insignificant, as suggested by others (e.g., Saucedo et al., 2020; Waldkirch, 2010).

Second, FDI is consistently linked to increases in the wage gap between skilled and unskilled workers. This could be due to: (i) skilled wages rising more than unskilled wages; or (ii) skilled wages increasing while unskilled wages decrease or remain unchanged. 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 increased, pre-existing wage inequalities were reinforced by considerably higher increases in skilled wages. FDI-induced inter-industry wage differentials have also been found in the case of Mexico (Noria, 2015). The widening of the wage differential between types of workers was stronger for FDI in manufacturing than in services (Taylor & Driffield, 2005). However, incremental FDI in services had deeper inequality-enhancing effects, possibly due to rising FDI in this sector.

Third, at the subsector level, evidence was found in support of hypothesis H3. The effects of FDI on local wages were larger for initial incoming flows of foreign investment than for incremental inflows. This finding is in agreement with the evidence that MNE entry effects on wages are more substantial after initial shocks and they wane with subsequent FDI (Girma & Görg, 2007). Nonetheless, in some industries and services, incremental FDI continued 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 Mexico (Noria, 2015; Saucedo et al., 2020). The variable of industry-specific wage effects captures underlying technology and knowledge intensity in different economic activities that have distinct skill requirements (Wang, 2011). Effects were found to differ greatly, 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 the effects of FDI were indeed the result of a very complex interaction between MNEs and the territories and industries in which they operate (Dunning, 2000).

6 | FINAL REMARKS

The possibility that FDI has been contributing to widening wage inequalities in Mexico has important implications for public policy (Blomström & Kokko, 2002). We draw two broad implications surrounding these issues and outline areas of opportunity for policy tackling the growing wage gap in Mexican municipalities.

The first broad implication is related to the evidence that foreign investment is generally associated with higher average wages, mainly for skilled workers but also for unskilled workers. MNEs provide attractive employment opportunities to high-skilled graduates (Blomström & Kokko, 2002). Evidence herein suggests that FDI is associated with higher average skilled wages in general, both in manufacturing and in services. Insofar as FDI raises the demand for skilled labour, in turn increasing 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 and call centres in business services rely more on low-skilled labour than on highly skilled workers (Waldkirch, 2010). Hence, the higher wages for the unskilled may offset the returns to higher education, pushing vulnerable youth out of school and limiting overall educational attainment (Asali et al., 2016; Atkin, 2016; Ibarra-Olivo, 2021). The results strongly suggest that FDI in different industries provides different incentives to invest in education. Types of skills required vary by industry according to the underlying knowledge intensity of the economic activity. Higher unskilled wages are the norm in several subsectors from automobile and electronics to business services and tourism. For example, consider the arrival of a foreign-owned automobile assembly plant (or a hotel or a call centre) introducing a wage premium for unskilled labour at a given location. In these circumstances, individuals with the minimum educational level required may choose to drop out of school and get a highly paid unskilled job. If FDI has this effect, income inequality may widen further down the line, while FDI may simultaneously lower educational attainment in a municipality in the long run.

In the absence of significant educational policies, unskilled workers will lose in terms of well-being as their wages are further eroded. Large disparities in access to education will prevent unskilled workers from acquiring additional skills, while skilled workers will benefit from the opportunities provided by MNEs. Wage inequality will prevail. Educational policies in Mexico should therefore aim at expanding overall access to education and training for unskilled workers (Atkin, 2016; Lee & Wie, 2015). For instance, expanding compulsory schooling, increasing conditional cash transfers to keep youth in school, or raising the age of employment will increase overall educational attainment and enable the poorest to progress in terms of life-long earnings. Policies that solely focus on expansion at the upper end of the educational distribution will not reduce the wage gap and will be largely ineffective (Cortez, 2001).

A second broad implication relates to the increasing wage gap between different types of workers. FDI is generally associated with increases in wage inequality, not only at the most aggregated level, but also within specific industrial categories. Furthermore, FDI in manufacturing industries has more severe initial effects on widening the wage gap than FDI in services, which is associated more with persistent, incremental wage gap effects. Industrial policy at the municipal level in Mexico mostly targets FDI attraction. The efforts of local governments in this respect are commonly justified by the potential employment generation of multinational activity. Unfortunately, any 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 inequalities will eventually disappear as more workers climb up the skill ladder (Galor, 2000; Galor & Tsiddon, 1997). Nonetheless, the equalizing effect is highly dependent on the level of access to education. Improved access to higher education increases the earning opportunity of those at the lower end of the income distribution, reducing wage inequalities (Checchi, 2000). However, in the context of large disparities in access to education, the economic opportunities are captured by the skilled, increasing the income gap (Rodríguez-Pose & Tselios, 2009).

This paper, while answering important questions, also suggests further avenues for investigation. First, there is a need to further research into how FDI-induced wage effects affect domestically owned firms, by teasing out the direct effects embodied in foreign wage premia from indirect spillovers to domestic sector 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, meaning that FDI wage effects can vary across FDI sources. The last natural avenue of further research 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 also in training and vocational education (Miyamoto, 2003); and ultimately the subsequent impact on the accumulation in human capital.

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APPENDIX A

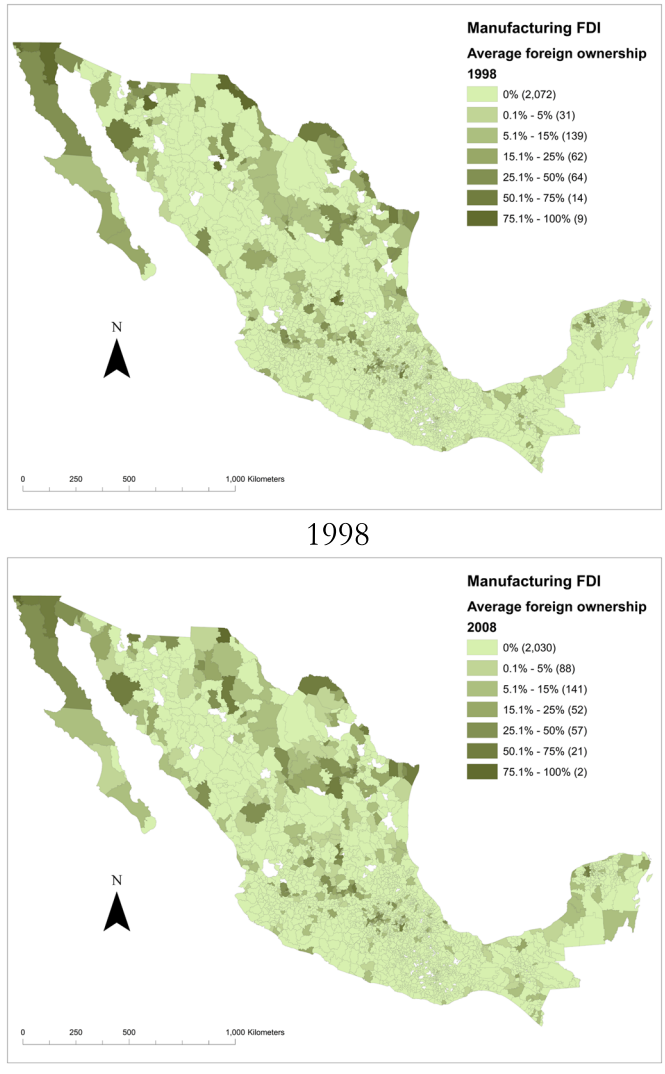
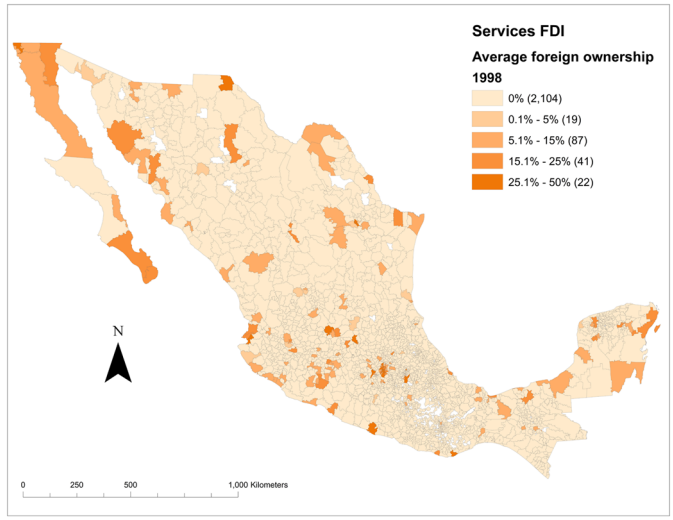
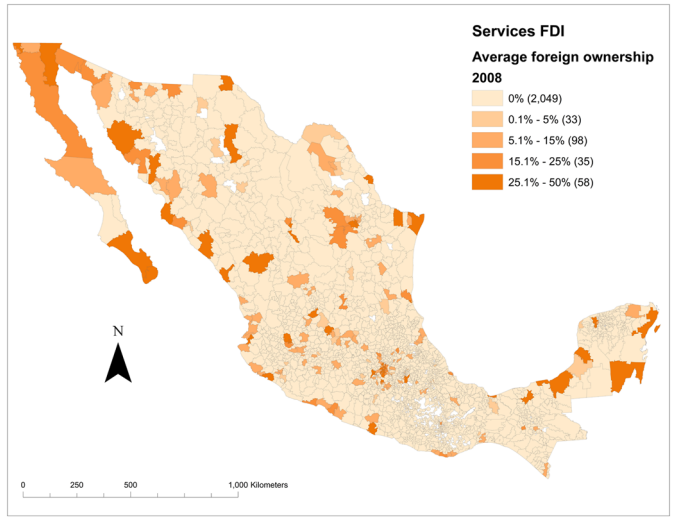


FIGURE A1 Manufacturing FDI in Mexico: Average foreign ownership by municipality, 1998–2008 *Source*: Authors, with data from INEGI Censos Economicos (1999, 2009)

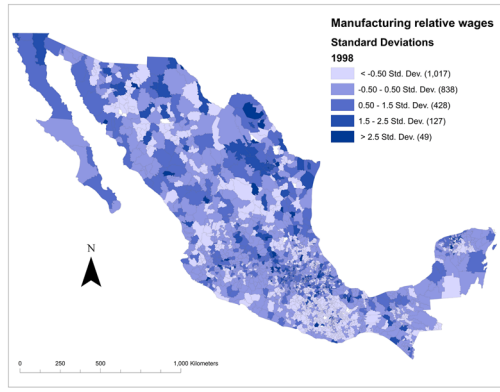


1998

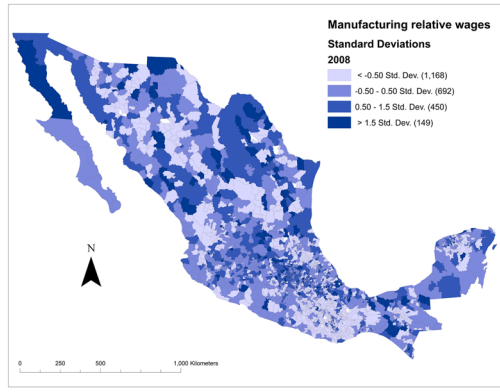


2008

FIGURE A2 Services FDI in Mexico: Average foreign ownership by municipality, 1998–2008 *Source*: Authors, with data from INEGI Censos Economicos (1999, 2009)



1998



2008

FIGURE A3 Manufacturing relative wages in Mexico: Average relative wages by municipality, 1998–2008 *Note*: The variable plotted is average relative wages as the ratio of skilled to unskilled wages for all sectors. *Source*: Authors, with data from INEGI Censos Economicos (1999, 2009).

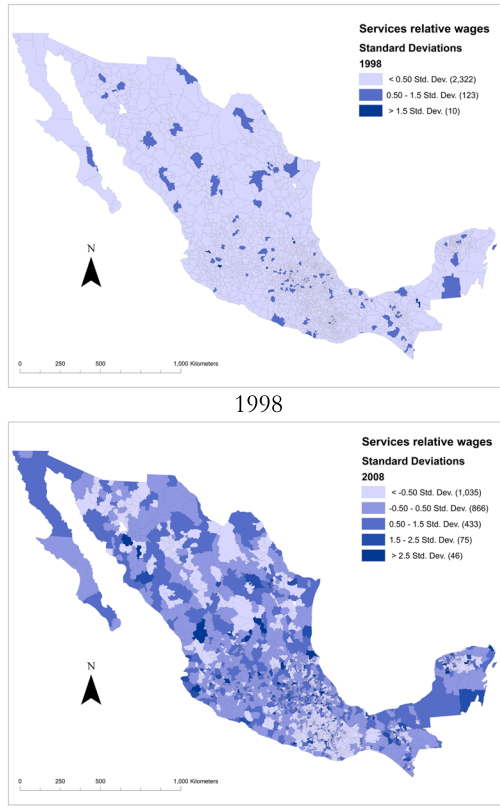


FIGURE A4 Services relative wages in Mexico: Average relative wages by municipality, 1998–2008 *Note*: The variable plotted is average relative wages as the ratio of skilled to unskilled wages for all sectors. *Source*: Authors, with data from INEGI Censos Economicos (1999, 2009).

TABLE A1 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 and Beverages
311	Food Manufacturing
312	Beverage and Tobacco Product Manufacturing
	Chemical
325	Chemical Manufacturing
326	Plastics and Rubber Products Manufacturing
327	Nonmetallic Mineral Product Manufacturing
	Electronics
334	Computer and Electronic Product Manufacturing
335	Electrical Equipment, Appliance, and 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 and Finance
52	Finance and Insurance
522	Credit Intermediation and Related Activities
523	Securities, Commodity Contracts, and Other Financial Investments and Related Activities
524	Insurance Carriers and Related Activities
53	Real Estate and Rental and Leasing
531	Real Estate
532	Rental and Leasing Services
	Business support and Media
51	Information
(8 subsectors)	Publishing Industries (except Internet), Motion Picture and Sound Recording Industries, Broadcasting (except Internet), Telecommunications, Data Processing, Hosting and Related Services, Other Information Services
54	Professional, Scientific and Technical Services
55	Management of Companies and Enterprises
56	Administrative and Support, Waste Management and Remediation Services
61	Educational Services
62	Health Care and Social Assistance

(Continues)

TABLE A1 (Continued)

Sector Subsector	Description
	All Industries
71	Arts, Entertainment and Recreation
72	Accommodation and Food Services
81	Other Services
	Tourism
485	Transit and Ground Passenger Transportation
487	Scenic and Sightseeing Transportation
488	Support Activities for Transportation
711	Performing Arts, Spectator Sports, and Related Industries
712	Museums, Historical Sites, and Similar Institution
713	Amusement, Gambling, and Recreation Industries
721	Accommodation, including Hotels and Motels
722	Food Services and Drinking Places

Source: SAIC (2013), authors' aggregation of subsectors.

TABLE A2 Descriptive statistics at the municipality level by FDI presence in 1998

Total FDI	No FDI		FDI	
Variable	**Mean**	**SD**	**Mean**	**SD**
Labour productivity	2.80	0.93	4.11	0.74
Capital	8.32	2.23	13.39	1.98
Exports	0.01	0.05	0.09	0.16
Average schooling	5.11	1.30	7.14	1.38
Population aged 15 to 29	0.25	0.03	0.28	0.05
Development index	0.75	0.08	0.83	0.05
Skilled wages	1.70	1.59	3.76	0.53
Unskilled wages	2.08	0.98	2.93	0.34
Observations	1,854		412	
Manufacturing FDI	**No FDI**		**FDI**	
Variable	**Mean**	**SD**	**Mean**	**SD**
Labour productivity	2.85	1.09	4.50	0.95
Capital	7.68	2.26	12.99	2.37
Exports	0.01	0.07	0.12	0.18
Average schooling	5.40	1.32	7.52	1.38
Population aged 15 to 29	0.26	0.02	0.28	0.01
Development index	0.76	0.07	0.84	0.04
Skilled wages	1.85	1.48	3.94	0.63
Unskilled wages	2.16	0.98	3.02	0.40
Observations	1,621		254	
Services FDI	**No FDI**		**FDI**	
Variable	**Mean**	**SD**	**Mean**	**SD**
Labour productivity	2.58	0.81	3.80	0.84
Capital	7.23	2.36	12.96	2.04
Average schooling	5.55	1.32	7.88	1.44
Population aged 15 to 29	0.26	0.02	0.29	0.01
Development index	0.77	0.07	0.85	0.04
Skilled wages	1.25	1.57	3.74	0.69
Unskilled wages	1.92	0.98	2.96	0.42
Observations	1,583		166	

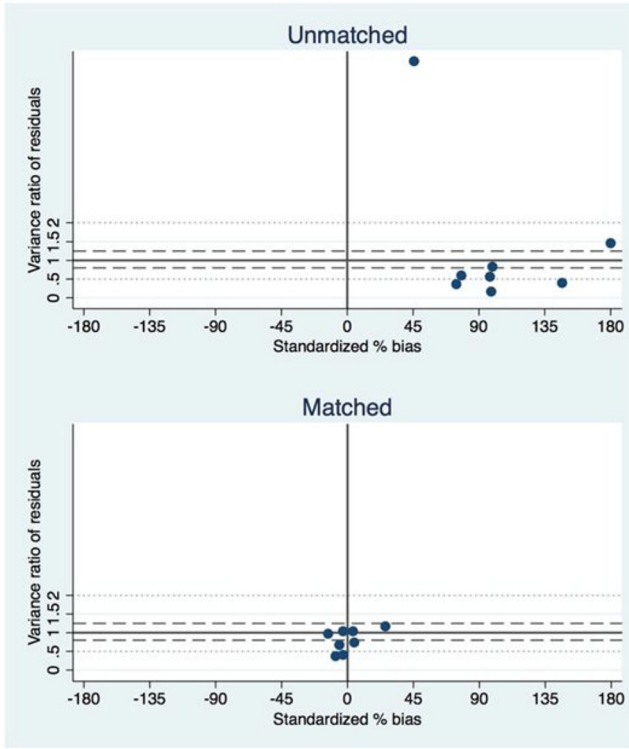


FIGURE A5 Standardised bias and variance ratios for unmatched and matched data: All industries

TABLE A3 Balancing tests from matched data for all manufacturing industries

	Means				T-test		
Variable	Treated (1)	Control (2)	% Bias (3)	% Bias reduction (4)	t-stat (5)	P-value (6)	Variance Ratio (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	0.09072	0.09164	−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	0.28047	0.27924	5.7	92.9	0.38	0.702	0.61
Development index	0.82401	0.8282	−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

Notes: Matching is shown for the pool of all manufacturing industries, initial FDI^{-} 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

	Means				T-test		
Variable	Treated (1)	Control (2)	% Bias (3)	% Bias reduction (4)	t-stat (5)	P-value (6)	Variance ratio (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	0.28135	0.27912	10.5	86.1	0.72	0.473	0.91
Development index	0.83378	0.82781	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

Notes: 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.