Indirect Job Creation and the Informal Sector in Mexico

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(Working paper)

Abstract

This paper analyzes the effects of localized labor demand shocks in the tradable sector, such as the establishment of a large tradable firm in a municipality, over nontradable formal and informal jobs in the case of Mexico. Results indicate that locations that experienced this shock have between 8 and 13 thousand more jobs than other municipalities over a ten-year period. Indirect job creation is similar in both the formal and the informal sectors, but informality appears to be more vulnerable to negative shocks. Furthermore, the effects of shocks are symmetric in the formal sector but not in the informal, where negative shocks have greater effects over nontradable employment.

Key words: *local multipliers, informal sector, agglomeration, pecuniary externalities, Mexico*
JEL classification: J23, R11, R12, R23

1 Introduction

Whenever new jobs are created in an economy, there are further effects associated to the fact that newly employed increase their expenditure and stimulate other industries. These multiplier effects are taken into consideration in the conduction of macroeconomic policies and the evaluation of economic crises recovery plans (See Romer and Bernstein).

This same process occurs at the local level, as Moretti (2010) argues. When a localized demand shock, such as the establishment of a new firm, occurs the increasing demand associated with that shock generates a new set of jobs in the nontradable sector, mainly services; even though this indirect job generation is partially offset by general equilibrium effects induced by local wages and nontradable prices increases. [2] The analysis of these multipliers is important for regional development policy, as local governments grant incentives for firms to locate in a given city and the knowledge of these figures can contribute to better target these efforts or gauge its appropriateness. As this same author notes, local multipliers also provide bounds for national multipliers. Considering the negative case, as Black,

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[2] In most theoretical models based on Rosen (1979) and Roback (1982) nontradable prices are mainly housing prices as this sector is included along with firms and consumers (workers).

McKinnish and Sanders (2005) mention, when a firm closes there is concern regarding expected jobs losses.

There is little evidence in the literature of local labor markets regarding local multipliers and all of them focus on developed countries. In the case of the U.S., the results obtained by Moretti (2010) indicate that whenever a job is created in the tradable sector, 1.6 nontradable jobs arise, but as Moretti and Thulin (2013) analyze for the cases of Sweden and the U.S., there is great variation in the value of the multiplier across industries and types of jobs.

The case of Mexico, being a developing country, has a great deal of distinctive feature that makes it an interesting object of study in the context of local labor markets and the multiplier effect. Given the increasing role of the nontradable sector in Mexico, which accounts for 80 percent of total employment in the case of Metropolitan Areas, and recent movements in the manufacturing (tradable) sectors, it is important to deepen on how job creation in these two sectors is related.

The analysis of local multipliers for Mexico poses an additional challenge as, as Maloney (2004) argues, in the case of developing countries the nontradable sector is characterized by a high informality rate.[3] According to Mexico's National Institute of Statistics and Geography (INEGI), more than 60% of national employment belongs to the informal sector. Informal jobs represent a lower tax collection and more expenses (e.g. the Seguro Popular in the case of Mexico, which grants medical insurance for informal and unemployed individuals) on the government's side, while on the workers' side it represents concerns regarding job security, as well as a higher vulnerability to labor market shocks. As Loayza and Sugawara (2009) point out, informality is not only a sign of underdevelopment but may be the source of further retardation.[4]

The purpose of this study is to estimate whether nontradable jobs are created indirectly as a result of new tradable jobs in a city using the establishment of new large firms[5] in order to deal in a better way with the problem of endogeneity or inverse causality that arises when aggregated employment data is used. Furthermore it seeks to assess whether indirect creation of employment is focused on the formal or the informal sector. In this sense, its main contribution and departure from previous literature is the analysis of informality in the framework of the local labor markets literature, which allows assessing the quality of local job creation.

The paper is organized as follows: section 2 provides a literature review of both theoretical and empirical studies on local multipliers as well as on articles regarding informality. In section 3, the methodology is presented. Section 4 explains the data used in the analysis as well as some descriptive statistics. Results are discussed in section 5 and conclusions in section 6.

[3] In recent years low-technology manufacturing sectors have shown movements from the Center of the country to the South, while medium-high technology sectors have moved to the North.

[4] In their empirical analysis these authors find negative effects of informality on economic growth.

[5] This variable is selected as treatment variable considering the important role that start-ups play in employment growth dynamics (See Haltiwanger, Jarmin & Miranda, 2013).

2 Literature review

2.a) Local multipliers

The analysis of local multipliers builds upon spatial labor markets equilibrium analysis. As Glaeser (2008) mentions, the most important concept in regional economics is the spatial equilibrium condition that indicates that if two identical individuals choose different locations it must be because they are receiving the same level of utility. That is, if an individual chooses a location with low wages it must be because he is being compensated with something else (amenities or another advantage).

Starting from this crucial assumption, standard spatial equilibrium models, such as the ones presented by Glaeser and Gottlieb (2009) and Moretti (2010) assume that each locality is a competitive economy that produces both nationally traded goods (which prices can't be affected locally) and nontradable goods (which prices are determined locally). As there is perfect labor mobility within the locality, marginal productivity equals wages. Most of these models assume labor heterogeneity with skilled workers receiving a higher wages than unskilled. For workers, their utility depends on wages less their housing costs and consumption expenses. Additionally, Moretti (2011) includes idiosyncratic preferences about locations, which makes unnecessary to equalize utility for all individuals in all locations in the case of inframarginal workers.

In general, these models predict that following a local demand shock in the tradable sector (e.g. the attraction of a new firm), the number of workers and wages in a city will increase. Thus, apart from the tradable jobs directly created, a set of nontradable jobs will arise as a result of the increasing demand for these products, mainly services.

In the case of the tradable sector, however, the effect is ambiguous and depends on general equilibrium effects. On one hand, as a result of the shock in the tradable sector, wages rise, increasing the costs for other firms and thus, probably reducing employment in the tradable sector. On the other hand, in the presence of agglomeration economies and backward and forward linkages, there could be a positive multiplier of tradable goods over other tradable goods.

As Moretti (2010) argues, the magnitude of the multiplier effect of tradable goods over nontradable goods, depends on different factors. First, consumer preferences regarding nontradable products; if consumers (workers) have strong preferences for nontradable goods the multiplier will take a higher value. Second, tradable goods production technology; if the demand shock occurs in a sector that is labor intensive, the direct effect on the number of workers will be higher and, thus, their demand for nontradables will be higher, resulting in a larger multiplier. Third, the type of new jobs; as mentioned before, skilled workers receive higher wages, so if the share of skilled workers is higher in the industry in which the demand shock occurs, a larger multiplier is expected. Finally, general equilibrium effects on wages and local housing prices could partially offset the positive effect on nontradable products; as wages increase, local services costs are also higher, generating a decline in the supply of services (a partial crowding out on the nontradable sector) that also depends on labor supply elasticity.

Regarding the empirical analysis of local multipliers, as Black et al. (2005) argue, there are two different strands of literature. The first one estimates local effects using aggregated labor data, and the second one that takes advantage of specific and localized labor shocks to identify their effects. An example of this first approach is Moretti (2010) who uses U.S. Census data from 1980-2000 and estimates a long-term local labor multiplier of 1.6 for the whole sample, finding significantly higher effects (2.5) for tradable skilled jobs. A similar analysis is performed by Moretti and Thulin (2013) with a matched employer-employed database for Sweden finding a multiplier of tradable jobs over nontradable ranging between 0.4 and 0.8.[6] In order to identify the effects, these two papers use a Bartik shock as an instrumental variable for local labor demand shocks, considering that there could be unobserved shocks that affect both tradable and nontradable employment in a city.[7]

Along the second line of research are papers such as Carrington (1996), who uses the specific shock generated by the construction of the Trans-Alaskan Pipeline System between 1974 and 1977 to analyze the employment dynamics in that state. As Black et al. (2005) notes, this was a very large temporary shock into a very small economy (Alaska). Additionally, due to its climate, Alaska experiences swings in its employment and population, which could have generated a smoother pattern in terms of employment, against what might be observed in other states. That is, though significant effects were found, the results for Alaska may have a lot of particularities that make it difficult to draw general conclusions from it.

Following this same strand, Black et al. (2005) take advantage of the coal boom in the 1970s during the OPEC oil embargo, and the later coal bust during the 1980s. These authors find that the effect of new employment in the mining sector on local jobs was of 0.17, while the negative effect (job losses) due to the coal bust was of 0.35. These results indicate asymmetry in the effects as negative demand shocks have an effect of almost double than positive shocks. Effects on the tradable sector were not significant.

Moretti and Greenstone (2004) take a totally different approach by using information of "Million Dollar Plants" articles of the corporate real estate journal Site Selection, which describes the location process of new plants in U.S. counties. The main advantage of this dataset is that it allows them to construct a counterfactual by comparing the winner counties with runner-up counties. Even though they conclude that their estimates are imprecise, they find employment effects for industries in different sectors from the incumbent, as well as for neighbor counties.

[6] In the case of Moretti and Thulin (2013) Stockholm proves to be an influential observation as once it is included in the sample, this multiplier increases, taking a value of approximately 4 nontradable jobs for each tradable job created.
[7] See Bartik (1991).

2.b) Informal economy

The informal economy is a phenomenon observed mainly in developing countries.[8] A great deal of research has been conducted in order to assess the causes of informality, but there is still no consensus on this issue's causes, let alone its definition and measurement. In the case of Mexico, for example, the measurement of informality was adjusted recently according to the International Labor Organization (ILO) statistical manual, changing the informality rate from 34% to 60%.[9]

Regarding the definition of informality, as Fortin, Marceu and Savard (1997) mention, in general, three approaches have been used to distinguish the informal sector from the formal. The first one is the scale of the firm, measured by its number of workers. Under this approach, which these authors call scale dualism, an arbitrary threshold is defined and firms smaller than it are considered informal. The second, regarded as wage dualism, considers the wage differential between identical individuals. Such a segmentation, as will be explained in more detail later, can arise from market rigidities and regulations. The third view, referred to as evasion dualism, consists on those firms that avoid paying taxes and other contributions, mainly social security.

Considering its causes, as Rauch (1991) argues, initially this sector was not even seen as a topic worth of separate study. Currently there are two opposing lines of research on informality. One considers that it arises from a segmented market, and the other assumes that it is a voluntary decision in the context of integrated markets.

Under the first strand, in the Harris-Todaro framework[10] informality was seen as consequence of segmented or dualistic labor markets, as a temporary stage in the process of migration, where unskilled rural workers that migrated to urban environments were waiting to be absorbed by a modern formal sector, obtaining thus a more permanent job.

A recent variant of the dualistic view, according to Maloney (2004), is the one that considers that informality as caused by firms facing international competition (price takers) who due to high labor costs induced by wage rigidities, decide to subcontract informal workers at a lower wage.

Alternatively, under the second line of research, Maloney (2004) is in favor of a life-cycle model where workers enter into the formal sectors, acquire certain abilities and knowledge, as well as capital and contacts, and then leave in order to open informal own businesses. He also argues that the later entry into informality is also consistent with a safety net where older people who become unemployed are unable, due to the obsolescence of their abilities, to re-enter the formal sector and thus, end up entering informality. Additionally, informal jobs offer less demanding work for this group. Something similar happens in the case of married women, who can more easily balance work and homecare working on their own than in formal employment.

[8] According to Bonner and Spooner (2011), the informal sector represents between 50 percent and 75 percent of non-agricultural employment in developing countries. Although there are not comparable statistics for developed countries, these authors argue that approximately 25% of employment in the U.S is non-standard or atypical (self-employment, part-time work or temporary work) which, though not all of them are informal, most of them receive little if any employment benefits.

[9] See INEGI (2012) and ILO (2012)

[10] See Ray (1998) for a summary and predictions of this model.

It is important to note that under the framework of integrated labor markets, as Levy (2008) argues, social programs focused on the informal sector, such as Seguro Popular in the case of Mexico, generates perverse incentives for formal workers to become informal.

Although the models from the two strands differ in their assumptions, their predictions regarding the effects of a local labor demand shock on informality are similar.

As Esquivel and Ordaz-Díaz (2008) argue, there is mixed empirical evidence for Mexico regarding whether there are integrated markets (with a wage premium in favor of the informal sector) or segmented markets (with a wage premium in the formal sector).

Under the integrated markets strand of literature, Maloney (2004) argues that wage rigidities that would lead to a segmented labor market are not observed and more than 60% of self-employed individuals in the informal sector left their previous formal jobs and entered informality voluntarily. Regarding the subcontracting view, this same author reports that only 20% of informal self-employed firms report being affiliated to larger firms.

Considering this attractiveness of the informal sectors, formal employers must generate incentives for their employees not to leave their jobs to enter informality. This could create a segmented market. That is, under this hypothesis, informality generates dualistic markets and not the other way around.

Other recent studies focus on the firms' side more than the employment side. For example, Straub (2005) emphasizes credit market rigidities. These models are closely related with occupational choice models following Banerjee and Newman (1993), where the lack of access to credit markets that stems from moral hazard, prevent some agents from becoming entrepreneurs.

A related literature, as mentioned in Loayza and Sugawara (2009), considers that the presence of a burdensome regulatory framework, with bad quality in public services and weak law enforcement, generates incentives for firms, specially the small ones, to operate in the informal sector. Empirical evidence from recent studies such as Arias et al. (2010) and Alcaraz, Chiquiar y Ramos-Francia (2008) support the view of segmented markets and argue that informality is mainly caused by regulation

According to Galiani and Weinschelbaum (2012), three stylized facts characterize the informal sector. First, small firms tend to be informal while larger firms are usually formal (scale dualism). Second, as Loayza and Sugawara (2009) also argue, the wage gap between the formal and the informal sector is larger for skilled people, making the informal sector a last resort for this kind of people, while for unskilled people it appears to be a first choice. Finally, family members different from the household head have a higher probability of entering the informal sector; this last statement is based on the idea that having one member of the family (usually the head) working in the formal sector provides medical insurance and other benefits for all the other members; this allows them to make riskier choices such as entering the informal sector.

3 Empirical Strategy

First of all, this analysis requires a suitable definition of tradable and non-tradable products. As a first approach and following Moretti and Thulin (2013), the traditional assumption method of considering manufacturing products as tradable and the services sector as nontradable will be used. In a second stage and as a robustness test, following Delgado et al. (2005), concentration indicators such as the Gini index and location quotients (LQ)[11] will be used in order to assess tradability, considering that tradable sectors tend to be more regionally concentrated as they don't require much interaction with the final consumers.

The methodology proposed for the analysis of indirect job creation is the use of differences in differences in order to assess whether municipalities experienced a higher increase in non-tradable employment (multiplier effect) following the establishment of a new large tradable firm.[12] This variable is selected as treatment variable considering the important role that start-ups play in employment growth dynamics (See Haltiwanger, Jarmin & Miranda, 2013). Large firms are chosen because if there really is a multiplier effect, it will be more easily identified when bigger shocks are considered. Additionally the establishment of large firms are more likely to be announced and to have effects over expectations for the municipality and therefore, to affect nontradable employment in a greater magnitude.

The differences in differences (DD) method is selected as the empirical strategy considering that in this non-experimental framework the control and treatment group may not have similar pre-treatment characteristics. The equation we are going to estimate is:

$$NT_{c,t} = \propto + \gamma B_c + \lambda t + \beta(B_c t) + \theta x_{c,t} + \varepsilon_{ct} \qquad (3.1)$$

Where

$NT_{c,t}$= Non-tradable employment in city or municipality c at time t
B_c=Dummy variable that indicates whether a new large tradable firm established in municipality or city c
t= time dummy variable (1 after the establishment of the new firm, 0 before)
$x_{c,t}$ =Relevant controls

The important parameter here is $\hat{\beta}$ as it indicates the effect of the establishment of new large tradable firms on nontradable employment. Even though this methodology does not provide a multiplier, it is closer to obtaining a causal relation.

Regional effects will be used as controls, as well as tradable employment in firms different from the newly established. This last variable is important because firms already established could have a totally different dynamic that could have effects over nontradable employment in the municipality and it also accounts for the initial size of the municipality in terms of the tradable sector.

[11] Location quotients basically compare the employment share of certain sector in a city with its share in national employment
[12] In order to test the symmetry of the results, this analysis will also be performed for the case of the closure of companies.

In a first stage this equation is estimated using only IMSS data, which leads to results regarding indirect job creation only in the formal sector. In a second stage the IMSS data is merged with data from Mexico's Population and Housing Censuses in order to assess whether indirect job creation is similar in the formal and the informal sectors.

3 Data and descriptive statistics

3.a) Data sources and definitions

The main data source for this study is Mexico's Social Security Institute (IMSS),[13] which provides firm-level employment data for the period 1997-2008. Due to confidentiality issues it is not possible to have access or to disclose the names of the firms analyzed in this paper.

Even though currently the National Institute of Statistics and Geography (INEGI) registers about 2,400 municipalities in Mexico, some of them are of relatively recent creation. Therefore, the sample used here consists of an unbalanced panel of 1,594 for which information is available at least for one year. As a robustness test the same equations are estimated using a balanced panel of 1,415 municipalities.

According to INEGI, a large firm is defined as one with more than 250 employees and sales of more than 250 million pesos.[14] As the information regarding sales is not available at the firm level, big firms in this case are selected using only the employment criterion.

Two different treatment variables were constructed and analyzed in this stage:

- **T_1=**Defined as 1 when a the municipality has a new large firm; 0 otherwise
- **T_2=** Defined as 1 when a municipality has a new large firm; -1 when a large firm disappears in a municipality; 0 otherwise.

According to this definition of the treatment variables, T_2 implicitly assumes that the effects are symmetric. That is, that a positive shock (tradable job creation) has the same effect in absolute value as a negative shock (tradable job losses).

It is important to note here that by definition of this variable, it is possible for a municipality to have both cases. A municipality can have a big firm disappearing in the same period as a new firm is establishing in the municipality. Thus, the criterion used in this case in order to classify the municipalities is the net employment generated (jobs created minus jobs lost).

The effects are analyzed first for 2000 and 2008 in order to make results comparable to the ones obtained later with Census data. In this case, the treatment variables are constructed using the establishment of large tradable firms (in the case of T1) between 1997 and 2000 and analyzing their effects in term of nontradable jobs creation between 2000 and 2008.

[13] The Ministry of Economy of Mexico provided this information under certain confidentiality conditions. The names of the firms are omitted from the database in order to comply with the law.
[14] INEGI, 2009

In a second stage and in order to take advantage of the whole database we use the yearly establishment of large tradable firms and analyze their effects over a five-year period. For example, the effect of large tradable firms that appeared in 1998 is analyzed for the period of 1998-2003.[15]

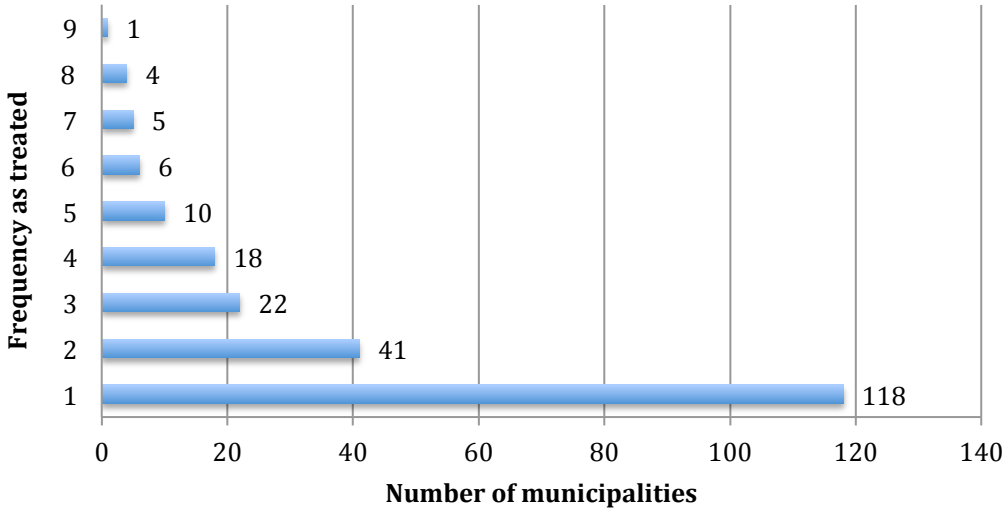
Finally, in order to analyze informality, we use data from the samples of the 2000 and 2010 Mexico's Population and Housing Censuses, INEGI at the municipality level. This data is merged with the IMSS data by municipality and the effects of the establishment and disappearance of large tradable firms are analyzed for this ten-year period.

3.b) Descriptive statistics

Establishment of new large tradable firms (T_1)

For the whole sample of municipalities (unbalanced) in the period 1998-2008, only in 225 municipalities new large tradable firms established. As Figure 1 shows, more than half of them experienced the establishment of a new firm in only one year and 26 municipalities appear five or more times as the location of a new large tradable firm.

FIGURE 1. NUMBER OF LARGE TRADABLE FIRMS ESTABLISHMENTS



Source: Author's calculations with data from the Mexican Social Security Institute (IMSS)

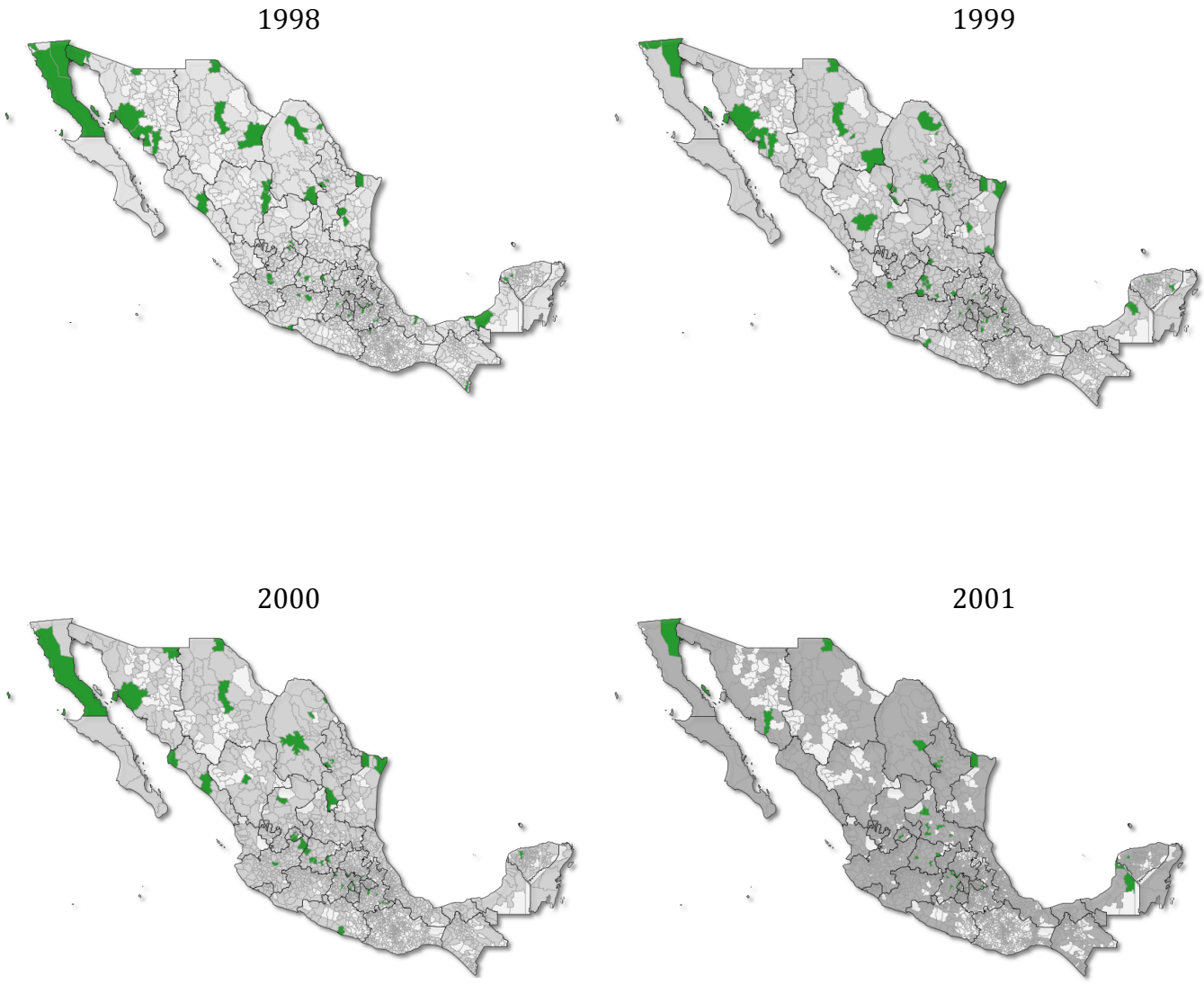
As can be seen in Figure 2, the municipalities considered in the analysis where large tradable firms established had some bias to the north, at least for the first three

[15] This length is arbitrarily selected considering that previous study rely only in Census data which implies a ten-year period; thus, we consider that using half of this length can be a good start point for comparison. By analyzing five-year periods, the establishment of firms is analyzed from 1997-2003 and the outcome (increase in non-tradable employment) is analyzed for 2003-2008.

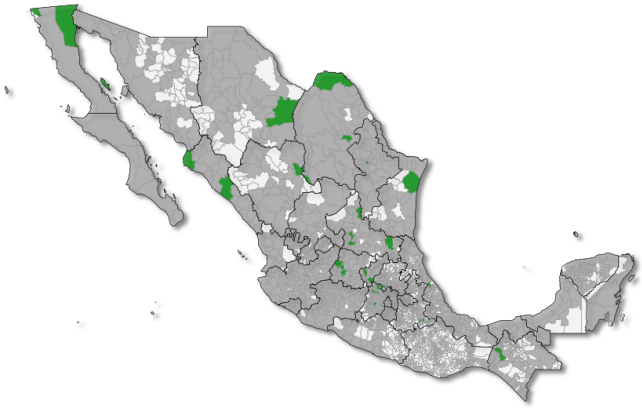
years of analysis, while for later years appear more evenly distributed across the country. It is important to take into consideration this concentration in the north of the country in the empirical analysis.

Additionally, as the figure shows, municipalities in the north have a greater area than municipalities in the southern region.

FIGURE 2. MUNICIPALITIES WHERE NEW LARGE TRADABLE FIRMS ESTABLISHED



2002



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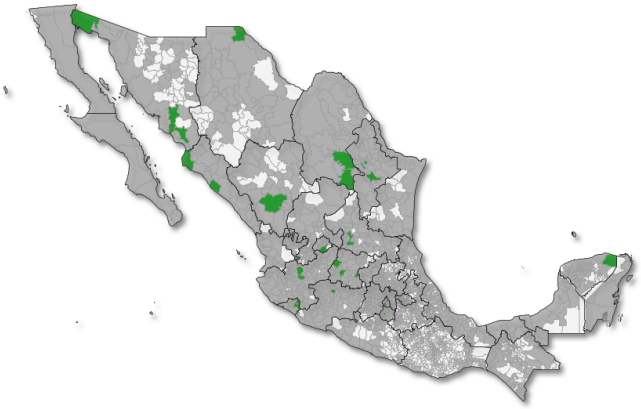

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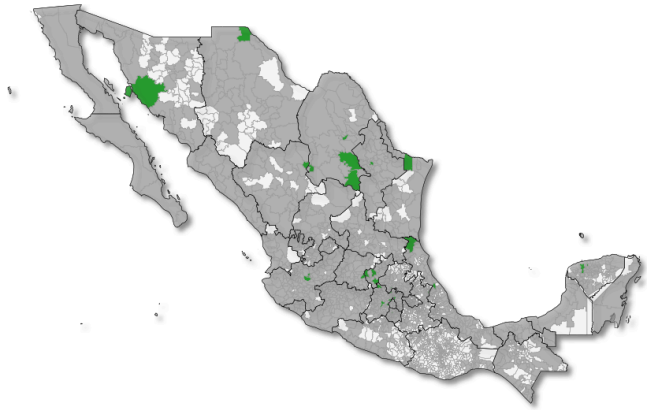

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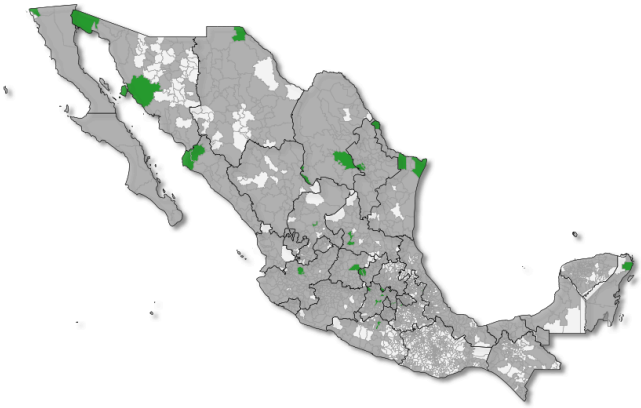

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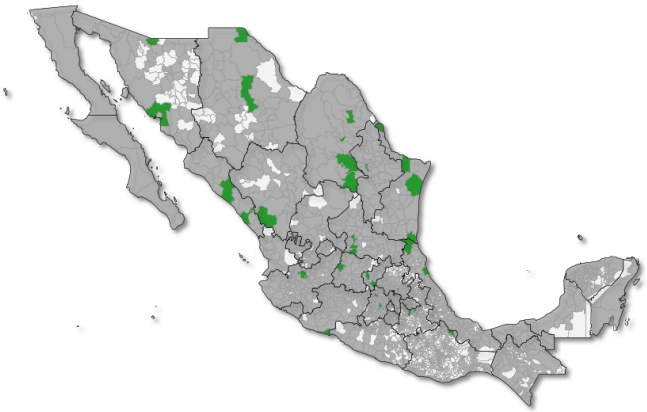
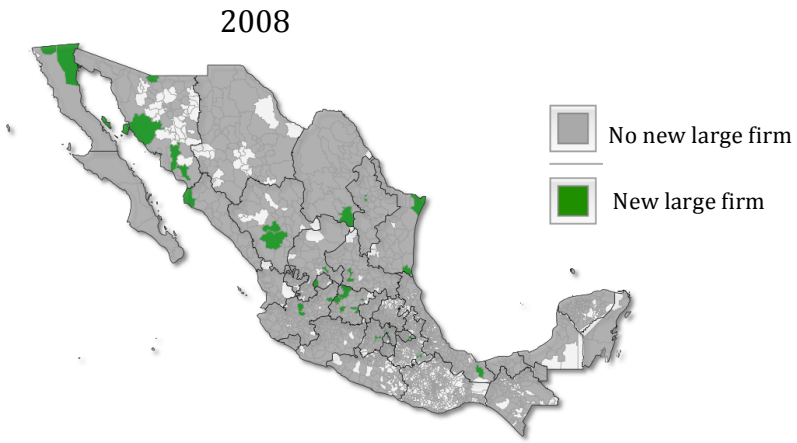




Source: Author's calculations with data from the Mexican Social Security Institute (IMSS)

Considering whether the municipalities where new firms established are similar to the ones where no change was experienced, Table 1 shows the average municipality nontradable employment for the two groups in the period where the establishment of new large tradable firms is analyzed. As the table shows, initial average employment is much higher in the "treated" municipalities. This is important because an indirect job creation process could be already at work in these locations and it is important to take this factor into consideration in the empirical analysis.

TABLE 1. AVERAGE MUNICIPALITY NONTRADABLE AND TRADABLE EMPLOYMENT IN THE YEAR OF ESTABLISHMENT

T_1	1998	1999	2000	2001	2002	2003
No new tradable firms established						
Nontradable	3,351	2,604	3,652	4,368	4,353	4,057
Tradable	1,667	1,463	1,937	2,079	2,135	1,877
N	1,377	1,380	1,396	1,416	1,423	1,426
New tradable firms established						
Nontradable	30,316	51,650	45,840	36,798	43,984	57,007
Tradable	27,546	35,954	36,347	31,638	28,107	32,258
N	66	67	52	36	34	36

Source: Author's calculations with data from the Mexican Social Security Institute (IMSS)

Establishment and closing of large tradable firms (T_2)

When both establishment and closure of large firms are taken into consideration, 279 municipalities are included as treated. Almost 40% of them appear only once as such (-1 if there is a closure and 1 in the case of establishments) and 61 of them appear five or more times.

FIGURE 3. NUMBER OF LARGE TRADABLE FIRMS ESTABLISHMENTS

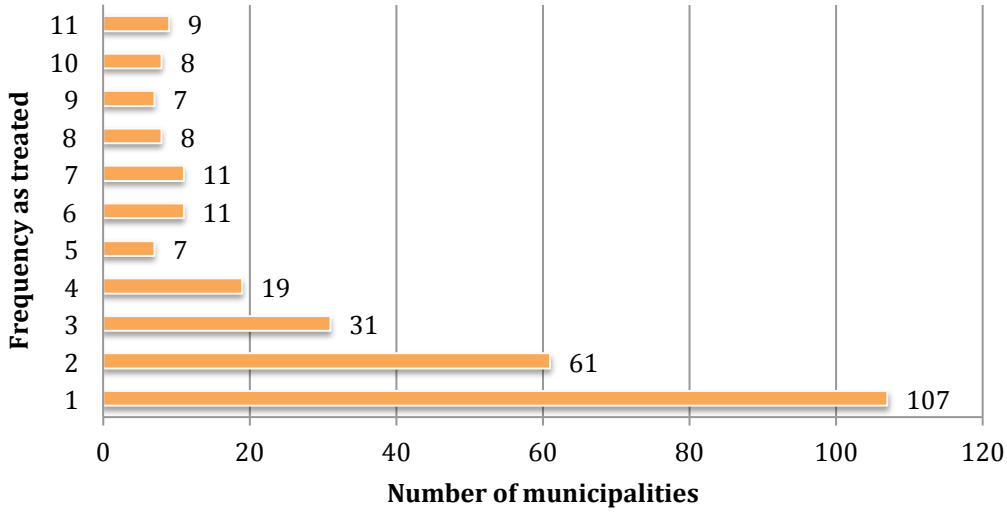
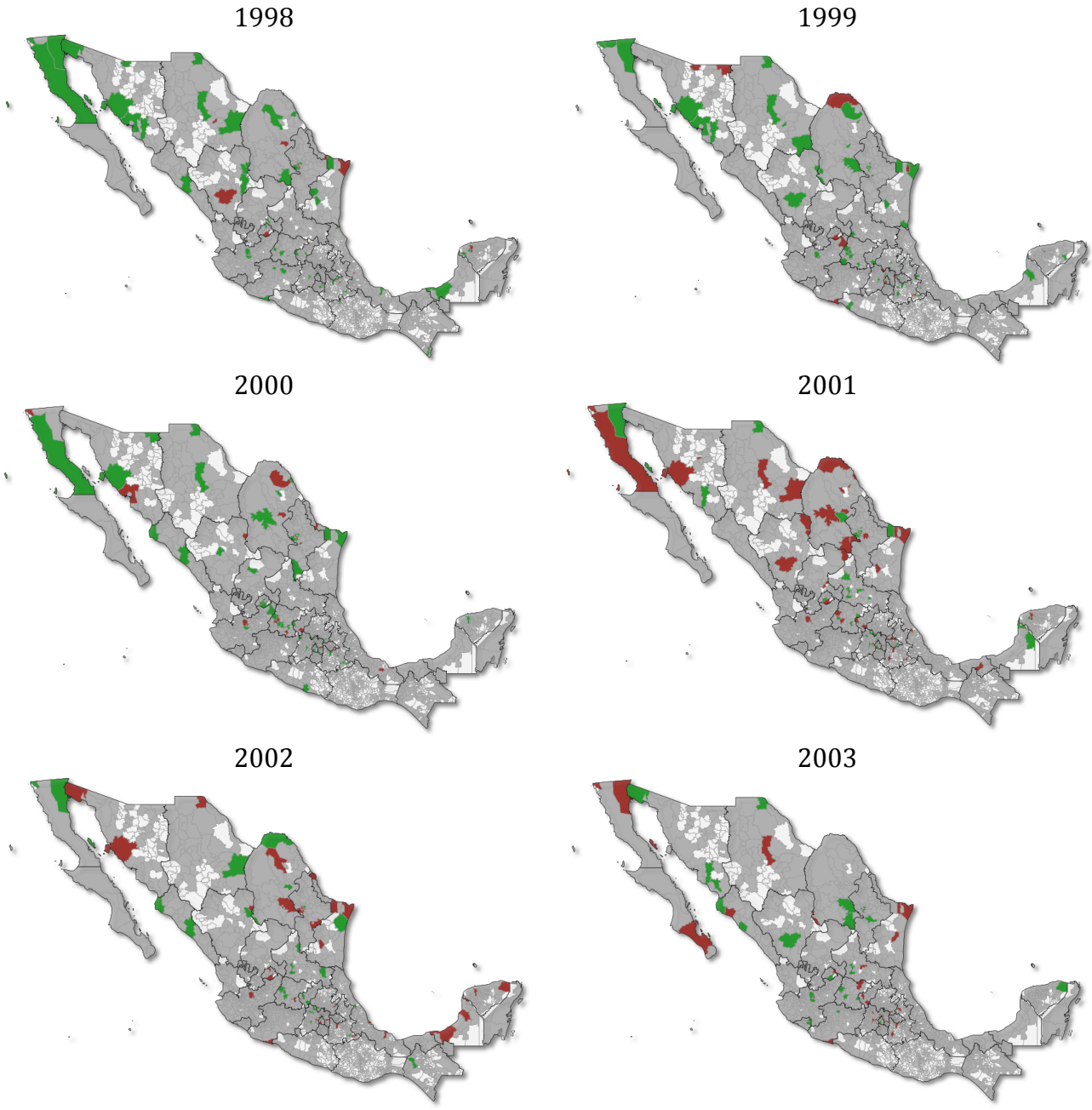
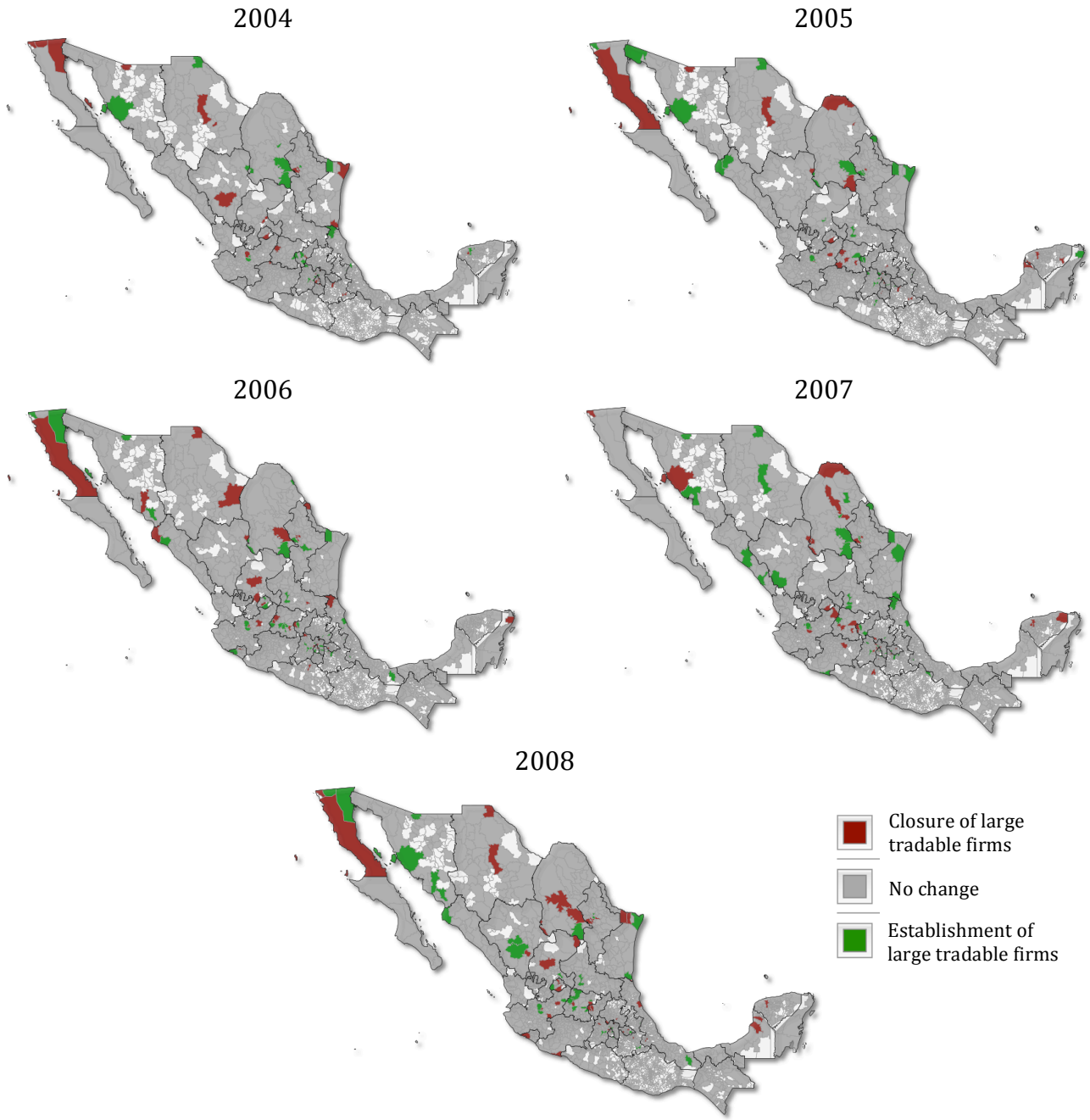


Figure 4 presents the location of the municipalities that exhibited the establishment or loss of a large tradable firm. It is important to note here how 2001 and 2008 show comparatively more closures than the others, in coincidence with recessions. This indicates that the variable T_2 accounts for periods of economic crises.

Once again in the first years of analysis, the movement (establishment and closing) of large tradable firms appears to be more concentrated in the northern region while for later years it is more evenly distributed.

FIGURE 4. MUNICIPALITIES WHERE LARGE FIRMS ESTABLISHED OR DISAPPEARED





Source: Author's calculations with data from the Mexican Social Security Institute (IMSS)

As can be seen in Table 2, the municipalities that lost big firms are very similar in tradable employment against the ones that exhibited the establishment of large tradable firms. However, they are very different against the municipalities that did not lose nor gain a large tradable firm in this period, which have much lower values for tradable employment. This difference could be related to the benefits of agglomeration economies (knowledge spillovers, linkages and market access, among

others), which incentivize industries to locate in locations with higher wages and more congestion instead of locating to regions with lower wages.

TABLE 2. AVERAGE MUNICIPALITY NONTRADABLE AND TRADABLE EMPLOYMENT IN THE YEAR OF ESTABLISHMENT OR CLOSING

	98	99	2000	2001	2002	2003
Disappearance of large tradable firms						
Nontradable	83,133	27,810	57,176	50,362	68,005	49,890
Tradable	35,369	25,178	37,964	29,773	33,821	27,643
N	14	14	24	53	43	38
No change						
Nontradable	2,531	2,346	2,715	2,579	2,369	2,803
Tradable	1,321	1,220	1,307	1,003	1,148	1,172
N	1,363	1,366	1,372	1,363	1,380	1,388
Establishment of large tradable firms						
Nontradable	30,316	51,650	45,840	36,798	43,984	57,007
Tradable	27,546	35,954	36,347	31,638	28,107	32,258
N	66	67	52	36	34	36

Source: Author's calculations with data from the Mexican Social Security Institute (IMSS)

4 Results

4.1. The formal sector

As mentioned before, as a first exercise and in order to compare the results with the estimates that obtained later with data from the Population and Housing Censuses, only data from 2000 and 2008 is used. The treatment indicator is constructed with the large tradable firms established in between 1997 and 2000. That is, this variable takes the value of 1 for municipalities where new large tradable firms established during this period.

The first two columns of Table 5 show results for the treatment variable T_1 (establishment of large tradable firms) controlling tradable employment associated to firms already established in the municipality (column 1) and, alternatively, for the whole tradable employment variation in the municipality (column 2); both specifications include regional controls. In columns 3 and 4 of the table, the same analysis is performed for variable T_2 (both establishment and closing). Results indicate that there is indeed a multiplier effect of tradable jobs over nontradable employment as the effect of the establishment of new large firms in a municipality generates an average increase of between 5,000 and 13,000 nontradable jobs, depending on the treatment variable, over an eight-year period.[16] Additionally, the

[16] The same analysis was performed in logarithms and the results are consistent with the figures shown in Table 5.

tradable employment controls are also significant in all specifications, which are also indicators of local multipliers effects.

Regional effects were included in order to account for the regional differences mentioned in the descriptive analysis. In this case, the North is the base and as the table shows, only the dummy variables associated to the Center and the Central-North region have non-significant coefficients. These results are associated to the fact that these two regions are closer to the North, and thus more similar, than other regions.

TABLE 5. DIFFERENCES IN DIFFERENCES ESTIMATES OF THE EFFECT OF THE ESTABLISHMENT AND CLOSING OF LARGE TRADABLE FIRMS IN A MUNICIPALITY OVER FORMAL EMPLOYMENT 2000-2008

Dependent variable: nontradable employment	**T1 (1)**	**T1 (2)**	**T2 (3)**	**T2 (4)**
Effect	13,015.47***	13,036.33***	5,134.16***	5,407.60***
	(5.53)	(5.57)	(2.78)	(2.89)
Region effects				
Capital	11,413.52**	11,406.89**	11,071.08**	11,069.20**
	(2.41)	(2.40)	(2.34)	(2.34)
Gulf	4,589.32***	4,555.87***	3,924.14**	3,909.03**
	(3.07)	(3.05)	(2.57)	(2.54)
Pacific	5,380.06***	5,343.63***	4,525.43**	4,526.42**
	(2.86)	(2.83)	(2.45)	(2.41)
South	3,476.36**	3,441.42**	2,420.97*	2,393.57*
	(2.51)	(2.48)	(1.75)	(1.72)
Central-North	1,947.62	1,900.39	1,664.31	1,651.09
	(1.55)	(1.51)	(1.41)	(1.39)
Center	1,651.17	1,594.12	1,305.02	1,264.91
	(1.27)	(1.22)	(1.07)	(1.03)
Other tradable	1.39***		1.46***	
	(4.48)		(4.99)	
All tradable		1.37***		1.45***
		(4.45)		(4.94)
Time effect	1,056.46***	1,044.73***	1,660.34***	1,663.66***
	(2.83)	(2.8)	(3.4)	(3.4)
Group effect	1,647.67	1,576.78	-3,608.69	-3,843.79
	(0.29)	(0.28)	(-0.90)	(-0.95)
Intercept	-2,990.43**	-2,943.06**	-2,232.99	-2,207.02
	(-2.15)	(-2.12)	(-1.51)	(-1.48)
N	3,031	3,031	3,031	3,031
p	0.000	0.000	0.000	0.000
R^2	0.47	0.46	0.46	0.45

Source: Author's calculations with data from the Mexican Social Security Institute (IMSS)
t statistics are in parenthesis.
* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

In order to test the robustness of these results and to take advantage of all the firm-level data, the same specification was estimated for the whole sample over five-year periods. This length was chosen as most of the empirical studies in the field use Census data, which provides information for periods of ten years. The idea here is to use a much shorter time period (half of what is common), but long enough to allow these indirect effects to occur. It is important to note that these estimates should be interpreted with some caution considering the serial correlation associated with DD in the case of long time series such as the one presented in this analysis.[17]

[17] See Bertrand, Duflo and Mullainathan (2004) for an analysis regarding the weaknesses of the differences in differences method.

As Table 6 shows, results using the whole database are consistent with the results using only two cross-sections of data (Table 5). Control variables used in the previous table (other tradable employment, total tradable employment and regional effects) yield similar results. The effects of both treatment variables are significant in all specifications but, unsurprisingly, their magnitudes are lower in this specification. In the case of T_1 if we compare the results with the ones presented in Table 5, adjusting for the length of the period, we obtain very similar results. Performing the same exercise for T_2, results in Table 6 are still a little lower. The higher sensitivity of closures to recessions could explain these results, as these last estimates use more information, including two years of economic decline for the Mexican economy (2001 and 2008).

Another feature to highlight of this table is the result regarding time effects. As can be seen in the table, after 2001 the coefficients associated to time effects have significant and positive values that indicate the increasing role of the nontradable (mainly services) sector in the economy.

TABLE 6. DIFFERENCES IN DIFFERENCES ESTIMATES OF THE EFFECT OF THE ESTABLISHMENT AND CLOSING OF LARGE TRADABLE FIRMS IN A MUNICIPALITY OVER FORMAL EMPLOYMENT 1998-2008

Dependent variable: nontradable employment		**T1 (1)**	**T1 (2)**	**T2 (3)**	**T2 (4)**
Effect		**7,090.64*** **	**7,864.61*** **	**1,138.25**	**2,031.86*** **
		(4.09)	(4.50)	(1.36)	(2.59)
Region effects					
	Capital	10,326.14**	10,323.54**	10,292.64**	10,298.44**
		(2.31)	(2.31)	(2.31)	(2.30)
	Gulf	3,998.53***	3,981.77***	3,932.67***	3,924.46***
		(2.90)	(2.88)	(2.81)	(2.80)
	Pacific	4,533.49***	4,513.25***	4,477.72***	4,470.39***
		(2.76)	(2.75)	(2.74)	(2.73)
	South	2,905.23**	2,887.15**	2,842.80**	2,834.83**
		(2.26)	(2.25)	(2.16)	(2.14)
	Central-North	1,825.49	1,807.51	1,848.56	1,848.31
		(1.59)	(1.58)	(1.63)	(1.62)
	Center	1,513.64	1,489.74	1,473.85	1,465.46
		(1.27)	(1.25)	(1.24)	(1.23)
Time effects					
	1999	-3.77	-11.12	-5.94	-11.96
		(-0.06)	(-0.18)	(-0.08)	(-0.17)
	2000	78.56	75.24	3.39	6.23
		(0.70)	(0.67)	(0.04)	(0.07)
	2001	558.94***	557.10***	343.50**	346.33***
		(4.26)	(4.18)	(2.57)	(2.59)
	2002	770.60***	764.43***	591.11***	592.42***
		(5.14)	(5.09)	(4.47)	(4.52)
	2003	1,012.65***	1,020.24***	864.47***	873.46***
		(6.42)	(6.45)	(5.76)	(5.81)
	2004	1,132.19***	1,135.94***	990.82***	993.87***
		(6.36)	(6.37)	(5.72)	(5.70)
	2005	1,423.40***	1,419.50***	1,163.34***	1,162.54***
		(6.12)	(6.09)	(4.54)	(4.53)
	2006	1,793.89***	1,790.45***	1,354.93***	1,361.01***
		(4.55)	(4.53)	(3.33)	(3.35)
	2007	2,161.14***	2,153.26***	1,742.81***	1,739.05***
		(5.15)	(5.12)	(4.08)	(4.07)
	2008	2,511.62***	2,492.11***	2,089.32***	2,105.20***
		(5.76)	(5.70)	(4.70)	(4.72)
	Other tradable	1.45***		1.45***	
		(5.02)		(5.39)	

Dependent variable: nontradable employment	T1 (1)	T1 (2)	T2 (3)	T2 (4)
All tradable		1.44***		1.45***
		(5.00)		(5.37)
Time effect	-222.49**	-240.65**	195.67*	196.62*
	(-2.05)	(-2.23)	-1.95	-1.92
Group effect	-2,624.08	-3,436.08	-5,057.20**	-5,936.98**
	(-0.63)	(-0.80)	(-2.00)	(-2.35)
Intercept	-2,567.09**	-2,533.74**	-2,493.09*	-2,485.49*
	(-2.08)	(-2.05)	(-1.91)	(-1.90)
N	17,368	17,368	17,368	17,368
p	0.000	0.000	0.000	0.000
r2	0.48	0.48	0.48	0.48

Source: Author's calculations with data from the Mexican Social Security Institute (IMSS)
t statistics are in parenthesis.
* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

4.2. The informal sector

In order to shed light over the question regarding the quality of indirect job creation, the same equation was estimated for both the formal and the informal sectors using data from the 2000 and the 2010 Population and Housing Censuses. In this case we used a Seemingly Unrelated Regression (SUR) to estimate the effects of both sectors and test whether their coefficients are equal.

As can be seen in the first row of Table 7, in the case of T_1, the establishment of new large tradable firms, controlling for other changes in the municipality, yields a 13 thousand more formal ten years later, while for the informal sector this figure is slightly higher, reaching 16 thousand. Testing the equality of these coefficients, the null hypothesis is rejected indicating that more jobs are created in the informal sector than in the formal. It is also important to note here that the coefficient associated to T_1 in the formal sector is very similar to the one obtained using IMSS data, which is an indicator of the robustness of our results.

Analyzing the results for T_2, as the table shows, the establishment (closure) of a large tradable firm in a municipality yields almost 4 thousand new (lost) jobs. In this case, it is not possible to reject the hypothesis that the coefficients for the formal and the informal sector are equal, so the job creation or job loss is the same in both sectors. Comparing the coefficient of the formal sector with the one obtained in Table 5, we observe a lower value here. This result could be explained by the two-year difference in the period considered, combined with the recession in 2008.

TABLE 7. SUR RESULTS OF DD ESTIMATES OF THE EFFECT OF THE ESTABLISHMENT AND CLOSING OF LARGE TRADABLE FIRMS IN A MUNICIPALITY OVER INFORMAL AND FORMAL EMPLOYMENT 2000-2010

Dependent variable: nontradable employment		**T1**		**T2**	
		Informal	**Formal**	**Informal**	**Formal**
Effect		16,659.00***	13,617.08***	3,856.57**	4,286.73***
		(7.52)	(8.17)	(2.22)	(3.30)
Region effects					
	Capital	19,770.44***	8,636.00***	19,308.92***	8,308.43***
		(5.89)	(4.31)	(5.72)	(4.10)
	Gulf	6,962.63***	2,864.03***	6,005.57***	2,171.72**
		(5.66)	(2.78)	(4.92)	(2.05)
	Pacific	7,976.43***	4,219.98***	6,861.48***	3,417.53***
		(5.59)	(3.21)	(5.03)	(2.64)
	South	6,549.28***	1,726.27**	4,839.21***	449.38
		(5.14)	(2.03)	(3.93)	(0.50)
	Central-North	4,902.52***	795.83	4,416.59***	435.1
		(4.83)	(0.98)	(4.76)	(0.55)
	Center	4,867.73***	-196.66	4,154.60***	-717.98
		(3.40)	(-0.20)	(3.03)	(-0.74)
Time effect		1,600.22***	932.19***	2,338.90***	1,441.02***
		(12.14)	(8.49)	(10.86)	(8.27)
Group effect		5,527.28	3,175.48	1,303.01	-77.8
		(1.32)	(1.00)	(0.50)	(-0.04)
Other tradable		1.14***	1.01***	1.24***	1.08***
		(5.14)	(5.87)	(5.79)	(6.54)
Intercept		-3,227.15***	-510.84	-2,286.72	183.24
		(-2.95)	(-0.66)	(-2.03)	(0.22)
N		3031	3031	3031	3031
P		0.000	0.000	0.000	0.000
Adjusted R^2		0.54	0.62	0.52	0.60

Source: Author's calculations with data from the Mexican Social Security Institute (IMSS) and the 2000 and 2010 Population and Housing Censuses, INEGI:
t statistics are in parenthesis.
* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

4.3. Asymmetries

As already mentioned in section 3, the construction of T_2 implicitly assumes that the closing and the establishment of new large firms have symmetric effects which as Black et al. (2005) could not be the case, as these authors find that job losses have a larger multiplier than job creation.

In order to test whether there are asymmetries in the effects, T2 is divided into two different dummy variables (one for establishments and one for closings) and all the relevant interactions are included in equation 3.1.

$$NT_{c,t} = \propto + \gamma_1 B_c^+ + \gamma_2 B_c^- + \lambda t + \beta_1 (B_c^+ t) + \beta_2 (B_c^- t) + \theta x_{c,t} + \varepsilon_{ct} \qquad (4.1)$$

We test whether $\beta_1 = \beta_2$. If the null hypothesis can't be rejected the effects are symmetric and equation 3.1 is correctly estimated. But if the hypothesis is rejected, as will be discussed later, it has different policy implications.

Table 8 presents the results of the asymmetries analysis for all the specifications of T1 used throughout the paper. The first column shows equation 4.1 estimated with the data from Table 5. Even though the magnitude for the negative effect appears to be much higher than the one of the positive effect, the hypothesis that both coefficients are equal couldn't be rejected which could indicate that the symmetry assumption is correct and the specification used in Table 5 is correct.

In the second column, the whole yearly database is used once again and the results indicate that the effects are similar for both positive shocks and negative shocks. The hypothesis of equality of both coefficients couldn't be rejected also.

The last two columns of the table correspond to the results of the SUR regression analysis for the formal and informal sectors using both Census and IMSS data. The results show that in the case of the informal sector the hypothesis of symmetry between the shocks is rejected, indicating that a negative shock in the tradable sector has a higher effect over informal nontradable jobs than a positive shock. The formal sector exhibits a completely different outcome as the hypothesis of symmetry is not rejected.

As the SUR specification allows to test equality of coefficients between the two equations (formal and informal), we tested whether the positive shocks are equal for the formal and informal sectors and the same with negative shocks. The hypothesis of equality could not be rejected in the case of the establishments of large tradable firms, while for the closure of large tradable firms it is rejected. These results indicate that positive shocks work in a similar way over nontradable formal and informal employment in a municipality while the informal sector is more sensitive to negative shocks than the formal sector.

TABLE 8. ANALYSIS OF ASYMMETRIES IN THE EFFECT OF THE ESTABLISHMENT AND CLOSING OF LARGE TRADABLE FIRMS IN A MUNICIPALITY OVER INFORMAL AND FORMAL EMPLOYMENT

Dependent variable: nontradable employment		**2000-2008**	**1998-2008**	**2000-2010**	
				Formal	**Informal**
Effect positive		5,936.68**	6,999.06***	4,924.73**	5,177.65***
		(2.26)	(4.14)	(2.29)	(3.17)
Effect negative		12,289.98*	7,874.23***	14,410.95***	10,086.75***
		(1.73)	(3.48)	(3.24)	(3.02)
Region effects					
	Capital	11,226.65**	10,140.81**	19,452.09***	8,416.65***
		(2.38)	(2.32)	(5.78)	(4.16)
	Gulf	4,475.29***	4,232.37***	6,510.74***	2,553.05**
		(3.30)	(3.26)	(5.53)	(2.51)
	Pacific	5,435.32***	4,846.05***	7,693.66***	4045.23***
		(3.19)	(3.01)	(5.58)	(3.13)
	South	3,031.65***	3,192.73***	5,391.09***	863.96
		(2.58)	(2.70)	(4.58)	(1.04)
	Central-North	2,157.40**	1933.75*	4,866.90***	774.59
		(2.00)	(1.73)	(5.12)	(1.00)
	Center	1,736.52	1,610.74	4,549.45***	-420.1
		(1.58)	(1.41)	(3.36)	(-0.44)
Other tradable		1.42***	1.38***	1.20***	1.06***
		(4.80)	(4.60)	(5.45)	(6.22)
Time effect		1,096.68***	-203.41	1,749.44***	977.55***
		(2.72)	(-1.43)	(15.13)	(9.60)
Group effect (positive)		-1,543.92	-269.75	2,969.18	1,122.28

Dependent variable: nontradable employment	2000-2008	1998-2008	2000-2010	
			Formal	Informal
	(-0.34)	(-0.05)	(0.89)	(0.45)
Group effect (negative)	11,225.51	11,112.66	4,475.97	4,133.96
	(1.21)	(1.19)	(0.56)	(0.74)
Year effects				
1999		7.15		
		(0.10)		
2000		34.32		
		(0.36)		
2001		280.38		
		(1.55)		
2002		570.78***		
		(4.04)		
2003		851.66***		
		(5.50)		
2004		987.39***		
		(5.25)		
2005		1,171.76***		
		(4.42)		
2006		1,131.22***		
		(2.69)		
2007		1,584.79***		
		(3.77)		
2008		1,946.54***		
		(4.37)		
Intercept	-2,896.89**	-2,733.68**	-2,856.51***	-237
	(-2.40)	(-2.38)	(-2.83)	(-0.33)
N	3,031	17,863	3,031	3,031
p	0.000	0.000	0.000	0.000
R2	0.46	0.49	0.52	0.61

Source: Author's calculations with data from the Mexican Social Security Institute (IMSS) and the 2000 and 2010 Population and Housing Censuses, INEGI:
t statistics are in parenthesis.
* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

4.4) Robustness checks

As a robustness test, all the specifications were estimated using state effects instead of region effects. The results are shown in Table 9. In the case of T_1, results are very similar to the ones presented in all the previous tables. However, for T_2 results are much lower only in the case of the first specification (for 2000-2008) in all other cases results don't change much.

The right panel of the table shows results for panel. That is, for the 1,415 municipalities that appear in all the years of the sample. Once again, results for T_1 do not change in any specification while for T_2 results only differ in the case of the analysis of the informal sector, where the magnitudes of the coefficients are much higher but the conclusions are similar.

From this analysis we can conclude that even though the magnitudes change once the closing of large firms is also considered, the conclusions of the analysis regarding indirect job creation do not change.

TABLE 9. ROBUSTNESS CHECKS

	Including state effects instead of region effects				Balanced panel			
	T1(1)	**T1(2)**	**T2(3)**	**T2 (4)**	**T1(1)**	**T1(2)**	**T2(3)**	**T2 (4)**
2000-2008								
(Table 5)	12,442.54***	12,457.52***	3,974.88**	4,222.23**	12,893.97***	12,915.18***	8,765.67***	9,106.66***
	(5.06)	(5.08)	(2.04)	(2.14)	(5.46)	(5.50)	(4.73)	(4.87)
1998-2008								
(Table 6)	6,884.54***	7,604.41***	1,116.92	1,949.28***	8,712.74***	9,531.28***	2,198.80*	3,118.52***
	(4.02)	(4.37)	(1.41)	(2.63)	(4.12)	(4.48)	(1.84)	(2.62)
	Informal	Formal	Informal	Formal	Informal	Formal	Informal	Formal
2000-2010								
(Table 7)	16,349.54***	13,351.88***	3,415.43**	3,930.44***	16,472.73***	13,556.20***	10,186.56***	8,638.75***
	(7.42)	(7.98)	(2.01)	(3.02)	(7.41)	(8.12)	(5.00)	(5.69)

Source: Author's calculations with data from the Mexican Social Security Institute (IMSS) and the 2000 and 2010 Population and Housing Censuses, INEGI:
t statistics are in parenthesis.
* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

5 Discussion

Every time new jobs are created in a city, there is an indirect job creation stemming from the higher demand for nontradable goods. These multipliers are important for regional development policy, as local government grant incentives for investment and having a measure of the expected job creation would allow to have better evaluations of the expected results of these efforts and to better target them. Additionally, we could have more information in the case of economic crises of the expected job losses.

In the case of a developing country, such as Mexico, considering that 60% of employment occurs in the informal sector, it is not only important to assess the magnitude but the quality of indirect job creation.

This paper analyzed indirect job creation for Mexico between 1998-2008 using a localized labor demand shock (the establishment of a large tradable firm) in order to deal in a better way with the problem of endogeneity or inverse causality that arises when aggregated employment data is used. Even though our methodology does not yield a value for the multiplier, it provides evidence regarding whether there is indeed a multiplier effect.

The results indicate that the municipalities that experienced the establishment of a large tradable firm have between 8 and 13 more nontradable jobs than other locations over an eight-year period. This magnitude reduces but is still significant when both the establishment and closing of firms are considered.

Regarding the quality of indirect job creation, the value for the informal sector is higher when only positive shocks are considered but taking into account both shocks (positive and negative), formal and informal jobs are created indirectly in the same proportion, reproducing the same employment structure. This is clearly not a

desirable outcome considering the low tax collection associated to informality. Additionally, when we analyze whether positive and negative shocks have the same (inverse) effect, we find that positive shocks work in a similar way over nontradable formal and informal employment in a municipality while the informal sector is more vulnerable to negative shocks than the formal sector. Furthermore, shocks are symmetric in the formal sector but not in the informal sector, where negative shocks have greater effects. This means that it will take longer for the informal to recover after a crisis.

So informality represents a concern not only because of tax collection but because in the event of economic crises that traduce into firm closings, more people working in the informal sector will probably loose their jobs.

This analysis is a first approach and even though the magnitudes may not be precise, the conclusions are robust. This study should be extended in different dimensions. First of all, it is important to include cluster analysis in the definition of the tradable sector (See Delgado et al., 2005). Second, due to the serial correlation problems associated with differences in differences estimators, it is important to explore alternative and probably more powerful methodologies such as the use of synthetic controls to generate a counterfactual[18] or event study analysis. Finally, considering that the main channel through which indirect job creation works is the higher demand for nontradable products, consumer patterns should be analyzed in order to better characterize the results obtained in this paper.

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[18] See Abadie and Gardeazabal (2003) and Abadie, Diamond and Hainmuller (2010) for the synthetic control methods.

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