The effect of local industry competition and trade on firm productivity. Evidence from the Mexican manufacturing industry

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Abstract

In recent years the economics literature has seen an increasing number of studies seeking to explain which factors stimulate economic productivity, including the effects of market imperfections. Those that have studied the productivity effects of local industry concentration have focused on the effects through agglomeration. This paper contributes to this literature by studying the joint effects of competition and exposure to trade on economic productivity in a developing country context. The analysis exploits a unique dataset containing concentration indices and economic productivity estimates at the 3-digit manufacturing sector for more than seventy metropolitan areas over a 20-year period in Mexico. This paper uses an instrumental variable approach for the industry concentration index which combines the initial level of market competition at the level of metropolitan areas with national trends. The results show evidence of a concave relationship between concentration and economic productivity, with a threshold level of industry concentration after which less competition has unambiguous negative effects of economic productivity. However, such negative effects of market concentration on productivity are neutralized, and depending the sector reversed, when certain sector has a high exposure to external markets.

Keywords: Productivity, Market concentration, Trade, Instrumental Variables; Mexico
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1. Introduction

Between 1950s to 1970s imports substitution (IS) constituted one of the main economic policies in developing countries to foster economic growth. In the case of most Latin American countries, from the mid-1970s, there was a considerable shift towards adoption of the strategy of export promotion (EP) as a consequence of their economic underperformance presenting no growth on average and a decline on real income (Barro and Sala-i-Martin, 1995), fiscal deficits, acute inflation, supply shortages and severe balance-of-payments crises coupled with economic recession. The 1980s was marked by attempts to correct these macroeconomic disequilibria. Mexico was part of these efforts with the implementation of economic reforms to shift the economy away from its traditional state-led development strategy. By late 1970s, Mexico was fundamentally an oil-exporting economy. Since 1985, several initiatives were taken to promote non-oil exports, such as easing of requirements for importing intermediate and capital goods, increasing access to credit for exporters, and reducing restrictions on the use of export earnings. This efforts culminated with the signing of NAFTA, which around 2015 represented about 85 percent of the total exports of the country.

However, economic productivity growth in Mexico has not kept pace with productivity growth of other developed economies even when factor accumulation was faster in the country. For example, if total factor productivity (TFP) had kept pace, relative income per capita would be 24 per cent higher in 2008 vs. 1960 (see Busso et al., 2012). There are several causes for this relative reduction of TFP: an inefficient allocation of factors of production, a large informal sector, and excess in regulatory policies that often penalizes large firms and creates barriers to entry of new firms. This paper focuses on the latter, specifically, we try to understand to what extent limited local industry competition explains the stagnation in productivity growth in the manufacturing sector in Mexico. As our period of analysis coincides with the timeframe of trade liberalization in Mexico, we would like to further identify how economic productivity of certain firms for which the relevant market is international, rather than local, respond to local industry competition.

Even when standard models of endogenous technological change are ambiguous about the relationship between market competition and economic productivity because of rent dissipation (see Romer, 1986; Aghion and Howitt, 1992; and, Aghion et al., 2001), empirical research shows that market concentration causes harmful effects to economic outcomes such as higher consumer prices (Lamm, 1981; Cotterill, 1986; Waterson, 1993; Weiss, 1989; and, Evans and Kessides, 1994), higher poverty rates (Rodriguez-Castelan and Rodriguez-Chamussy, 2015), and lower levels of productivity growth (Aghion et al ., 2005; Blundell, Griffith and Van Reenen, 1999; and, Nickell, 1996).

There is little evidence of the dynamics role of market concentration and productivity in developing countries; and in those cases when evidence is available it consists of cross-country analysis which usually ignores the effects at firm-level productivity. Moreover, as the evidence about the impacts on economic productivity of the interactions between local market competition and access to

international markets is thin, this paper aims to fill a gap in the literature on this topic by taking advantage of the Economic Census of manufacturing firms in each metropolitan area in Mexico for over twenty years.

Using data from five rounds of the Economic Census in Mexico (1989, 1994, 1999, 2004, 2009) this paper estimates a fixed effect model to identify the potential impacts of product market competition on economic productivity in the manufacturing industry. On its current version, our unit of analysis is an aggregate of firms at the municipality level desegregated at the 3-digit level. A future version of the paper will be able to desegregate this even more by using information at the firm level. Unfortunately, for the Census rounds before 2009 it is not possible to construct a panel of firm. However, we will use the we will use a panel of firms for the last two rounds of the Economic Census (2009 and 2014) to estimate an Olley-Pakes correction to approximate the potential magnitude of bias that might be present in the long-term models with industry-metropolitan area units of analysis.

Given potential endogeneity issues when linking market concentration to economic productivity at the local level, we also present an instrumental variable strategy following a Bartik (1991) procedure. Specifically, we produce industry-specific Bartik instruments departing from baseline (1999) observed levels of local competition for each industry at the 3-digit level, and create a variable for changes in competition for each industry in every metropolitan area that follow national level changes in competition for every industry studied. In this way, the total change in concentration in any given geographical area can be divided into an exogenous component from the Bartik instrument, and deviations from this predicted change. This estimation strategy allows to identify the causal effect from local market competition on economic productivity.

Our main results find evidence that less product market competition is associated with lower productivity growth, but these effects are non-linear. We show that an increase in local competition is positively associated with productivity growth at low levels of competition, which may be associated with positive externalities of agglomeration. However, as local product competition in manufacturing increases after a certain threshold, productivity growth declines, which may be associated with lower access to extranormal rents, and higher local competitions for factors of economic production.

In terms of exposure to international markets, we use the map of economic complexity from Harvard to construct the level of exposure to international markets at the sector and metropolitan area level. This variable is defined as the share of total exports of 3-digit sector in a metropolitan area with respect to the national overall exports in the same 3-digit sector. We find that our main results hold, that is more competition has a negative effect on economic productivity, but such effects are neutralized for those firms with higher exposure to international markets, which may imply that the relevant competition for those firm is not domestic.

These results have important implications for public policy, particularly for middle income countries with low levels of economic competition and less exposition to external markets, as these may be experiencing a double negative effect on economic productivity. Thus, policies which aim to reduce cost of entry for new firms combined with promotion of trade will be the most effective to boost productivity in manufacturing in these types of countries. Our results are in line with those by Atkin, Khandelwal and Osman (2016) as we find that firms more exposed to external markets are also more productive. We also find that these effects are of greater magnitude for nine (out of 17) sectors at the 3-digit level that concentrate about 72 percent of the total export value in manufacturing in Mexico.

The rest of the paper is structured as follows. Section 2 presents a discussion of the literature on the links between market competition and economic productivity. It will also briefly discuss how exposure to external markets may be relevant for increasing productivity growth. Section 3 discusses the data sources and present some stylized facts on both market competition in manufacturing over the last 20 years in Mexico in its main metropolitan areas. It also presents some stylize facts of recent trends of productivity growth at the 3-digit level in the manufacturing industry in Mexico. Section 4 outlays the main empirical strategy of this paper and discusses the main findings. This section also studies the heterogeneous effects of exposure to international trade on the effects of local market concentration on economic productivity. It also presents the heterogeneous effects by sector of economic activity. Section 6 concludes.

2. Literature review

The literature on endogenous growth shows that in the standard model of endogenous technological change there is a rent dissipation effect (Romer, 1986; and Aghion and Howitt, 1992). This result implies that increases in the level of product market competition in the intermediate producer's level reduces expected future profits from innovations and the rate of technical change. However, Aghion et al. (2001) extends this basic framework and shows that a positive relationship between market competition and growth might still exists where an oligopolistic intermediate uses innovation to allow a firm not isolate itself, temporarily, from competition. In this manner, incentives to innovate remain present and become stronger the closer a firm is to the technological frontier[4]. Thus, a positive relationship between product market competition and growth, is not an implication of all theoretical work.

Empirical research on the effects of market concentration shows, however, that limited market competition is associated with higher prices generating a welfare loss, for example see (Lamm, 1981; Cotterill, 1986; Waterson, 1993; Weiss, 1989; and Evans and Kessides, 1994). Moreover, low levels of competition directly affect consumers through increased poverty rates (Rodriguez-Castelan and

[4] It follows, in their model, that an increase in competition involves an innovation-tradeoff: it reduces monopoly rents, but enhances the incentive to innovate in order to escape competition

Rodriguez-Chamussy, 2017), but also firms, as it negatively affects productivity growth (Aghion et al., 2005; Blundell, Griffith and Van Reenen, 1999; and, Nickell, 1996).

For the specific case of Mexico, despite of being one of countries in the world with the most number of trade agreements and corresponding levels of trade, Mexico lags among the OECD in product market competition indicators, and also in labor regulations (Conway, Janod, and Nicoletti, 2005). This makes Mexico a country of interest for studying the effects of competition on productivity.

Most studies of the link between competition and productivity have been focused on the aggregate level of productivity growth but not on the effect on firms themselves with a few exceptions for the case of trade liberalization and product regulation (Galindo and Schiantarelli, 2005). This is even more tangible for research on developing countries where lack of adequate data appears to be the main limitation for the existence of such studies.

The studies in the literature have studied several ways in which increased competition can affect productivity. These channels are product regulation, learning from other firms, especially from overseas clients. In the case of product regulation and entry costs, Scarpetta, Hemmings, Tressel and Woo (2002) identify that Industry productivity performance is negatively affected by strict product market regulations, especially if there is a significant technology gap with the technology leader, while Barseghyan (2008) estimates that an increase in entry costs by eighty percent of income per capita would reduce total factor productivity by 22 percent.

In studies that relate the existence of market power in the local markets and the presence of an relatively open economy, using data from UK companies Nickell (1996) finds that competition, measured by increased numbers of competitors or by lower levels of rents, is associated with higher total factor productivity growth. Competition is measured using a Lerner Index, or price cost margin averaged across firms within the industry. This measure has several advantages over indicators such as market share or the Herfindahl concentration index as those measures rely more directly on precise definitions of geographic and product markets. This is important since in the case of the U.K. firms operate in international markets causing that market concentration measures based only on U.K. data may be misleading. Similarly, Aghion et al ., 2005, using as a measure of competition the same Lerner index used by Nickell (1996) and policy changes[5] to address the endogeneity between competition and innovation find positive effect of product market competition on productivity growth particularly at low levels of competition.

Among studies that analyze the effect of regulation in a developing country context, Srivastava (1996) and Ramaswamy (1999) find large positive effects of product market deregulations in India on firm-level productivity growth. At the same time, Kaplan, Piedra, and Seira (2007) find a positive impact of

[5] Thatcher era privatizations, the EU Single Market Programme,12 and the Monopoly and Merger Commission investigations that resulted in structural or behavioral remedies being imposed on the industry

entry deregulations on business startups in Mexico, similarly to the results found by Scarpetta, Hemmings, Tressel and Woo (2002).

Analyzing the effect competition has on productivity growth and providing a clear benchmarking on their results, Aghion et al. (2008) use three different datasets in order to compare product market competition in South African manufacturing firms and sectors to their corresponding sectors worldwide and proceed to assess the effect of competition on productivity growth. This paper also uses a Lerner Index to measure competition as well as transformation of the Nominal Solow Residual, as described in Roeger (1995), the growth rate of real local currency value-added per worker and total factor productivity (TFP) growth. Even when the results of the paper do not resolve all questions surrounding an appropriate instrumentation strategy, the results are consistent to show that mark-ups are significantly higher in South African industries than in their worldwide counterparts with an average profitability margins that doubles the present in other countries, and do not show signs of converging even in the most recent periods. More importantly, these high mark-ups are detrimental since they are associated with lower productivity growth rates. The authors estimate that a reduction of 10 percent in mark-ups would lead to an increase in productivity growth between 2 and 2.5 percent per year.

A related study by Ospina nd Schiffbauer (2006) captures competition pressure directly from firm managers. The authors use the World Bank Enterprise Survey that collects information that allows them to construct a measure of the cost competition each firm faces[6]. At the same time, mark-ups are constructed as sales over operating costs. They find a positive and causal relationship from competition on productivity. Specifically, firms that have 20 percent higher markups on average have 1.2 percent lower TFP levels and 8 percent lower labor productivity. Additionally, the authors use the countries that became market economies in the 1990's as a natural experiment to control the fact that reforms differ on extend and political motivation. They find that countries that during the period experienced a more pronounced increase in competition experienced a productivity growth between 12–15 percent.

At the local level, limited market competition can affect the adequate use of resources through several ways: the level of employment, real wages or the capture of rent (Nickell, 1999), as well as the levels of labor protection (Amable and Gatti, 2006). In addition, a number of studies have found a positive effect from competition on wages in developed countries. [7]

[6] The question explicitly asks "How important is pressure from domestic competitors on key decisions about your business with respect to reducing the production costs of existing products or services?". The answer to this question go from 1 to 4 where 1 is low importance and 4 high importance.

[7] See Griffith, Harrison and Macartney (2007); Nickell et al, (1994); Abowd and Lemieux,(1993); Blanchflower and Machin, (1996); Guadalupe, (2007).

According to Nickell (1999), there are three channels through which product competition impacts the demand of factors of production such as labor. First, higher product competition increases production and labor demand. This happens as the mark-up reduces increasing labor demand at any wage level. Second, labor supply elasticity goes down as product competition increases, and thus there is a reduction in the real bargaining wage. Third, the reduction in the labor demand elasticity leads to a higher capture of rents by those already in the labor market, which has an incidence in more permanent workers in jobs given a wage level. However, in a diversified location these effects might not exist when the concentration of production occurs in only one of multiple sectors.

Other studies have focused their attention on the impact international competition has in local markets trying to explain the empirical regularity that exporter firms are more productive than non-exporters. The results of these group of papers is of particular importance to our study since external competition can be a path to avoid the negative impacts of market concentration on productivity since it forces firms to stay competitive due to the menace of foreign entrant firms.

Two mechanisms have been proposed to explain why export status and firm productivity would be positive correlated. The first is self-selection: Only the more productive firms engage in export activities and can compete in international competitive markets. The second mechanism is the 'learning-by-exporting' hypothesis: Firms that enter the export markets gain access to technical expertise from their buyers, which non-exporters do not have allowing them to improve their efficiency level. Moreover, if performance does improve, it is unclear whether such improvements occur through learning-by-exporting—outward shifts in the production possibility frontier (PPF)—or simply through movements along the PPF. There are two central challenges in answering these questions. First, more productive firm's select into exporting, see Melitz (2003), while at the same time it is difficult to fins detailed information required to isolate changes that occur within firms due to exporting.

While the self-selection hypothesis has been relatively easy to prove empirically (Clerides, et al., 1998; Bernard and Jensen, 1999; Van Biesebroeck, 2006; and, Alvarez and Lopez, 2004), the evidence on the learning hypothesis has been less clear-cut. To fill this gap, Loecker (2007) studies the presence of the learning hypothesis through exporting on productivity on the Slovenian manufacturing sector at the firm level between 1994 and 2000. Using matching sampling techniques to control for self-selection into export markets, as well as productivity estimates from an Olley and Pakes (1996) algorithm to account for different market structures for exporting firms, the author finds that export entrants effectively become more productive. At the same time, the productivity gap between exporters and their domestic counterparts widens over time with these productivity gains being higher for firms exporting towards higher income regions. This identification strategy uses the massive entrance of Slovenian firms into the export markets over the various years within the sample period

1994–2000 that allows to identify the instantaneous and future productivity gains upon export entry controlling for the self-selection process.

Similarly, in a more controlled setting, Atkin, Khandelwal and Osman (2016) find similar results by conducting a randomized experiment to generate exogenous variation in the access to foreign markets for rug producers in Egypt. The authors find large improvements in quality as well as higher profits between 16-26 percent. These results from the literature on exports and productivity show that when the relevant competition is not in the local market, high levels of local concentration might not end up having a negative effect as theory and empirical findings would predict since the relevant market is not local.

3. Data and stylized facts on market concentration and economic productivity in Mexico

Data

Our analysis uses detailed establishment level data from Mexico's Economic Census (MEC) collected every five years by the National Statistical Office (INEGI). The census measures economic activity taking place in private establishments with a fixed location, collection information on firms sales, value added, number of workers, types of contractual arrangements, labor remunerations and value of fixed capital. Although it covers all non-agricultural activity, we focus on the manufacturing sector. Unfortunately, MEC does not allows to construct a panel of firms except for the data of 2009 and 2014. Thus, the corrections for endogeneity in the productivity variable are only possible for the period 2009-14; for this subsample we implement an Olley and Pakes (1996) correction to explore the size of the possible bias on the TFP estimation.

On his current state, the paper uses information of the firms aggregated at the municipality level from 1989 to 2009. This allows as to produce some first results and explore the data. During the month of August, we will run the same regressions using firm level observations, extending the results to 2014 data, as well as including the Olley and Pakes correction.

This paper also uses the definition of metropolitan area as the relevant geographical area to define local competition. Thus, we use the list of the fifty-six Metropolitan Areas in Mexico defined by the National Council of Population (CONAPO) in 2005 to construct HHI for sectors at the 3-digit level in the manufacturing industry (See Annex 1 for the complete list of metropolitan areas, and Annex 2 for the list of 3-digit sectors within manufacturing).

Additionally, for the census of 2004, 2008 and 2014 we also use the Mexican Atlas of Economic Complexity developed by Harvard. It allows us to know for each economic zone the amount of exports and imports at a 3-digit sector level. We use this information to test if exposure to international markets eliminates the negative effects of market concentration on productivity.

Stylized Facts

We construct HHI variables for each economic region both using the total sales as well as the total value added on each industry. The construction of this measures excludes from the sample the sectors that had less than 300 employees on a specific economic region[8]. As can be seen in the Table 1, when the level of concentration for each sector at the national level is computed, we see very little change across years. However, the variance on this indicator is grater when computed for each economic region[9]. See Annex 3.

Table 1. Evolution of HHI index in Mexico

Evolution of HHI index

	1988	1993	1998	2003	2008
Food Manufacturing	0.009	0.017	0.013	0.020	0.013
Beverage and Tobacco Product Manufacturing	0.126	0.128	0.109	0.158	0.309
Textile Mills	0.034	0.014	0.022	0.021	0.025
Textile Product Mills	0.053	0.056	0.040	0.087	0.213
Apparel Manufacturing	0.014	0.012	0.011	0.019	0.019
Leather and Allied Product Manufacturing	0.052	0.030	0.041	0.025	0.044
Wood Product Manufacturing	0.053	0.044	0.018	0.044	0.028
Paper Manufacturing	0.068	0.030	0.038	0.060	0.052
Printing and Related Support Activities Printing industry	0.042	0.028	0.107	0.064	0.034
Chemical Manufacturing	0.018	0.021	0.022	0.084	0.041
Plastics and Rubber Products Manufacturing	0.057	0.069	0.156	0.050	0.029
Nonmetallic Mineral Product Manufacturing	0.027	0.021	0.025	0.031	0.030
Primary Metal Manufacturing	0.181	0.069	0.125	0.090	0.080
Machinery Manufacturing	0.019	0.026	0.044	0.038	0.052
Computer and Electronic Product Manufacturing	0.045	0.049	0.040	0.037	0.062
Furniture and Related Product Manufacturing	0.038	0.038	0.060	0.047	0.090
Miscellaneous Manufacturing	0.045	0.045	0.031	0.030	0.096

Source: Authors calculations bases on Economic Census

[8] This drops 61 observations from the sample.

[9] We also estimate the level of competition using a mark-up Lerner index following Aghion et al ., 2005,. As mentioned before, this measure has several advantages over indicators such as market share or the Herfindahl concentration index as those measures rely more directly on precise definitions of geographic and product markets. This is important since in the case of the U.K. firms operate in international markets causing that market concentration measures based only on U.K. data may be misleading. We show this results as a robust test.

The data does not allows us to estimate economic productivity following Olley and Pakes (1996) to correct for potential endogeneity for the long period of analysis. Thus, as a second best we estimate TFP for each firm (municipality aggregates on this current version) and eliminate the results on the top and bottom deciles of the distribution since their predicted TFP is too high[10]. The regression used to estimate the TFP includes as independent variables the logarithm of the total capital and labor at the municipality level for each year and the total cost of inputs, as well as fixed effect for each year, region and sector:

$$\ln(y_{i,t}) = \beta_0 + \beta_1 capital_{i,t} + \beta_2 Labor_{i,t} + \beta_3 Inputs_{i,t} + Year_t + Region_r + Sector_j + \epsilon_{i,t}$$

We estimate the TFP as the residual from the previous equation: $TFP = \widehat{\epsilon_{i,t}}$. The previous equation is estimated for both the logarithm of value added and the total sales. As has been thoroughly explored in the literature, the previous estimation of the TFP presents bias problem since we have an endogeneity problem where input selection depends on unobserved productivity variable that determines the exit of inefficient firms in later periods. Methods to solve for this problem include Olley and Pakes (1996) correction that requires a monotonic relationship between a firm-level decision variable and the unobserved firm-level state variable "productivity".

Given the restriction on the data, the inclusion of year, region and sector fixed effects accounts as best as possible for the unobserved market conditions that affect the level of productivity of the firm. The remaining bias left on the estimation is a problem if we consider that it varies across time. We explore this by using the sub-sample panel for the last two censuses. Table 2 below presents the evolution of TFP by sector at the 3-digit level within the manufacturing industry for four periods. As can be seen on the Table, only a few sectors saw a decrease on their aggregate productivity at the national level, with more sectors seeing an increase with respect to the productivity level from 1988. In general, the food and apparel manufacturing, and Metal Product Manufacturing are the only sector that did not experience such an increment.

[10] Results do not change after using the variance of the estimated TFP as a weight.

Table 2. Evolution of TFP by industry in the manufacturing sector in Mexico

	Evolution of TFP by sector 1998 base year			
	1993	1998	2003	2008
Food Manufacturing	0.742	0.723	0.693	0.752
Beverage and Tobacco Product Manufacturing	0.588	0.644	0.931	1.181
Textile Mills	1.278	1.479	4.956	1.497
Textile Product Mills	1.361	1.472	1.791	1.609
Apparel Manufacturing	0.717	0.828	0.716	0.712
Leather and Allied Product Manufacturing	1.518	1.606	1.893	1.446
Wood Product Manufacturing	1.043	1.171	1.445	1.304
Paper Manufacturing	1.241	1.628	1.867	1.739
Printing and Related Support Activities Printing industry	1.316	1.561	1.689	1.673
Petroleum and Coal Products Manufacturing	1.043	0.957	1.098	1.789
Chemical Manufacturing	1.211	1.696	1.660	1.708
Plastics and Rubber Products Manufacturing	1.877	2.320	1.894	2.068
Nonmetallic Mineral Product Manufacturing	1.059	1.136	1.431	1.162
Primary Metal Manufacturing	1.174	1.867	1.535	1.195
Fabricated Metal Product Manufacturing	0.771	0.906	1.083	0.855
Machinery Manufacturing	1.003	1.557	1.956	1.658
Computer and Electronic Product Manufacturing	0.842	1.627	1.170	1.171
Electrical Equipment, Appliance, and Component Manufacturing	1.478	1.707	2.238	1.721
Transportation Equipment Manufacturing	1.142	1.290	1.578	1.528
Furniture and Related Product Manufacturing	1.173	1.459	1.525	1.332
Miscellaneous Manufacturing	1.462	1.693	2.776	1.882

Source: Authors calculations bases on Economic Census

4. Empirical Strategy and main results

To study the effects of competition on economic productivity in Mexico we regress the level of 3-digit sector concentration (approximated with HHI) for every metropolitan area against the level of productivity of each firm located in the relevant metropolitan area. The model estimated includes as controls the share of each sector at the 3-digit level and the change in the number of firms at the same level of disaggregation. In order to account for not observable time invariant characteristics that affect each sector annually, we also include sector-year specific fixed effects. Additionally, to control for economic area specific shocks fixed effects at the economic area are also included.

However, our industry concentration index presents problems of endogeneity since it can be that sectors with high levels of productivity may be the result of high levels of competition. Also, there are other valid concerns about other unobserved factors that simultaneously determine sectoral concentration and firm productivity at the local level which may vary over time, such as availability of factors of production at the local level, managerial ability, local government regulations, etc. To

circumvent these potential problems, we implement a Bartik (1991) instrument approach. This approach has the advantage that it reduces simultaneity concerns and does not rely on industry specific variation at the geographic-level since this source of variation is potentially problematic and driven by area specific shocks. Hence, we generate industry-specific Bartik instruments. In this way, the total change in concentration in a geographic area *j* can be divided into an "exogenous component" created recreated using the Bartik (1991) instrument and deviations from this predicted change. In this manner, our instrument allows us to only use the exogenous source of variation (see for instance Boustan et al., 2008).

Main results

Next, we estimate the effect of market concertation on productivity in the manufacturing sector. We start by estimating the model:

$$\mathrm{TFP}_{i,t} = \beta_0 + \beta_1 HHI_{r,t} + \beta_2 HHI_{r,t}^2 + \sum \beta_j X_{r,t} + Year_t * Region_r + Sector_j * Region_r + \epsilon_{i,t} \quad (1)$$

In the previous equation, the inclusion fixed effects of time-economic area as well as sector-economic area are included to account for sector and region-specific shocks. However, its inclusion limits the number of controls that can be used; the controls that are included are the share that each economic sector at the three-digit level has on the economic area as well as the change in the total number of firms on each region/sector. These controls are included to account for how important a sector is in an economic region overall activity. In particular, they are useful to understand how the concentration of a region in a particular sector is related to an overall concentration in a given sector. For example, we expect to have different effects on productivity as a consequence of a higher concentration in a sector, as a single firm becomes more predominant, than to an economic area disproportionally concentrating in a specific sector, measured by a high sector share.

The results of the model can be seen on Table 3. The first set of results omit the quadratic term. On them, it can be seen that higher levels of concentration at the economic region level has a negative effect on the productivity levels. At the same time, this effect is non-linear, that is, at low levels of concentration as a firm starts to increase its productivity increases. However, there is a point where higher levels of concentration start to have a negative impact of productivity.

We estimate different models presented in Table 3 below. Columns (1)-(4) show results of linear models. Column (1) present the results for a pooled OLS regression which does not find any effect of HHI on economic productivity. Columns (2) and (3) represent fixed effects models and establish a negative and statistically significant relationship between concentration and economic productivity, which increases in magnitude but is not statistically significant when the instrumental variables model is estimated (Column 4).

Table 3. The effects of market concentration on economic productivity in the manufacturing sector in Mexico, 1993-2008

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Simple				Quadratic			
HHI	-0.004	-0.027***	-0.023**	-0.083	0.009	0.001	0.055*	0.281*
	(0.006)	(0.006)	(0.009)	(0.052)	(0.018)	(0.019)	(0.030)	(0.170)
HHI^2					-0.015	-0.033	-0.077***	-0.331*
					(0.020)	(0.021)	(0.028)	(0.183)
Constant	0.715***	0.716***	0.705***	0.707***	0.713***	0.713***	0.692***	0.633***
	(0.002)	(0.002)	(0.006)	(0.051)	(0.003)	(0.003)	(0.008)	(0.051)
Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
FE area-year	No	No	Yes	Yes	No	No	Yes	Yes
FE Sector-year	No	No	Yes	Yes	No	No	Yes	Yes
IV	No	No	No	Yes	No	No	No	Yes
Observations	49,111	48,906	48,906	48,222	49,111	48,906	48,906	48,222
R-squared	0.000	0.002	0.008	0.014	0.000	0.002	0.008	0.013
Number of FE_year_area			220				220	

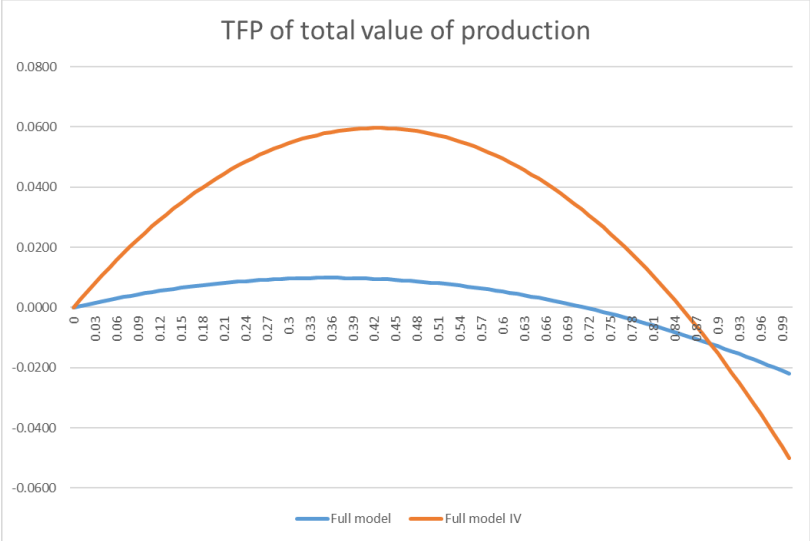
Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Following the literature that has discussed non-linear effects of concentration on productivity, we include a quadratic term on the effect of the HHI on firm productivity. All models presented in Table (5)-(8) test such potential quadratic relationship. We focus on the results from the instrumental variables model (column 8), which also include all the controls already mentioned as well as metropolitan area-time fixed effects, and sector-metropolitan area fixed effects. We find a non-linear and concave association between concentration and economic productivity which is illustrated on Figure 1 (also observed for the fixed effect model, blue trajectory).

These estimates tell us that at a certain degree of local market concentration have a positive effect on economic productivity, a result in line with the predictions of the standard model of endogenous technical change which imply that increasing (decreasing) competition (concentration) reduces expected future profits from innovations and rate of technical change. However, there is a threshold on the level of market concentration after which this relationship becomes negative. This result reflects that there is competition/innovation tradeoff. This tradeoff is the consequence of oligopoly rents on innovation, that enhance the incentive to innovate to escape competition, but as the pressure of competition disappears, the incentives to innovate also dwindle. Our findings also show that the point where concentration starts to have a negative effect on productivity is similar for both the instrumented and non-instrumented models.

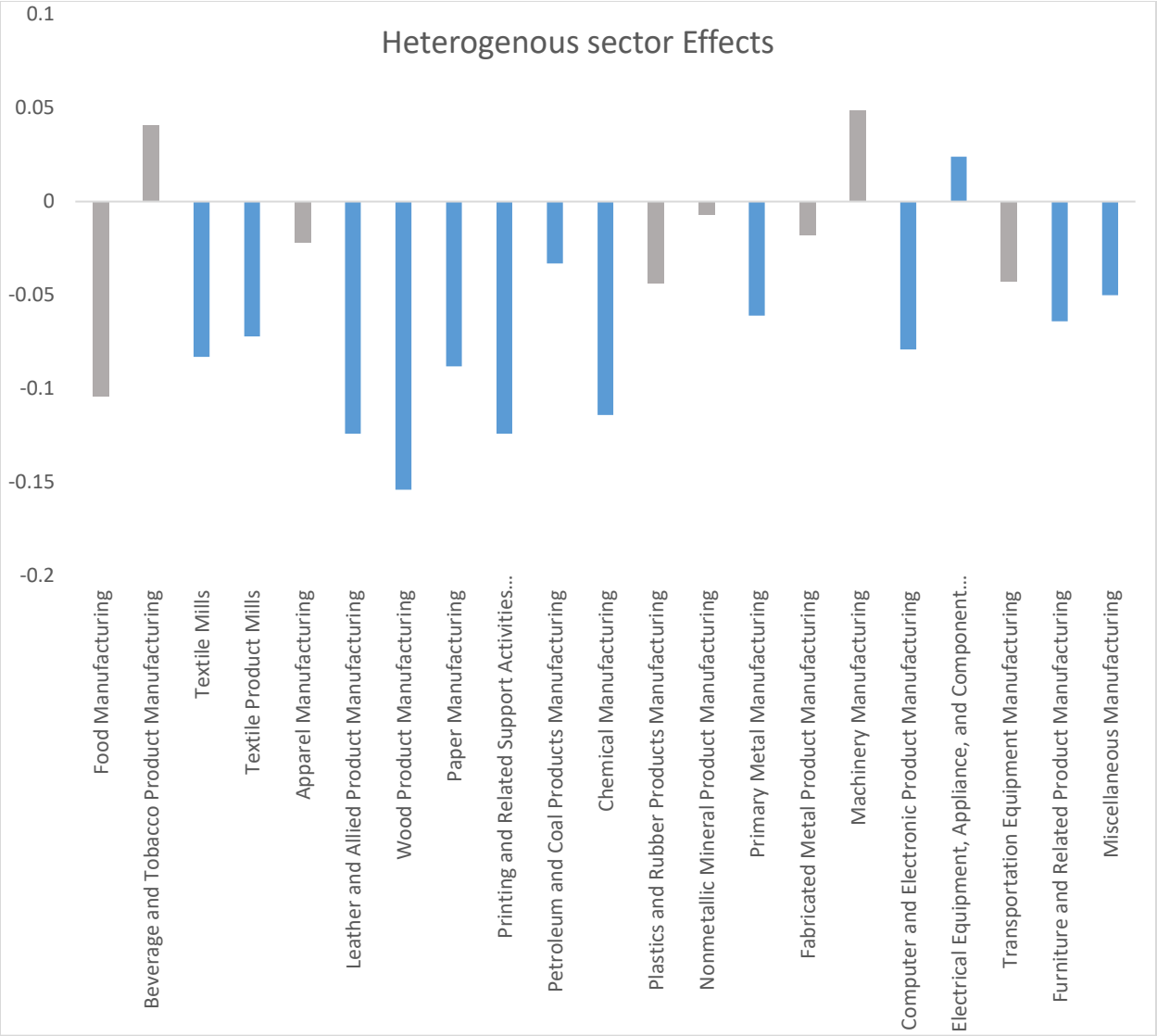
Figure 1. Non-linear association between market concentration and economic productivity



Source: Authors calculations bases on Economic Census

The previous results can be extended to specific industries. As can be seen on Figure 2, out of 21 sectors we observe a negative impact of concentration on productivity on 8 of them.

Figure 2. Effects of market concentration on economic productivity, at the 3-digit category



Note: Statistically significant results shown on grey

Source: Authors calculations bases on Economic Census

Heterogeneous effects by exposure to international markets

Furthermore, we would like to learn whether the effects of concentration on productivity are somewhat neutralized when the relevant market of manufacturing firms is international. So, taking advantage of data from the Atlas of Economic Complexity produced by Harvard, we estimate the impacts of competition on productivity depending the exposure to international markets for each sector at the 3-digit classification.

We estimate is defined in equation (2). As a measure of exposure to international markets we use the share of total exports of each sector that are produced on each metropolitan area as a percentage of the total production of the country. We interact this variable with the concentration index in order to find the heterogeneous effect created by different levels of external competition.

$$\mathrm{TFP}_{i,t} = \beta_0 + \beta_1 HHI_{r,t} + \beta_2 exportshare_{r,t} + \beta_3 exportshare_{r,t} * HHI_{r,t} + \sum \beta_j X_{r,t} + Year_t * Region_r + Sector_j * Region_r + \epsilon_{i,t} \quad (2)$$

The results of the estimation of equation (2) can be seen in Table 4. Our preliminary results, show that concentration has a negative impact on productivity, but as share of exports goes up this effect is neutralized. For instance, results in column (3) suggest that at certain level of local competition, more exposure to external markets will cancel the negative effect of market concentration on productivity. Given the magnitude of the interaction coefficient, one would expect that high exposure to external markets would complete cancel and even revert the negative effect of lack of competition at the local level.

Table 4. The joint effect of concentration and exposure to the external market on economic productivity in the manufacturing sector in Mexico, 1993-2008

	(1)	(2)	(3)
HHI	-0.003	-0.057***	-0.053***
	(0.009)	(0.009)	(0.012)
Share exports	-1.123*	-1.730***	-1.411*
	(0.574)	(0.568)	(0.720)
Share exports * HHI	3.626*	7.125***	4.759**
	(1.924)	(1.908)	(2.206)
Constant	0.716***	0.574***	0.527***
	(0.004)	(0.007)	(0.010)
Controls	No	Yes	Yes
FE	No	No	Yes
Observations	25,035	25,010	25,010
R-squared	0.000	0.023	0.030
Number of FE_year_area			110

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5. Next steps

a. Add firm level observations

Due to the confidentially of the Economic Census, to have access to firm level observations it is necessary make all the estimations directly on the INEGI. This will be done on early August 2017. Gaining access to firm level data will help us to gain precision on the point estimates previously shown.

b. Olley and Pakes bias correction

Even after gaining access to the firm level data, a panel data dataset can only be created for the last two rounds of the Economic Census. We will estimate the productivity measure using the Olley and Pakes (1996) approach. This will allow us to understand in what direction the results for the long dataset might be biased.

We will also use the results from estimating the TFP using the Olley and Pakes (1996) correction on estimating the effect of external competition.

6. Conclusions

With only few exceptions, most middle-income countries have struggled in their quest of sustained economic growth through higher productivity compared instead of just factor accumulation. The economic literature has seen a proliferation of both theoretical and empirical studies that have tried to estimate the effects of different factors, such as openness to trade, access to credit, innovation, and factor misallocation, on economic productivity. In the case of market concentration, some studies have focused on the effects of industry concentration on firm productivity ignoring the role of external competition has. By using information from economic census and mitigating potential issues of double causality, this paper finds evidence of a concave relationship between industry concentration and economic productivity. In particular, we show that there is a level of concentration where appropriation of extranormal rents at the local level would have a positive effect on economic productivity. However, depending the specific sector of analysis, there is a threshold level of industry concentration after which less competition has unambiguous negative effects of economic productivity.

Moreover, this study finds that the potential negative effects of market concentration on productivity are neutralized, and depending the sector reversed, when exposure to external markets exists. This can be interpreted as if local market concentration would only affect economic productivity if the relevant demand for those firms is domestic. These results have important implications for policy since it would suggest that programs that seek to boost productivity in developing countries should focus on fostering firm entry, and thus enhancing industry competition, in those sectors and geographical areas that are more exposed to international trade.

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Annex

Annex 1. List of metropolitan areas in Mexico, 2005

No.	Metropolitan Area	Mun[1]	Pop[2]	Area[3]
01	MA of Aguascalientes	3	834	1,824.7
02	MA of Tijuana	3	1,575	4,422.0
03	MA of Mexicali	1	856	14,541.5
04	MA of La Laguna	4	1,111	5,011.9
05	MA of Saltillo	3	725	14,071.5
06	MA of Monclova-Frontera	3	294	5,049.1
07	MA of Piedras Negras	2	170	1,382.7
08	MA of Colima-Villa de Álvarez	5	295	2,293.7
09	MA of Tecomán	2	123	1,198.1
10	MA of Tuxtla Gutiérrez	2	577	1,210.0
11	MA of Juárez	1	1,313	3,561.1
12	MA of Chihuahua	3	785	18,112.9
13	MA of Valle de México	76	19,240	7,853.9
14	MA of León	2	1,425	1,759.1
15	MA of San Francisco del Rincón	2	159	716.4
16	MA of Moroleón-Uriangato	2	100	274.8
17	MA of Acapulco	2	787	3,534.1
18	MA of Pachuca	7	439	1,201.6
19	MA of Tulancingo	3	205	673.6
20	MA of Tula	5	185	592.3
21	MA of Guadalajara	8	4,096	2,734.1
22	MA of Puerto Vallarta	2	304	1,447.9
23	MA of Ocotlán	2	133	1,078.3
24	MA of Toluca	14	1,633	2,038.3
25	MA of Morelia	2	736	1,453.9
26	MA of Zamora-Jacona	2	231	454.2
27	MA of La Piedad-Pénjamo	2	229	1,846.8
28	MA of Cuernavaca	7	802	964.1
29	MA of Cuautla	6	383	980.5
30	MA of Tepic	2	379	2,135.5
31	MA of Monterrey	12	3,738	6,680.4
32	MA of Oaxaca	20	544	585.0
33	MA of Tehuantepec	3	150	1,506.3
34	MA of Puebla-Tlaxcala	38	2,470	2,223.4
35	MA of Tehuacán	2	279	647.4
36	MA of Querétaro	4	951	2,051.2
37	MA of Cancún	2	586	3,020.8
38	MA of San Luis Potosí-Soledad de G. S.	2	958	1,776.6
39	MA of Rioverde-Ciudad Fernández	2	127	3,591.4
40	MA of Guaymas	2	185	8,580.5
41	MA of Villahermosa	2	645	2,258.3
42	MA of Tampico	5	803	5,285.9
43	MA of Reynosa-Río Bravo	2	634	4,722.5
44	MA of Matamoros	1	462	4,634.0
45	MA of Nuevo Laredo	1	356	1,201.9
46	MA of Tlaxcala-Apizaco	19	458	708.6
47	MA of Veracruz	4	741	1,509.1
48	MA of Xalapa	7	595	866.7
49	MA of Poza Rica	5	481	2,791.7
50	MA of Orizaba	11	381	509.2
51	MA of Minatitlán	6	331	2,927.8
52	MA of Coatzacoalcos	3	321	496.3
53	MA of Córdoba	4	294	461.6
54	MA of Acayucan	3	106	829.3
55	MA of Mérida	5	898	1,528.3
56	MA of Zacatecas-Guadalupe	2	261	1,215.5
	Total	345	57,879	167,028.2

Source: CONAPO

Annex 2. Sectors at the 3-digit level on manufacturing in Mexico

Sector code	Industry
311	Food Manufacturing
312	Beverage and Tobacco Product Manufacturing
313	Textile Mills
314	Textile Product Mills
315	Apparel Manufacturing
316	Leather and Allied Product Manufacturing
321	Wood Product Manufacturing
322	Paper Manufacturing
323	Printing and Related Support Activities
324	Petroleum and Coal Products Manufacturing
325	Chemical Manufacturing
326	Plastics and Rubber Products Manufacturing
327	Nonmetallic Mineral Product Manufacturing
331	Primary Metal Manufacturing
332	Fabricated Metal Product Manufacturing
333	Machinery Manufacturing
334	Computer and Electronic Product Manufacturing
335	Electrical Equipment, Appliance, and Component Manufacturing
336	Transportation Equipment Manufacturing
337	Furniture and Related Product Manufacturing
339	Miscellaneous Manufacturing

Source: Authors calculations bases on Economic Census

Annex 3. Evolution of HHI index by region and sector

	1988																				
Metropolitan area	311	312	313	314	315	316	321	322	323	324	325	326	327	331	332	333	334	335	336	337	339
1	0.68	0.87	1.00	1.00	0.63	0.50	0.91	1.00	1.00		0.47		0.70		0.32			1.00	1.00	0.55	0.87
2	0.94	0.91		1.00	0.51	1.00	0.59		1.00				0.75		0.48				1.00	0.38	
3	0.41	0.34	0.39	0.47	0.29	0.47	0.61	1.00	1.00	1.00	0.53	0.28	0.36	0.33	0.14	0.97	1.00	0.42	0.60	0.72	0.28
4	0.58	0.54		1.00	0.58		0.70		1.00		1.00		0.88		0.96					1.00	1.00
5	0.19	0.96	1.00	0.78	0.55	0.84	0.82	0.51	1.00		0.87	0.70	0.31	0.36	0.32	0.87	1.00	0.65	1.00	1.00	1.00
6	0.16	0.96	0.92	0.98	0.30	0.74	0.64	1.00	1.00	1.00	0.26	0.32	0.62	0.94	0.27	0.22	0.30	0.40	0.62	0.72	0.47
7	0.23	0.39			0.76	1.00	0.50	1.00	1.00		0.34	1.00	0.41	1.00	0.60	0.69		1.00		0.75	
8	0.65	0.93		1.00	0.53	0.42	0.89		1.00		0.48	0.79	0.39	1.00	0.38	1.00	1.00		0.81	0.35	1.00
9	0.25	0.50		0.54	0.22	0.68	0.24	0.88	0.84		0.45	0.30	0.25	0.54	0.43	0.47	1.00	0.53	1.00	0.64	0.35
10	0.45	0.43		0.84	0.41	0.95	0.67		0.96		0.25	0.60	0.76	1.00	0.22	1.00	1.00	0.51	0.51	0.39	1.00
11	0.26	0.49	0.64	0.72	0.87	0.31	0.23	0.95	0.87	1.00	0.22	0.61	0.49	0.88	0.43	0.47	1.00	0.94	1.00	0.45	0.37
12	0.09	0.64	0.30	0.54	0.17	0.17	0.24	0.70	0.28	0.38	0.29	0.77	0.22	0.33	0.27	0.15	0.32	0.58	0.40	0.37	0.14
13	0.26	0.42		1.00	0.59	1.00	0.50	1.00	0.50		1.00		0.39	1.00	0.49	0.83			1.00	1.00	1.00
14	0.38	0.83	0.68	0.64	0.23	0.36	0.45	0.98	1.00	1.00	0.81	0.29	0.38	0.56	0.29	0.25	0.26	0.28	0.92	0.51	0.45
15	0.09	0.60	0.81	0.59	0.15	0.60	0.65	0.99	0.53	0.66	0.33	0.18	0.79	0.62	0.22	0.38	1.00	0.29	0.39	0.36	0.74
16	0.41	0.42			0.76	0.69	0.67		0.63		1.00	0.38	0.20		0.75	1.00	1.00	1.00		0.63	
17	0.29	0.95	0.25	0.73	0.21	0.20	0.44	0.36	0.92	1.00	0.55	0.73	0.83	0.93	0.64	0.31	1.00	0.57	0.48	0.78	0.91
18	0.51	0.88		1.00	0.55		0.50	1.00	1.00	1.00	0.93	0.58	0.40	0.52	0.33	0.48	0.36	0.36	0.90	1.00	0.63
19	0.40	0.81	0.54	0.93	0.28	0.41	0.26	0.38	1.00	0.60	0.18	0.72	0.76	0.51	0.23	0.42	0.66	0.54	1.00	0.49	0.53
20	0.19	0.71	1.00	0.56	0.30	0.00	0.54	0.51	1.00	0.91	0.62	0.45	0.47	0.70	0.18	0.25	0.53	0.42	0.76	0.90	0.37
21	0.34	0.82			0.36		0.44		1.00	1.00	0.58	1.00	0.97	1.00	0.60	0.89				0.60	
22	0.69	0.86			0.83	1.00	0.91	1.00	0.91		0.99	1.00	0.62	0.87	0.51	0.42	1.00	0.88	0.80	0.50	1.00
23	0.10	0.68	0.34	0.81	0.23	0.19	0.12	0.21	0.45	0.49	0.12	0.11	0.17	0.32	0.16	0.17	0.14	0.15	0.27	0.16	0.29
24	0.47	0.94	0.95	1.00	0.49	0.35	0.75	1.00	1.00		0.41	0.36	0.67	0.90	0.78	0.43		0.80	0.65	0.60	0.90
25	0.44	0.27	0.23	0.33	0.15		0.53		1.00				0.62		0.44					0.57	
26	0.84	0.97	1.00	1.00	0.90	0.73	0.81	1.00	1.00		1.00	0.74	0.44	1.00	0.44	0.37	0.62	0.94	0.58	1.00	1.00
27	0.35	0.70		0.41	0.41	0.43	0.31		1.00		0.58	0.80	0.62		0.59	1.00		0.51	1.00	0.47	0.88
28	0.59	0.51		1.00	0.35	1.00	0.55		0.64	1.00	0.99		0.34	1.00	0.61	1.00				0.59	
29	0.31	0.98	0.27	0.83	0.45	0.28	0.44	0.95	0.43		0.40	0.38	0.56	0.93	0.44			1.00	1.00	0.22	1.00
30	0.39	1.00	0.67	0.37	0.31	0.71	0.51		1.00		1.00	0.47	0.91	0.98	0.55	1.00	1.00	0.30	0.96	0.34	1.00
31	0.36	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	0.69	0.48	1.00	0.89	0.51	1.00	1.00		0.71	
32	0.42	0.41		1.00	0.30	1.00	0.33	1.00	0.80		1.00	1.00	0.17	0.55	0.27	0.58			1.00	0.25	1.00
33	0.17	0.34	0.08	0.20	0.13	0.33	0.37	0.85	0.67	0.80	0.24	0.28	0.21	0.75	0.15	0.18	0.56	0.23	0.96	0.45	0.44
34	0.21	0.44		1.00	0.82	0.64	0.43		1.00				0.71	0.99	0.61	1.00			1.00	0.88	1.00
35	0.20	0.94	0.48	0.82	0.82		0.33	0.43	0.53	0.55	0.46	0.77	0.95	0.28	0.58	0.42	1.00	0.66	0.38	0.41	0.71
36	0.24	0.91	1.00	1.00	0.83	0.65	0.41	0.95	0.74		1.00	0.75	0.30	1.00	0.89	0.62	0.89	0.70	0.78	0.98	0.47
37	0.30	0.63	1.00		0.54	0.30	0.31		1.00		0.00		0.24		0.35				1.00	0.35	0.67
38	0.10	0.83	0.40	0.36	0.46	0.69	0.34	0.83	1.00	0.83	0.27	0.45	0.14	0.36	0.33	0.61	0.90	0.45	0.37	0.51	0.61
39	0.16	0.93	0.54	0.88	0.34	0.92	0.49	0.71	0.53	1.00	0.25	0.38	0.31	0.46	0.36	0.82	0.81	0.57	1.00	0.68	0.87
40	0.39		1.00	1.00	0.81	0.52	0.54	0.99	1.00		0.97	0.60	0.37	0.41	0.55	0.60			1.00	0.50	1.00
41	0.34	0.55		0.46	0.44		0.40	1.00	0.75	0.99	0.45	0.20	0.38	0.99	0.51	0.53		0.47	0.48	0.37	0.88
42	0.57	0.63			1.00	1.00	0.37		0.62		1.00		0.36		0.51				1.00	0.52	1.00
43	0.78	0.97	1.00		0.42	0.96	0.84	1.00	1.00	1.00	0.34	0.59	0.50		0.40	1.00		1.00	1.00	1.00	0.26
44	0.30	1.00			1.00				1.00		1.00		1.00		1.00					1.00	
45	0.43	0.74		1.00	0.43	0.58	0.53	1.00	0.53		0.45	0.51	0.42	1.00	0.30	0.97	1.00		0.53	0.74	0.77
46	0.51														1.00						
47	0.37	0.60	1.00	0.52	0.39	0.43	0.62	0.54	1.00	1.00	0.20	0.44	0.64	0.29	0.19	0.30	0.46	0.48	0.24	0.36	0.40
48	0.20	0.51	0.17	0.52	0.52	0.40	0.39	0.52	0.51		0.19	0.29	0.40	0.33	0.24	0.42	0.33	0.46	0.88	0.41	0.42
49	0.72	1.00			0.82		0.29	1.00	0.35	1.00	1.00	0.50	0.52		0.17					0.36	1.00
50	0.61	0.49	0.58	1.00	0.30	1.00	0.34		1.00		0.90	0.93	0.37	0.88	0.25	0.97			1.00	0.67	1.00
51	0.03	0.22	0.02	0.14	0.03	0.08	0.13	0.07	0.07	0.74	0.03	0.19	0.08	0.12	0.03	0.03	0.08	0.04	0.31	0.08	0.05
52	0.47	0.50		1.00	0.24	0.75	0.35	0.53	0.48		0.37	0.49	0.24	0.50	0.64	0.83	1.00	0.51	0.94	0.61	0.66
53	0.35	0.94		1.00	0.88	1.00	0.74		1.00		1.00	0.36	0.64	1.00	0.64	1.00		1.00		0.57	1.00
54	0.44	0.87	0.60	0.90	0.35	0.44	0.26	1.00	0.93	1.00	1.00	0.63	0.29	0.61	0.38	0.45		0.51	1.00	0.23	
55	0.44	1.00	1.00	1.00	0.58	0.50	0.49		0.53		1.00	0.67	0.39	0.53	0.42	1.00		0.56		0.37	0.97

	1993																					
Metropolitan area	311	312	313	314	315	316	321	322	323	324	325	326	327	331	332	333	334	335	336	337	339
1	0.69	0.55	0.00	1.00	0.89	0.90	0.66	0.83	1.00	0.00	0.90	0.81	0.77	1.00	0.17	1.00	0.00	1.00	0.00	0.78	0.50
2	0.80	0.55	1.00	0.50	0.33	1.00	0.00	1.00	1.00	0.00	0.51	0.00	0.97	0.00	0.37	0.00	0.00	0.00	1.00	0.43	1.00
3	0.32	0.37	0.21	0.69	0.14	0.57	0.51	0.94	0.67	0.00	0.19	0.65	0.35	0.34	0.18	0.87	0.62	0.66	0.73	0.33	0.61
4	0.34	0.99	0.00	0.45	0.42	0.00	0.40	1.00	0.80	0.00	1.00	1.00	0.53	0.00	0.27	1.00	0.00	1.00	1.00	0.79	1.00
5	0.23	0.91	0.86	0.59	0.69	1.00	0.74	0.83	1.00	0.00	0.49	0.36	0.53	0.93	0.26	0.69	0.00	0.48	0.47	0.97	0.62
6	0.14	0.88	1.00	0.38	0.36	0.43	0.73	0.78	0.92	1.00	0.31	0.34	0.54	0.99	0.40	0.27	0.39	0.48	0.24	0.55	0.48
7	0.38	0.37	0.00	0.54	0.25	0.00	0.75	1.00	0.83	0.00	0.43	0.82	0.78	0.00	0.28	1.00	0.00	1.00	0.82	0.27	0.00
8	0.21	0.70	1.00	0.66	0.42	0.39	0.21	0.95	0.67	0.00	0.51	0.43	0.30	1.00	0.21	1.00	0.00	1.00	1.00	0.52	0.46
9	0.26	0.42	0.00	0.41	0.34	0.57	0.25	1.00	0.46	0.00	0.99	0.31	0.69	0.50	0.74	0.62	1.00	1.00	0.85	0.79	0.32
10	0.36	0.74	0.00	0.52	0.24	0.99	0.60	0.00	0.81	0.00	0.30	0.39	0.36	0.00	0.49	0.69	0.00	0.00	0.63	0.37	0.61
11	0.30	0.33	0.23	0.60	0.74	0.51	0.21	0.86	0.52	0.00	0.19	0.58	0.49	0.00	0.42	0.56	0.84	0.37	0.97	0.79	0.41
12	0.08	0.86	0.15	0.57	0.07	0.12	0.52	0.30	0.35	0.27	0.24	0.65	0.33	0.26	0.09	0.08	0.41	0.27	0.55	0.25	0.10
13	0.26	0.70	0.00	1.00	0.81	1.00	0.85	1.00	0.63	0.00	1.00	0.95	0.60	0.00	0.19	0.61	0.00	1.00	0.66	0.57	0.63
14	0.30	0.87	0.50	0.55	0.51	0.51	0.38	0.93	1.00	1.00	0.64	0.25	0.34	1.00	0.32	0.20	0.25	0.21	0.33	0.70	0.44
15	0.16	0.31	0.99	0.26	0.12	0.53	0.80	0.99	0.43	1.00	0.40	0.13	0.56	0.96	0.09	0.15	0.86	0.26	0.22	0.36	0.30
16	0.24	0.34	0.53	0.59	0.28	0.53	0.29	0.00	0.55	0.00	1.00	0.91	0.18	1.00	0.71	0.71	0.00	0.87	1.00	0.51	0.48
17	0.24	0.81	0.26	0.62	0.19	0.16	0.60	0.31	0.89	1.00	0.26	0.33	0.64	0.62	0.16	0.52	0.00	0.48	0.44	0.30	0.32
18	0.27	0.85	1.00	0.59	0.87	1.00	0.92	0.54	1.00	1.00	0.52	0.57	0.28	0.99	0.24	0.27	0.36	0.35	0.56	1.00	0.79
19	0.16	0.48	0.79	0.82	0.21	0.44	0.52	0.38	0.81	0.52	0.19	0.24	0.55	0.36	0.19	0.40	0.98	0.31	0.49	0.31	0.32
20	0.19	0.50	1.00	0.96	0.35	1.00	0.78	0.48	1.00	1.00	0.25	0.34	0.38	0.82	0.31	0.31	0.24	0.50	0.84	0.66	0.48
21	0.79	0.81	0.00	0.00	0.26	0.00	0.69	0.00	0.62	1.00	0.32	0.52	0.44	0.00	0.34	1.00	0.00	0.00	0.91	0.24	1.00
22	0.40	0.47	1.00	0.00	0.50	0.64	0.35	0.58	0.53	0.91	0.97	0.46	0.41	0.38	0.28	0.45	0.00	0.58	0.83	0.57	0.84
23	0.09	0.59	0.12	0.35	0.12	0.24	0.19	0.19	0.39	0.17	0.09	0.56	0.10	0.20	0.09	0.15	0.16	0.15	0.36	0.33	0.12
24	0.45	0.49	1.00	0.47	0.33	0.43	0.41	0.91	1.00	0.00	0.31	0.39	0.39	1.00	0.44	0.52	1.00	0.87	0.97	0.96	0.76
25	0.58	0.27	0.35	0.41	0.19	1.00	0.34	0.00	0.61	0.00	0.00	1.00	0.53	0.00	0.39	0.00	0.00	0.00	0.00	0.50	1.00
26	0.83	0.88	0.00	0.46	0.54	0.60	0.69	0.86	1.00	0.00	0.51	0.37	0.33	1.00	0.31	0.43	0.35	0.53	0.64	1.00	0.57
27	0.20	0.53	0.29	0.30	0.35	0.40	0.46	1.00	1.00	0.00	0.57	0.75	0.42	1.00	0.09	0.98	0.00	0.56	0.84	0.14	0.92
28	0.73	0.34	1.00	0.85	0.52	0.50	0.96	0.00	0.71	1.00	0.97	0.88	0.18	1.00	0.40	0.00	0.00	0.00	0.63	0.78	0.58
29	0.19	0.98	0.49	0.66	0.23	0.35	0.24	0.87	0.91	0.00	0.35	0.36	0.67	1.00	0.84	1.00	0.00	1.00	1.00	0.25	0.36
30	0.30	0.63	0.00	0.56	0.18	0.30	0.44	0.00	0.95	0.00	0.51	0.74	0.43	0.82	0.67	0.28	1.00	0.79	0.74	0.73	0.83
31	0.20	0.65	0.00	0.56	0.58	1.00	1.00	1.00	1.00	0.00	0.00	0.45	0.47	0.00	0.76	1.00	0.51	0.50	0.89	0.54	1.00
32	0.14	0.27	0.00	0.76	0.76	0.58	0.25	1.00	0.58	0.00	1.00	0.67	0.34	0.00	0.47	1.00	0.00	0.94	0.87	0.29	0.30
33	0.14	0.36	0.07	0.29	0.15	0.42	0.28	0.43	0.38	0.48	0.14	0.36	0.20	0.46	0.15	0.24	0.52	0.24	0.92	0.19	0.28
34	0.13	0.35	0.00	0.50	0.45	0.30	0.31	1.00	1.00	0.00	0.00	1.00	0.50	0.00	0.35	0.00	0.00	0.00	0.00	0.46	0.84
35	0.25	0.96	0.55	0.37	0.26	0.38	0.32	0.42	0.81	1.00	0.36	0.61	0.89	0.31	0.17	0.38	0.60	0.37	0.28	0.41	0.31
36	0.55	0.58	1.00	0.99	0.28	0.89	0.56	1.00	0.83	1.00	0.96	0.53	0.66	1.00	0.52	0.49	0.30	0.50	0.56	0.94	0.79
37	0.21	0.55	0.00	0.87	0.63	0.59	0.45	1.00	1.00	0.00	1.00	1.00	0.30	0.00	0.40	1.00	0.00	0.00	1.00	0.58	0.73
38	0.11	0.68	0.32	0.39	0.17	0.41	0.41	0.60	0.92	0.00	0.15	0.38	0.22	0.30	0.19	0.23	0.60	0.84	0.32	0.33	0.68
39	0.14	0.49	0.69	1.00	0.77	0.68	0.92	0.98	0.54	1.00	0.31	0.40	0.32	0.84	0.28	0.47	0.52	0.52	0.99	0.55	0.39
40	0.31	1.00	0.41	0.96	0.42	0.18	0.82	0.33	0.91	0.00	0.92	0.44	0.89	0.50	0.82	0.36	0.00	0.00	0.00	0.52	0.81
41	0.40	0.29	0.00	0.44	0.50	0.00	0.32	0.55	0.56	1.00	0.25	0.14	0.30	0.99	0.36	0.32	1.00	0.57	0.82	0.97	0.53
42	0.30	0.34	1.00	0.57	0.95	1.00	0.38	1.00	0.84	0.00	1.00	0.91	0.98	0.00	0.32	0.00	0.00	0.00	1.00	0.66	1.00
43	0.65	0.99	1.00	0.69	0.30	0.83	0.35	0.53	1.00	1.00	0.82	0.52	0.46	0.00	0.72	0.97	1.00	0.00	1.00	1.00	0.55
44	0.29	0.50	0.00	0.89	1.00	0.00	1.00	0.00	1.00	0.00	0.99	0.00	0.95	0.00	0.95	0.00	0.00	0.00	0.00	1.00	0.56
45	0.39	0.56	0.00	0.62	0.41	0.40	0.38	1.00	0.92	0.00	0.77	0.35	0.53	0.00	0.45	0.81	0.00	1.00	1.00	0.67	0.58
46	0.52	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	0.00
47	0.41	0.51	1.00	0.49	0.35	0.60	0.44	0.54	1.00	1.00	0.15	0.27	0.35	0.42	0.14	0.25	0.29	0.29	0.47	0.38	0.30
48	0.16	0.48	0.18	0.70	0.18	0.23	0.26	0.26	0.57	1.00	0.12	0.30	0.40	0.28	0.33	0.13	0.34	0.53	0.86	0.41	0.41
49	0.52	0.68	0.00	1.00	0.52	1.00	0.40	1.00	0.23	1.00	0.53	0.90	0.47	0.51	0.47	0.80	0.00	1.00	0.95	0.43	0.54
50	0.40	0.62	0.22	0.52	0.24	0.82	0.35	0.00	1.00	0.00	0.78	0.52	0.29	0.00	0.75	0.86	1.00	1.00	0.62	0.90	0.98
51	0.04	0.30	0.02	0.11	0.02	0.07	0.07	0.04	0.07	0.11	0.03	0.17	0.06	0.14	0.02	0.03	0.14	0.07	0.24	0.05	0.05
52	0.30	0.52	0.52	0.61	0.19	0.65	0.25	0.54	0.42	1.00	0.38	0.64	0.45	0.35	0.33	0.41	1.00	0.49	0.77	0.59	0.30
53	0.33	0.58	0.00	0.43	0.49	0.56	0.28	1.00	1.00	1.00	0.98	0.30	0.52	1.00	0.71	0.71	0.00	1.00	0.54	0.50	0.79
54	0.68	0.96	1.00	0.63	0.51	0.31	0.16	1.00	0.64	0.00	0.75	0.43	0.21	1.00	0.79	0.94	0.00	1.00	0.79	0.38	0.51
55	0.56	0.88	1.00	0.43	0.30	0.75	0.30	0.00	0.67	0.00	0.57	0.72	0.30	0.46	0.26	0.00	1.00	0.91	1.00	0.54	0.70

	1998																					
Metropolitan area	311	312	313	314	315	316	321	322	323	324	325	326	327	331	332	333	334	335	336	337	339
1	0.97	0.54	0.00	0.39	0.79	0.25	0.41	1.00	0.92	0.00	0.54	0.49	0.91	1.00	0.19	0.35	1.00	0.98	0.00	0.60	0.31
2	0.24	0.51	0.00	1.00	0.41	1.00	0.37	0.80	1.00	0.00	0.00	1.00	0.23	0.00	0.87	0.87	0.00	0.00	0.36	0.35	0.00
3	0.28	0.58	0.25	0.76	0.13	0.53	0.48	0.97	0.62	0.00	0.58	0.23	0.53	0.84	0.18	0.90	0.98	0.73	0.69	0.34	0.77
4	0.75	0.37	1.00	0.68	0.24	1.00	0.45	1.00	0.66	1.00	0.85	0.51	0.51	1.00	0.63	1.00	0.00	1.00	0.50	0.81	0.72
5	0.23	0.90	0.71	0.72	0.30	0.91	0.70	0.50	1.00	0.00	0.51	0.28	0.95	0.86	0.15	0.93	0.00	0.55	0.54	0.61	0.37
6	0.16	0.90	1.00	0.83	0.32	0.39	0.72	0.58	0.92	1.00	0.48	0.43	0.39	0.58	0.29	0.35	0.47	0.41	0.56	0.50	0.23
7	0.43	0.35	0.00	0.96	0.22	1.00	0.32	1.00	0.77	0.00	0.62	0.63	0.91	1.00	0.56	0.95	1.00	1.00	1.00	0.31	0.44
8	0.36	0.55	0.00	0.60	0.53	0.45	0.26	0.94	0.50	0.00	0.89	0.94	0.60	1.00	0.33	0.34	0.00	0.65	0.44	0.52	0.29
9	0.31	0.49	0.00	1.00	0.31	0.33	0.41	0.89	0.47	0.00	0.58	0.27	0.63	0.51	0.87	0.45	0.00	1.00	0.62	0.75	0.27
10	0.34	0.85	1.00	0.44	0.22	1.00	0.18	1.00	0.87	0.00	0.39	0.93	0.56	1.00	0.28	0.56	1.00	0.51	1.00	0.28	0.38
11	0.81	0.75	0.41	0.55	0.39	0.59	0.58	0.59	0.27	1.00	0.18	0.70	0.42	0.37	0.45	0.58	0.97	0.35	0.99	0.28	0.67
12	0.06	0.77	0.16	0.49	0.06	0.10	0.27	0.27	0.28	0.48	0.27	0.73	0.25	0.39	0.29	0.77	0.70	0.43	0.27	0.22	0.19
13	0.45	0.45	1.00	0.49	0.75	1.00	0.44	0.79	0.50	0.00	0.95	0.92	0.78	0.97	0.35	1.00	0.41	0.99	0.39	0.98	0.61
14	0.38	0.87	0.79	0.88	0.34	0.56	0.31	0.95	1.00	1.00	0.85	0.28	0.39	0.64	0.38	0.36	0.19	0.21	0.53	0.38	0.33
15	0.22	0.41	0.83	0.29	0.15	0.60	0.33	0.97	0.49	0.42	0.27	0.18	0.59	0.93	0.21	0.14	0.83	0.92	0.38	0.53	0.46
16	0.35	0.87	0.00	0.56	0.38	0.73	0.46	0.94	0.65	0.00	0.64	0.62	0.74	1.00	0.78	0.86	1.00	0.97	0.60	0.50	0.43
17	0.42	0.96	0.74	0.44	0.25	0.31	0.28	0.33	0.88	1.00	0.16	0.41	0.24	0.65	0.52	0.26	0.84	0.40	1.00	0.40	0.21
18	0.37	0.80	1.00	0.57	0.38	1.00	0.41	1.00	1.00	1.00	0.48	0.91	0.62	1.00	0.53	0.46	0.53	0.53	0.66	1.00	0.74
19	0.17	0.74	0.52	0.61	0.24	0.23	0.31	0.29	0.52	1.00	0.20	0.36	0.49	0.43	0.21	0.30	0.91	0.39	0.58	0.35	0.42
20	0.15	0.52	1.00	0.56	0.22	1.00	0.34	0.59	1.00	0.00	0.38	0.43	0.38	0.36	0.34	0.42	0.31	0.73	0.88	1.00	0.78
21	0.96	0.85	1.00	0.66	0.25	0.00	0.29	0.64	0.61	1.00	0.44	0.45	0.32	1.00	0.22	0.94	0.00	0.00	0.76	0.22	0.52
22	0.63	0.43	0.60	0.77	0.51	1.00	0.65	0.99	0.57	0.86	0.75	0.39	0.27	0.50	0.59	0.49	1.00	0.99	0.97	0.84	0.30
23	0.06	0.66	0.17	0.44	0.30	0.19	0.16	0.20	0.24	0.18	0.09	0.33	0.10	0.21	0.07	0.15	0.14	0.13	0.24	0.28	0.14
24	0.65	0.51	0.99	0.62	0.26	0.33	0.80	0.91	1.00	0.00	0.35	0.38	0.45	1.00	0.65	0.51	0.89	0.88	1.00	0.50	0.25
25	0.15	0.37	0.80	0.44	0.19	1.00	0.60	0.00	0.50	0.00	1.00	0.83	0.46	1.00	0.23	0.62	0.00	0.00	0.00	0.52	0.55
26	0.38	0.74	1.00	0.80	0.48	0.61	0.43	0.77	1.00	0.00	1.00	0.51	0.46	1.00	0.21	0.50	0.42	0.72	0.76	0.79	0.50
27	0.39	0.35	0.70	0.29	0.21	0.16	0.18	0.34	0.44	1.00	0.79	0.60	0.24	0.44	0.18	0.37	1.00	0.50	1.00	0.11	0.91
28	0.52	0.81	1.00	1.00	0.90	0.67	0.68	1.00	0.57	0.00	0.65	0.52	0.36	1.00	0.30	0.36	0.00	0.00	1.00	0.56	0.54
29	0.28	0.78	0.64	0.38	0.17	0.32	0.29	0.74	0.34	0.00	0.46	0.33	0.45	0.51	0.21	0.62	0.00	0.52	0.55	0.17	0.69
30	0.26	0.95	0.73	0.34	0.46	0.31	0.71	1.00	0.44	0.00	0.51	0.82	0.25	0.67	0.58	0.42	1.00	0.81	0.91	0.42	0.29
31	0.26	0.63	0.00	0.63	0.48	0.61	0.33	0.52	0.97	0.00	0.00	0.48	0.29	0.00	0.53	1.00	0.62	0.58	0.67	0.67	0.56
32	0.26	0.25	1.00	0.50	0.25	0.25	0.26	0.65	0.58	1.00	1.00	0.41	0.71	0.00	0.14	1.00	0.00	1.00	0.82	0.22	0.46
33	0.08	0.30	0.06	0.17	0.14	0.62	0.51	0.25	0.26	0.56	0.18	0.22	0.28	0.79	0.09	0.42	0.99	0.32	0.61	0.15	0.40
34	0.22	0.50	0.00	0.56	0.26	0.26	0.21	1.00	1.00	0.00	0.71	1.00	0.45	1.00	0.25	0.84	0.00	0.00	1.00	0.47	0.53
35	0.19	0.97	0.37	0.97	0.71	0.50	0.51	0.45	0.94	0.57	0.60	0.54	0.81	0.41	0.28	0.45	0.34	0.28	0.18	0.30	0.85
36	0.51	0.57	0.00	0.98	0.30	0.78	0.29	0.95	0.83	1.00	0.86	0.66	0.31	0.50	0.40	0.39	0.33	0.47	0.38	0.40	0.61
37	0.47	0.49	0.00	1.00	0.70	0.69	0.34	1.00	0.98	0.00	1.00	1.00	0.36	0.72	0.24	0.00	0.00	1.00	0.00	0.60	0.93
38	0.16	0.76	0.35	0.38	0.18	0.82	0.34	0.60	0.86	0.55	0.33	0.57	0.58	0.30	0.19	0.38	0.62	0.47	0.37	0.44	0.92
39	0.15	0.86	0.85	0.51	0.39	0.99	0.50	0.98	0.64	0.99	0.48	0.40	0.34	0.48	0.20	0.51	0.70	0.54	0.51	0.81	0.44
40	0.63	1.00	0.42	1.00	0.42	0.58	0.38	0.45	0.97	0.00	0.80	0.35	0.21	0.70	0.29	0.32	0.00	0.00	0.00	0.64	0.54
41	0.36	0.20	0.63	0.49	0.78	0.58	0.61	0.48	0.60	1.00	0.18	0.49	0.43	0.99	0.35	0.60	0.82	0.94	0.34	0.23	0.17
42	0.50	0.81	0.52	0.00	0.56	0.00	0.31	1.00	1.00	0.00	1.00	0.00	0.95	0.00	0.33	0.00	0.00	0.00	1.00	0.86	0.87
43	0.76	0.93	0.69	0.71	0.31	0.63	0.50	0.70	1.00	0.00	0.39	0.46	0.58	0.00	0.45	0.49	0.50	0.50	1.00	1.00	0.89
44	0.21	0.82	0.00	0.50	0.28	0.00	0.69	1.00	1.00	0.00	0.98	0.00	0.98	0.00	0.49	0.00	1.00	0.00	0.00	1.00	0.53
45	0.61	0.39	0.00	0.40	0.74	0.47	0.33	0.98	0.92	0.00	0.69	0.47	0.85	0.00	0.25	0.98	0.00	0.80	0.71	0.47	0.31
46	0.36	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	0.00
47	0.64	0.69	0.78	0.90	0.42	0.44	0.29	0.54	0.63	1.00	0.29	0.18	0.22	0.65	0.17	0.18	0.22	0.27	0.26	0.33	0.25
48	0.14	0.50	0.17	0.69	0.23	0.21	0.33	0.45	0.86	0.82	0.19	0.15	0.46	0.44	0.46	0.13	0.54	0.46	0.82	0.77	0.48
49	0.59	0.39	0.00	0.46	0.47	0.00	0.18	1.00	0.26	1.00	0.44	0.94	0.56	1.00	0.56	0.00	0.00	0.00	0.00	0.63	1.00
50	0.28	0.44	0.41	0.65	0.32	1.00	0.31	1.00	0.64	0.00	0.52	0.61	0.23	1.00	0.64	0.36	0.00	0.55	0.62	1.00	1.00
51	0.05	0.27	0.03	0.35	0.01	0.07	0.11	0.05	0.12	0.14	0.03	0.37	0.08	0.15	0.04	0.04	0.20	0.07	0.19	0.15	0.05
52	0.37	0.27	0.61	0.90	0.84	0.25	0.36	0.95	0.35	1.00	0.26	0.45	0.36	0.56	0.19	0.98	0.43	0.41	0.50	0.40	0.36
53	0.43	0.95	1.00	0.90	0.33	1.00	0.50	1.00	1.00	1.00	1.00	0.64	0.59	1.00	0.36	1.00	0.00	1.00	0.64	0.37	0.55
54	0.69	0.52	0.00	0.53	0.68	0.38	0.49	1.00	0.90	0.00	0.54	0.43	0.40	0.99	0.11	0.27	0.50	0.59	0.00	0.26	0.30
55	0.50	0.90	1.00	0.42	0.57	0.99	0.68	0.54	0.56	0.00	0.46	0.60	0.32	0.96	0.23	0.55	0.00	1.00	1.00	0.38	0.39

	1988																				
Metropolitan area	311	312	313	314	315	316	321	322	323	324	325	326	327	331	332	333	334	335	336	337	339
1	0.96	0.57	1.00	0.48	0.43	0.52	0.32	1.00	0.70	0.00	0.68	0.88	0.92	1.00	0.25	0.71		1.00	0.54	0.50	0.87
2	0.33	0.26		0.72	0.42	1.00	0.58	1.00	1.00			1.00	0.56		0.68	1.00			1.00	0.33	1.00
3	0.25	0.33	0.24	0.51	0.47	0.47	0.43	0.95	0.98	0.00	0.82	0.25	0.47	0.52	0.23	0.78	0.51	0.59	0.86	0.50	0.39
4	0.65	0.73		0.51	0.30		0.31	0.92	0.91	1.00	0.83	0.88	0.57	1.00	0.32	0.67		1.00	0.74	0.61	0.31
5	0.21	0.93		0.57	0.40	1.00	0.66	0.87	1.00	0.00	0.48	0.46	0.86	0.68	0.23	0.91	1.00	0.59	0.25	0.56	0.28
6	0.24	0.77		0.79	0.71	0.33	0.76	0.84	0.74	0.00	0.24	0.33	0.38	0.89	0.37	0.50	0.39	0.70	0.44	0.37	0.96
7	0.38	0.62		0.62	0.32		0.33	0.73	0.79	0.00	0.41	1.00	0.88	1.00	0.30	1.00		1.00	0.51	0.42	0.31
8	0.50	0.92		0.39	0.36	0.48	0.19	0.49	0.52	0.00	0.27	0.39	0.59	0.72	0.16	0.30		0.79	0.87	0.40	0.24
9	0.35	0.27	1.00	0.55	0.30	0.50	0.52	0.50	0.64		0.99	0.24	0.77	0.64	0.43	0.84	1.00	0.85	0.32	0.64	0.32
10	0.29	0.39	0.70	0.72	0.16	1.00	0.26	0.38	0.80	0.00	0.50	0.94	0.68	1.00	0.45	0.44	1.00	0.92	1.00	0.29	0.97
11	0.74	0.59	0.43	0.31	0.75	0.44	0.34	0.47	0.82	0.00	0.27	0.87	0.81	0.37	0.32	0.32	0.90	0.32	0.97	0.20	0.32
12	0.10	0.41	0.34	0.58	0.14	0.10	0.11	0.61	0.24	0.20	0.14	0.17	0.27	0.18	0.18	0.76	0.29	0.54	0.45	0.17	0.12
13	0.38	0.44		0.89	0.76	0.99	0.42	1.00	0.50	0.00	1.00	1.00	0.98	1.00	0.74	0.99	0.47	1.00	0.42	0.82	0.52
14	0.44	0.84		0.47	0.36	0.49	0.36	0.99	1.00	1.00	0.67	0.87	0.39	0.50	0.48	0.39	0.34	0.26	0.52	0.74	0.52
15	0.15	0.48	0.54	0.41	0.16	0.41	0.57	0.99	0.31	0.34	0.26	0.18	0.27	0.98	0.13	0.22	0.70	0.94	0.24	0.43	0.53
16	0.23	0.91	1.00	0.66	0.49	0.92	0.28	1.00	0.80		0.68	1.00	0.49	1.00	0.17	0.41		0.98	1.00	0.59	0.36
17	0.29	0.92	0.51	0.68	0.15	0.24	0.31	0.74	0.62	1.00	0.20	0.28	0.28	0.33	0.60	0.23	0.71	0.66	0.88	0.45	0.29
18	0.35	0.80	1.00	0.50	0.46	1.00	0.93	0.51	1.00	1.00	0.45	0.77	0.40	0.68	0.30	0.35	0.41	0.88	0.44	1.00	0.76
19	0.11	0.48	0.47	0.57	0.21	0.30	0.24	0.49	0.59	0.81	0.19	0.25	0.42	0.95	0.25	0.29	0.93	0.38	0.54	0.39	0.36
20	0.15	0.55	1.00	0.48	0.30		0.34	0.64	1.00	1.00	1.00	0.50	0.50	0.98	0.19	0.37	0.37	0.68	0.91	0.47	0.37
21	0.49	0.61		0.66	0.28		0.84	0.39	0.51	1.00	0.56	0.97	0.34	1.00	0.16	0.37		1.00	0.36	0.64	0.50
22	0.38	0.49		0.69	0.40	1.00	0.61	0.38	0.44	1.00	0.99	0.48	0.74	0.91	0.81	0.26	1.00	0.86	0.53	0.48	0.45
23	0.07	0.36	0.17	0.55	0.15	0.21	0.18	0.13	0.38	0.19	0.15	0.19	0.08	0.46	0.26	0.29	0.66	0.14	0.17	0.35	0.26
24	0.53	0.69	0.62	0.49	0.26	0.44	0.22	0.91	1.00	1.00	0.29	0.42	0.48	1.00	0.57	0.45		0.91	0.77	0.38	0.31
25	0.29	0.50	0.47	0.62	0.14		0.38	1.00	0.50			0.51	0.66		0.29	0.34		1.00		0.57	0.35
26	0.30	0.51	1.00	0.80	0.30	1.00	0.41	0.81	1.00	0.00		0.34	0.33	1.00	0.83	0.64	1.00	0.67	0.52	1.00	0.87
27	0.19	0.42	0.55	0.30	0.27	0.36	0.43	0.36	0.90	1.00	0.59	0.80	0.25	1.00	0.05	0.33		0.84	0.51	0.67	0.60
28	0.51	0.84	1.00	0.35	0.80	0.78	0.37	0.95	0.59		0.56	0.69	0.29	0.85	0.20	0.29		1.00	1.00	0.50	0.36
29	0.61	0.95	1.00	0.41	0.12	0.31	0.11	0.44	0.32	0.00	0.91	0.38	0.47	0.49	0.16	0.83		0.25	0.40	0.16	0.54
30	0.61	0.97	1.00	0.75	0.30	0.47	0.39	0.75	0.45	0.00	0.24	0.86	0.29	0.44	0.42	0.36	1.00	0.33	0.33	0.93	0.39
31	0.20	0.85		0.99	0.76	1.00	0.80	0.95	1.00		1.00	0.50	0.50		0.33	0.92	0.99	0.52	0.86	0.72	0.90
32	0.35	0.44		0.81	0.38	0.44	0.19	0.64	0.42	0.00	0.51	1.00	0.25		0.38	0.55		1.00	1.00	0.31	0.54
33	0.11	0.30	0.33	0.37	0.10	0.75	0.32	0.29	0.40	0.48	0.31	0.34	0.31	0.54	0.16	0.26	0.58	0.39	0.81	0.27	0.68
34	0.38	0.48		0.56	0.23	0.31	0.46	0.86	0.59		0.94	1.00	0.48	0.61	0.36	0.50		1.00		0.65	0.24
35	0.18	0.98	0.73	0.34	0.76	1.00	0.81	0.88	0.91	0.55	0.17	0.17	0.45	0.38	0.41	0.28	0.74	0.20	0.16	0.36	0.40
36	0.45	0.54		0.90	0.38	1.00	0.39	0.69	0.74	1.00	0.94	0.63	0.54	0.36	0.42	0.30	0.27	0.49	0.46	0.99	0.45
37	0.30	0.49		1.00	0.91	0.49	0.32		1.00		0.88	1.00	0.16		0.30	0.82				0.52	0.50
38	0.17	0.48	0.33	0.44	0.81	0.79	0.20	0.62	0.68	1.00	0.49	0.85	0.68	0.23	0.21	0.43	0.42	0.82	0.16	0.23	0.74
39	0.19	0.87	0.78	1.00	0.47	0.98	0.30	0.99	0.61	0.00	0.62	0.31	0.53	0.78	0.17	0.37	1.00	0.39	0.51	0.55	0.30
40	0.82	0.50	0.55	0.29	0.50	0.52	0.38	0.84	0.99	1.00	0.88	0.43	0.23	0.71	0.30	0.28		1.00		0.53	0.33
41	0.37	0.38		0.39	0.69	0.53	0.37	0.31	0.34	0.99	0.17	0.84	0.36	1.00	0.36	0.36	1.00	0.94	1.00	0.24	0.20
42	0.52	0.86		1.00	0.44	1.00	0.23	0.90	0.51		0.71	1.00	0.98		0.21	0.47		1.00		0.84	0.52
43	0.74	0.93	0.53	0.49	0.28	0.34	0.56	0.56	1.00	0.00	0.41	0.93	0.85	1.00	0.40	0.80	1.00	1.00	0.96	1.00	0.29
44	0.19	0.50	1.00	0.87	0.50		0.70		1.00		1.00		1.00		0.53	1.00				1.00	0.33
45	0.49	0.44	0.70	0.43	0.35	0.37	0.36	0.97	1.00	0.00	0.93	0.50	0.83		0.23	0.93		1.00	0.36	0.37	0.25
46	1.00						1.00								1.00						
47	0.28	0.45	0.54	0.75	0.19	0.60	0.32	0.50	0.78	1.00	0.19	0.21	0.24	0.46	0.18	0.21	0.26	0.19	0.37	0.46	0.37
48	0.19	0.47	0.26	0.45	0.18	0.25	0.45	0.43	0.81	0.77	0.18	0.13	0.42	0.46	0.55	0.39	0.61	0.58	0.61	0.52	0.40
49	0.84	0.45		0.75	0.30	1.00	0.20	1.00	0.32	1.00	0.45	0.95	0.59	1.00	0.24	0.47			0.78	0.44	0.62
50	0.22	0.73	0.36	0.74	0.28	1.00	0.33		0.50		0.45	0.85	0.17		0.15	0.38		1.00	0.51	0.34	0.29
51	0.07	0.59	0.03	0.14	0.03	0.07	0.13	0.06	0.09	0.24	0.03	0.05	0.08	0.12	0.06	0.04	0.35	0.09	0.38	0.17	0.06
52	0.24	0.73	1.00	0.38	0.21	0.46	0.24	0.35	0.41	1.00	0.45	0.42	0.43	0.60	0.81	0.94	1.00	0.58	0.35	0.78	0.23
53	0.31	1.00		0.61	0.29	1.00	0.44	0.65	1.00	1.00	1.00	0.34	0.62	1.00	0.34	0.44		0.51	0.42	0.35	0.65
54	0.81	0.98		0.43	0.32	0.57	0.54	0.79	0.70		0.91	0.78	0.49	0.98	0.92	0.24	1.00	0.92	0.30	0.30	0.18
55	0.79	0.91	1.00	0.41	0.14	0.99	0.91	0.80	0.51	0.00	0.51	1.00	0.72	1.00	0.23	0.50		0.92	1.00	0.27	0.30

	2008																					
Metropolitan area	311	312	313	314	315	316	321	322	323	324	325	326	327	331	332	333	334	335	336	337	339
1	0.45	0.35	0.78	0.37	0.18	0.34	0.24	0.86	0.54		0.50	0.38	0.72		0.30	0.54		0.51	0.61	0.70	0.23
2	0.36	0.29		0.50	0.88	1.00	0.36	0.68	0.78			1.00	0.21		0.32	1.00			1.00	0.34	0.43
3	0.24	0.40	0.31	0.49	0.26	0.47	0.42	0.58	0.62	1.00	0.20	0.31	0.56	0.51	0.24	0.50	0.66	0.56	0.44	0.62	0.45
4	0.41	0.79	1.00	0.37	0.49	0.37	0.31	0.94	0.89	1.00	0.47	0.61	0.60	1.00	0.25	0.57		0.38	1.00	0.56	0.22
5	0.22	0.51	0.77	0.91	0.27	0.77	0.85	0.84	1.00	1.00	0.53	0.39	0.88	0.67	0.55	0.80		0.50	0.42	0.56	0.31
6	0.17	0.47	0.75	0.75	0.91	0.39	0.72	0.90	0.98		0.46	0.49	0.43	0.68	0.33	0.29	0.82	0.85	0.24	0.46	0.67
7	0.37	0.44		1.00	0.27	1.00	0.71	0.52	0.56	1.00	0.54	0.60	0.85		0.36	0.64	1.00	1.00	1.00	0.42	0.41
8	0.27	0.71	1.00	0.43	0.27	0.27	0.22	0.51	0.50		0.38	0.42	0.65	1.00	0.19	0.32		0.54	0.98	0.26	0.23
9	0.25	0.53	0.98	0.62	0.21	0.94	0.23	0.51	0.45		0.91	0.56	0.85	0.97	0.52	0.63		0.66	0.89	0.59	0.22
10	0.31	0.61	0.50	0.95	0.15	1.00	0.57	0.53	0.48	1.00	0.28	0.70	0.79	1.00	0.17	0.36	0.54	0.50	1.00	0.21	0.79
11	0.73	0.44	0.90	0.51	0.77	0.19	0.57	0.55	0.84		0.24	0.84	0.82	0.51	0.26	0.44	0.92	0.29	0.99	0.18	0.38
12	0.16	0.66	0.56	0.17	0.15	0.11	0.16	0.63	0.29	0.34	0.20	0.22	0.27	0.21	0.30	0.14	0.20	0.47	0.62	0.28	0.17
13	0.77	0.44		0.95	0.99	1.00	0.51	1.00	0.51		0.51	0.88	0.77	1.00	0.56	0.75	0.43	0.95	0.36	0.78	0.48
14	0.25	0.92	0.42	0.46	0.91	0.83	0.52	0.79	1.00	1.00	0.95	0.35	0.43	0.87	0.21	0.35	0.31	0.30	0.31	0.72	0.39
15	0.15	0.36	0.78	0.45	0.26	0.39	0.20	0.96	0.29	0.93	0.23	0.17	0.56	0.88	0.21	0.57	0.52	0.83	0.50	0.33	0.58
16	0.19	0.95	1.00	0.36	0.83	0.36	0.33		0.64		0.87	0.95	0.75		0.55	0.97		0.99	0.87	0.51	0.38
17	0.27	0.34	0.62	0.49	0.14	0.24	0.33	0.83	0.65	1.00	0.19	0.38	0.33	0.38	0.72	0.30	0.85	0.46	0.91	0.41	0.29
18	0.34	0.50		0.94	0.91	1.00	0.70	0.50	1.00	1.00	0.44	0.52	0.27	0.86	0.32	0.45	0.43	0.35	0.39	0.52	0.71
19	0.13	0.25	0.39	0.21	0.46	0.73	0.21	0.44	0.52	1.00	0.20	0.47	0.47	0.98	0.17	0.39	0.99	0.34	0.39	0.50	0.44
20	0.25	0.51	0.99	0.48	0.31	1.00	0.41	0.76	1.00	0.98	0.83	0.54	0.38	0.71	0.23	0.37	0.56	0.57	0.94	0.86	0.71
21	0.34	0.89		0.67	0.09	0.69	0.91	0.30	0.42	1.00	0.35	0.52	0.74	1.00	0.29	1.00	1.00	0.63	1.00	0.30	0.18
22	0.40	0.43		0.86	0.77	0.72	0.62	0.55	0.37	1.00	0.96	0.86	0.74	0.84	0.71	0.42		0.99	0.32	0.60	0.56
23	0.08	0.87	0.53	0.31	0.15	0.39	0.14	0.14	0.19	0.17	0.08	0.14	0.11	0.17	0.18	0.30	0.25	0.08	0.14	0.39	0.15
24	0.62	0.60	0.57	0.53	0.31	0.37	0.42	0.86	1.00	0.50	0.23	0.44	0.46	1.00	0.69	0.41		0.97	0.56	0.45	0.41
25	0.15	0.41	0.64	0.35	0.14		0.37	0.97	0.66		0.88	1.00	0.50	1.00	0.15	0.66	0.95	1.00		0.50	0.26
26	0.29	0.65		0.90	0.44	1.00	0.69	1.00	1.00		0.88	0.82	0.34	1.00	0.46	1.00	0.50	0.52	0.50	0.71	0.41
27	0.30	0.81	0.50	0.25	0.51	0.31	0.47	0.35	0.19		0.84	0.90	0.23		0.08	1.00	1.00	0.63	1.00	0.73	0.15
28	0.94	0.89	1.00	0.48	0.33	0.74	0.25	0.94	0.56		0.76	0.91	0.30	0.73	0.36	0.41		0.62		0.54	0.52
29	0.52	0.73	1.00	0.71	0.12	0.33	0.37	0.49	0.30		0.57	0.34	0.50	0.53	0.73	0.52		0.92	0.62	0.15	0.34
30	0.60	0.78	0.81	0.29	0.24	0.64	0.34	0.47	0.39	0.67	0.55	0.52	0.58	0.70	0.62	0.44	0.59	0.75	0.72	0.96	0.22
31	0.28	0.97		0.96	0.91		0.84	0.79	0.98			0.54	0.40		0.26	1.00	1.00	0.58	0.72	0.69	0.65
32	0.24	0.51		0.34	0.30	0.47	0.18	0.34	0.43		1.00	1.00	0.87	1.00	0.55	0.52		0.52	1.00	0.30	0.27
33	0.12	0.23	0.06	0.24	0.13	0.27	0.40	0.36	0.27	0.37	0.37	0.31	0.37	0.68	0.31	0.48	0.32	0.67	0.73	0.16	0.22
34	0.84	0.31	1.00	0.43	0.18	0.35	0.29	0.41	0.72		1.00	0.45	0.38		0.22	0.87				0.46	0.21
35	0.17	0.96	0.80	0.39	0.57	0.35	0.73	0.78	0.88	0.79	0.22	0.34	0.37	0.40	0.28	0.38	0.55	0.21	0.14	0.21	0.28
36	0.36	0.40		0.34	0.71	0.85	0.51	0.70	0.71		0.99	0.36	0.42		0.48	0.28	0.22	0.35	0.36	1.00	0.99
37	0.27	0.46		0.58	0.25	0.81	0.39	1.00	1.00		1.00	1.00	0.29		0.23	1.00				0.53	0.49
38	0.11	0.61	0.87	0.67	0.53	0.65	0.24	0.51	0.63	0.84	0.53	0.65	0.52	0.25	0.17	0.20	0.61	0.66	0.22	0.35	0.99
39	0.17	0.97	0.91	1.00	0.60	1.00	0.31	1.00	0.79	1.00	0.33	0.29	0.36	0.34	0.77	0.64	0.51	0.34	0.40	0.64	0.39
40	0.87	0.43	0.54	0.41	0.37	0.52	0.41	0.40	0.91		0.84	0.67	0.14	0.62	0.23	0.32		1.00	1.00	0.62	0.47
41	0.39	0.78	0.50	0.41	0.58	0.79	0.50	0.24	0.34	0.99	0.25	0.45	0.55	0.86	0.35	0.46		0.99	0.53	0.24	0.23
42	0.77	0.43	1.00	0.52	0.24	0.35	0.28	0.46	0.51		0.89	1.00	1.00		0.26	1.00			1.00	0.53	0.41
43	0.79	0.95	0.78	0.80	0.23	0.33	0.33	1.00	1.00		0.63	0.79	0.91		0.27	0.70		1.00	1.00	1.00	0.30
44	0.31	0.66		0.41	0.51	0.59	1.00	1.00	1.00		0.98	1.00	0.67		1.00					1.00	0.26
45	0.18	0.87	1.00	0.58	0.22	0.74	0.45	0.83	0.81	0.00	0.86	0.52	0.95		0.42	0.49	1.00	1.00	0.51	0.47	0.60
46	0.53	1.00			1.00																1.00
47	0.50	0.36	0.51	0.51	0.21	0.44	0.54	0.57	0.86	0.00	0.50	0.19	0.22	0.46	0.21	0.34	0.24	0.49	0.94	0.39	0.35
48	0.17	0.50	0.25	0.49	0.15	0.23	0.48	0.32	0.76	0.62	0.18	0.15	0.40	0.41	0.46	0.38	0.89	0.25	0.60	0.58	0.28
49	0.36	0.33	0.52	0.44	0.68		0.61	1.00	0.33	0.99	0.42	0.66	0.60		0.83	0.84			0.51	0.24	0.47
50	0.17	0.72	0.43	0.27	0.15	0.80	0.32		0.84		0.57	0.58	0.29		0.16	0.69		1.00	0.77	0.37	0.24
51	0.04	0.69	0.04	0.36	0.04	0.14	0.10	0.05	0.08	0.29	0.04	0.08	0.10	0.30	0.06	0.08	0.25	0.07	0.13	0.23	0.33
52	0.22	0.26	0.49	0.48	0.21	0.28	0.18	0.78	0.39	1.00	0.53	0.45	0.45	0.59	0.57	1.00	0.51	0.50	0.99	0.20	0.22
53	0.55	0.78	1.00	0.37	0.65	0.41	0.23	0.79	0.74	1.00	0.99	0.30	0.64	0.00	0.86	0.95		0.52	0.99	0.44	0.24
54	0.61	0.91	1.00	0.41	0.47	0.35	0.21	1.00	0.57	1.00	0.46	0.57	0.32	1.00	0.53	0.35		0.77	0.99	0.36	0.13
55	0.65	0.65	0.00	0.36	0.46	0.54	0.28	0.62	0.58		0.36	0.79	0.64	1.00	0.28	0.42		0.37	0.69	0.58	0.40

Source: Authors calculations bases on Economic Census

Annex 4. Total number of manufacturing companies by Economic Area Mexico

Economic area	1993	1998	2003	2008
1	1208	2049	1882	2619
2	302	375	398	448
3	2763	3028	2866	3525
6	826	1083	1021	1460
9	1029	1284	1359	1694
11	2198	2358	1785	2232
12	668	1227	939	1172
13	873	911	909	1149
14	714	957	998	1238
16	847	1133	1338	1748
20	11475	17252	15110	17405
21	400	466	476	756
25	2318	2803	2407	2255
26	3012	3561	2959	3372
28	458	619	645	779
29	5778	8865	6960	8811
30	701	912	920	1269
31	3463	3150	2959	3907
32	1058	1904	1089	1778
33	512	792	906	1040
34	686	838	760	1198
35	8783	11734	9416	10861
37	861	1858	1329	2153
38	497	760	743	628
39	2005	3701	3015	4151
40	551	711	770	813
41	921	1637	1301	1586
42	1020	1382	1230	2007
43	269	281	295	421
44	1524	1543	1407	1454
45	9337	11975	10407	14311
46	441	607	600	836
47	1741	2302	2252	3186
48	922	1186	1226	1724
49	321	469	411	452
50	2784	3934	3072	4072
53	704	1233	932	1558
55	1746	2011	1867	2298
56	601	466	518	566
57	1275	1477	1374	2025
58	221	282	348	439
59	1023	1331	1211	1697
61	17	14	5	11
62	2242	2689	2477	2853
64	2742	4705	4843	8077
65	460	645	748	970
66	614	886	791	987
68	47185	58528	53537	64378
69	1533	2545	1688	1889
70	1119	1566	1513	1667
71	1534	2114	1966	2338
72	698	894	760	1121

Source: Authors calculations bases on Economic Census