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THE ROLE OF TRANSPORT COSTS AND TRADE LIBERALISATION IN TERRITORIAL COMPETITIVENESS

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ABSTRACT

It is argued that globalisation has exacerbated the need of local and regional territories to compete in order to attract and retain productive investment and resources that will help to increase living standards and development. Indeed the emphasis on regional competitiveness has gradually expanded in strength and scope parallel to the globalisation debate. On the other hand, regional development also depends on other crucial factors such as institutional structures and economic policies. Of these trade policies are highly relevant as they are guided to a good extent by globalising tendencies. Transport and trade costs are reaffirmed as one essential dimension of competitiveness that also is greatly related to economic globalisation. This paper assesses the significance of transport costs and trade liberalisation on the distribution of economic activity across Mexican regions. We employ data on GDP at the state level in an examination of regional densities and shares. Then these indicators of revealed competitiveness are employed as dependent variables in a reduced form model where proxies for trade costs and liberalisation are the explanatory variables. The econometric test provides evidence on the role of interregional differences of transport costs, import access and FDI to foster agglomeration of economic activity in a region. Additionally we look for support for the argument that trade brings increasing agglomeration of economic activity in countries with poor infrastructure and high internal transport costs compared to industrialised economies, as in the case of Mexico. Poor transport infrastructure, long transportation times, inefficiencies, etc. create significant costs which affect the ability of producers and consumers to access regional and international markets effectively and efficiently. Therefore analysis of the role played by transport costs in the development of regional competitive capacities is fundamental.

Key words: Trade costs, Regional disparities, Competitiveness, Mexican manufacturing.

Introduction

Economic activities and territories in all latitudes undergo transformations and adjustments facing new and changing scenarios. Globalisation is the all embracing term that captures most of the changes happening internationally. It engenders competition processes through mechanism such as international trade and Foreign Direct Investment. Firms compete for surviving and gaining market shares –locally and internationally. But also territories compete to attract and retain investment and mobile productive resources -typically Foreign Direct Investment- in addition to dominate relevant markets. Therefore economic globalisation is said to have had an impact on the sectoral and spatial allocation of the economy and on the performance of industries and regions.

Regions, localities and sub-national economic spaces in general often have to establish strategies oriented to deal with the changing forms of globalisation and to reach national or international competitiveness. It has become commonplace that local actors concern about providing the conditions that make their countries, regions or cities more attractive for productive activities. Territorial competition is a phenomenon that involves those actions oriented to increase the attractiveness of territories in response to actions of the same character that are undertaken in other regions. The results of such competition among regions are referred to as the competitiveness of that region. Processes of territorial competition has among their outcomes the allocation/reallocation of economic activities in space as it can affect where economic activities choose to locate and the extent to which economic activity is agglomerated in those places. In consequence competition can result in a polarised spatial structure of the economy and increasing regional disparities. From many perspectives regional competitiveness is significantly related to transaction costs associated with national and international trade. External trade costs are modified by global integration through improving accessibility to export markets and imports. Internal transport costs, on the other hand, are a component which has a local nature and is susceptible of managing at the local level, probably through actions of territorial competition.

The present document has as an objective to analyse the relevance of trade and transport costs for the competitiveness of regions. Particularly, the paper is concerned with the effect of territorial competition on the spatial structure of national economies from the point of view of location and agglomeration. A winning region, in this case, is such that it concentrates economic activity meaning that such region is attracting, retaining or creating productive

activity. Thus competitiveness is reflected in the extent of geographically localized economic activity.

The paper is organised as follows: in the first section the theoretical framework of the analysis is outlined. Then some stylised facts about the geographic distribution of Mexican manufacturing activity and transport costs are described. Part four introduces an empirical model for evaluating the relationship between the spatial structure of a national economy and transport costs. There the model is specified and estimated, and results are discussed. The final section concludes.

1. Globalisation, Transport Costs and the Geographic Distribution of Economic Activity

There is vast literature addressing the theorisation of competitiveness and attending the question of what are the factors or sources of economic success of territories. Martin (NA) states that despite the various theoretical approaches they often lack a territorial dimension that is so crucial for understanding regional competitiveness. Nonetheless the New Economic Geography (NEG) and regional economics, where regions are seen as sources of increasing returns, are two obvious basis of explanation for competitiveness with a territorial character. These streams of theory attempt to explain regional competitiveness using the geographical concentration approach in which concentration of economic activity in a territory is an indicator of competitiveness and where agglomeration effects, transport costs, economies of scale and specialisation are relevant attributes for explaining regional performance.

The NEG offers a framework for understanding competitiveness considering potential impacts on growth, development as well as spatial equity. Furthermore it gives a theoretical support for policy evaluation (Potter, 2009). In addition, it offers insights on the impact of economic globalisation on the economic performance of regions because it is concerned with the effects of international trade on regional development. In the NEG external economies in the form of pecuniary externalities underpin the relative competitiveness of the constituent firms within the regional agglomerations (Pike et al, 2006). In this approach regional accessibility emerges as a natural source of regional competitiveness because regions with better accessibility to internal and external markets will attract more footloose investment and have above average performance. The importance of transport related cost and infrastructure for improving the competitiveness and the accessibility of regions is widely recognised from many other perspectives. For Lengyel (2004) regional accessibility, which involves transportation infrastructure (airports, trains, motorways, ports, etc.) and communications

(traditional media, internet, data transfer, etc.), is one of the success determinants or necessary conditions for competitiveness which have an indirect impact on ex post indicators of competitiveness because they take shape over a longer period of time. Senn (1995) states that specific locational factors such as production inputs, infrastructures, services, etc. are necessary for economic success of regions. Malecki (2006) points out that urban and regional competitiveness is inherently multidimensional, including traditional factors of production, infrastructure and location. Kresl and Balwant (1999) argue for what they call 'economic' determinants of competitiveness among of which are factors of production, infrastructure and economic structure. Bozzi (1995) reckons that among the key elements in the territorial structure which must be considered to assess the quality of the local environment infrastructure that affects transportation and telecommunications services.

Indeed, networks and transport systems have a crucial role to play in terms of assisting regional economic development. Regions with better access to markets are likely to be more productive and more competitive than others. The objective for regions is, in this sense, to improve the quantity and quality of the transport systems and transport infrastructure in general which will reduce the cost of accessing inputs and consumer markets. One should also keep in mind that the problematic of transport infrastructure is not only a regional problematic but also an intra-regional, national and international (Sepic,). Similarly a body of literature has been developed within NEG in order to explain the impact of economic globalisation on the relationship between transport costs and the distribution of economic activity. In other words, they have researched the effects of transport costs on regional disparities in a context of increasing globalisation.

On the one hand, the effect of trade reforms and liberalisation on the geography of production has been discussed. Given that liberalisation removed many barriers to international trade that imposed high costs of transaction, some early literature considered that improved access to export markets was a key factor in determining industrial relocation. Hanson (1998) and Krugman and Livas (1996), for instance, tested the effects of export market access on industrial location and wages in Mexico. They concluded that abstracting from the influence of other forces, relocation towards regions that enjoy better access to international markets is promoted by trade liberalisation and integration. However the export access argument is valid to some extent because trade liberalisation, by reducing external trade costs, has a twofold-effect. Not only did export opportunities increase, but also imported products became more accessible. That is, import competition as well as export access matter in localisation

decisions. Therefore relocation processes originated by better access to external markets might be counteracted or slowed down by foreign competition. Accordingly, large changes in location or agglomeration might not be triggered when import competition is severe in regions with better external access (Crozet and Koenig-Soubeyran, 2002; Behrens, 2003; Behrens et al., 2003; Overman and Winters, 2003).

On the other hand, domestic transport cost is another aspect of trade costs that can influence the geography of manufacturing. Trade costs include the cost of physically carrying goods from one place to another. These are transport costs associated with the friction of distance and the state of infrastructure. This is a component that has regained relevance with liberalisation and integration. When the economy is opened to international trade by reducing tariffs and other trade barriers, transport costs from one local site of production to the final markets (domestic or international) also have an impact on the location of firms (Behrens, 2003; Behrens et al., 2003).

According to Behrens (2003) and Behrens et al. (2003) the interplay of internal and external trade costs are crucial to explain geographic patterns of economic activity. However the effect of the opening up to trade differs across countries depending on their degree of internal integration and the quality of their transport infrastructures. They predict that with trade liberalisation increasing and persistent regional disparities will be observed in countries with high internal transport costs and low volume of interregional trade – generally considered as the situation prevalent in developing economies. In contrast, a more balanced regional structure will be observed in countries with low internal transport costs and a high volume of interregional trade -which is supposedly the case of developed economies. In developing economies, economic integration and liberalisation magnifies the large-market effect. When interregional trade costs remain high, local firms care more about market size, which strengthens the incentives for agglomerating in a few regions. The decrease in international trade costs brought about by trade liberalisations has a direct impact on local prices because the number of products available increase and because there are lower trade costs for imported products. Trade liberalisation exacerbates price competition within the national economies whereas price competition in turn increases the relative weight of interregional transport costs in local consumer prices.

In contrast to most models of GE, which rely on a multiplicative form of transport costs equivalent to an ad-valorem tariff (the so called iceberg costs), Behrens et al. (2003) distinguish between tariff and non-tariff components of external trade costs. International

transaction costs involve the cost of transporting goods from a sub-national region to the international market, meaning that internal transport cost are a component of external transaction costs. In this respect Behrens (2003) points out that interregional integration within developing countries, by improving infrastructures and unifying local markets, is a necessary condition for subsequent international integration to lead to a more balanced regional development. For the upgrading in the competitive position of regions improvement in transport infrastructure along with the unification of local markets are necessary conditions meaning that efficient, low-cost transportation is vital for regional development whereas the lack of transport infrastructure is a basic constraining factor.

These conclusions are supported by the findings in Crozet and Koenig-Soubeyran (2002) where trade liberalisation, by exacerbating the tendency of economic activity to concentrate, is more likely to increase regional disparities. In their model the actual cost of a transaction from any domestic region to foreign markets is related not only to an ad-valorem tariff but also to a tariff imposed by distance and therefore internal transportation costs matter as well as international trade costs. As a consequence of trade liberalisation, the agglomeration and dispersion forces are affected. Domestic demand, relative costs and competition externalities are influenced by the presence of foreign demand and supply. Lowering international transaction costs means that domestic firms have better access to foreign markets and that the domestic market represents a smaller share of their sales. Accordingly, the firms' incentives to locate near domestic consumers are relatively less significant. On the other hand, foreign products increase their participation in total supply and competition exacerbates. This lowers the need of national firms to locate far from each other, given that foreign products might exert larger pressure than other domestic firms (weaker dispersion forces). In other words, agglomeration and dispersion forces are weakened by trade liberalisation and economic integration via exports and imports.

Crozet and Koenig-Soubeyran show that in a country where all regions have the same access (in terms of distance) to the foreign markets economic integration is more likely to lead the domestic industrial sector to be spatially concentrated in the region that had taken an initial advantage. In contrast, in a heterogeneous country there is a pull effect in which national firms tend to locate towards the border region to benefit from the better access to foreign demand. On the other hand, foreign supply causes a push effect in which domestic firms tend to locate in remote regions in order to be as far as possible from their foreign competitors. With an initial decrease in external trade costs the push effect tends to dominate

the pull effect, leading to partial agglomeration in the remote region. If external trade costs are lowered further, the demand effect dominates over the competition effect and economic activity is again attracted to the border region. The final outcome is shaped by the interplay of the amount of foreign demand and the degree of competition from foreign firms. If foreign demand is big then production will locate in low-cost access regions, but if the presence of foreign firms in the local market is larger than domestic firms this will favour location towards remote regions. Hence the exact impact of trade liberalisation is hard to quantify due to endogenous local factors which develop independently of globalisation, such as competitive strategies oriented to the improvement of local performance.

With the regard to the effect of liberalisation on the spatial distribution of economic activity Overman and Winters (2003) also establish that is the interplay between both, import competition and export access, which define the internal economic geography in countries that liberalise their economies. Trade liberalisation brings an increase not only in export market access and imported intermediate goods but also in market competition from final imports. Import competition may cause firms located in a region bordering a commercial partner to be out-competed or cause them to relocate in a different country. Non-border regions are partly protected from increased competition due to higher transport costs between them and the country's trading partners.

2. The Geographic Distribution of Mexican Manufacturing

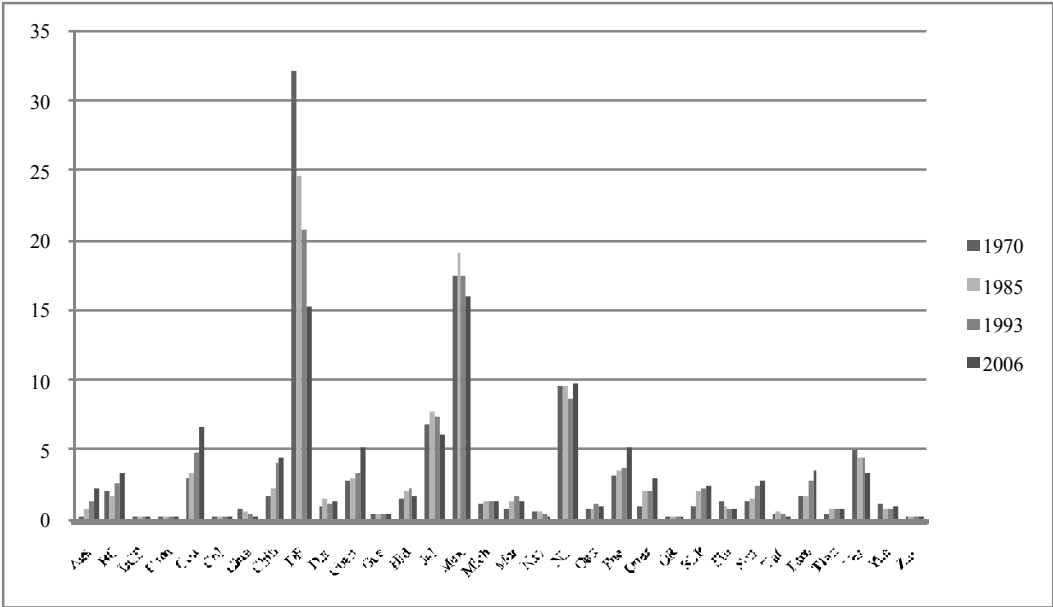
The wide differences in the economic performance of Mexican states have been largely documented. The economic dominance of Distrito Federal, the administrative geographic unit where Mexico's capital city is, followed by a few other states -Estado de Mexico, Jalisco and Nuevo Leon- is what typically characterised the economic geography of the country during the closed-economy strategy of development performed between the 1950s and 1970s. In 1970 Distrito Federal accounted for more than 32 percent of manufacturing GDP, whereas together with Jalisco, Estado de Mexico and Nuevo Leon contributed with more than 66 percent. This is a striking fact given that these regions comprise only 12 percent of the country's territory. At the beginning of the 1980s this picture had not changed much as there was only a minor decrease in these regions' participation (Sanchez-Reaza and Jordaan, 2002; Sanchez-Reaza and Jordaan, 2004).

For almost three decades now the Mexican economy has moved from an inward-looking strategy of industrialisation and development towards an increasingly open economy. Largely,

it was expected that far-reaching restructuring policies were beneficial in terms of regional equity and spatial development under the premise that formerly backward regions were going to gain from the opening of the economy, the result being a more homogeneous and a less fragmented geography of production. However there is evidence that spatial development has been limited to and localised in specific locations in the country.

When evaluating the spatial pattern of production in Mexico Trejo (2010) finds a long-run process of geographic relocation of manufacturing GDP from the traditionally industrialised states. States with maquiladora operations at the US border were the initial beneficiaries of the geographic decentralisation of manufacturing in the 1960s. However states in the Bajío region, which is a corridor that expands between Mexico City and the north, have been other recipients of manufacturing and have had the largest upward changes in GDP shares in the last 20 years (figure 1). In contrast, the states in the South and Yucatan Peninsula have had continual decreases in their shares. Little variation of agglomeration levels, sustained predominance of Distrito Federal and increasing polarisation are found. Mexican manufacturing has been geographically reorganised among a limited number of states, whereas imbalances with other states remain. Some geographic dispersion of manufacturing was happening even before trade liberalisation. The generalised programme of export promotion and liberalisation that started in the early 1980s did not give rise to relocation of manufacturing or the relative increase in the importance of northern states bordering the US but enhanced a process already in progress.

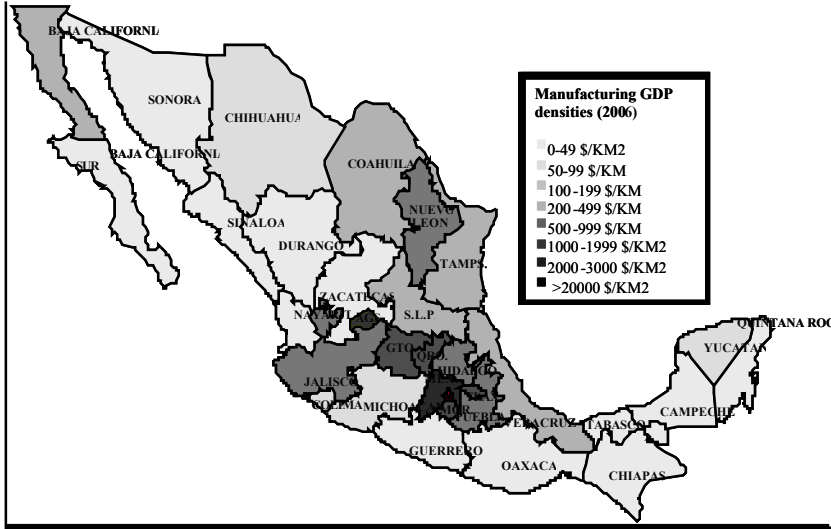
Figure 1. Regional shares in manufacturing GDP in selected years (%)



Source: INEGI

Regional differences are also manifest when allowing for regional sizes since GDP densities vary significantly from state to state. Between 1993 and 2006 manufacturing GDP became more geographically dense in the traditional manufacturing hubs of Distrito Federal and Estado de Mexico, and densities also increased significantly in the Bajío. Distrito Federal, Estado de Mexico, Morelos and Aguascalientes had the biggest production densities throughout the period 1993–2006. The ten most crowded states are located mainly in the centre of the country and in the Bajío, with the exception of Nuevo Leon which is in the north but has been part of the traditional industrial hubs. The states at the US border have medium levels of GDP densities, whereas the south has mostly low-density (map 1).

Map 1. Manufacturing GDP densities, 2006



Source: Own calculations

Seemingly economic reforms were a contributing factor for location shifts but had a limited impact in reducing agglomeration. There is the need to understand how key parameters of the economic environment, many of which are associated with regional competition and policy possibly affect regional imbalances.

3. Transport costs and infrastructure in Mexico

In Mexico, there is a concentrated transport structure which is highly dependent on roads. In 2003 the network consisted of approximately 349 thousand kilometres of roads of various types. Federal roads are used in the majority of freight movement for foreign trade and the more dynamic economic sectors. In 2000 the material condition of the federal road network was considered for the most part bad, with only 25 percent of roads in good conditions. (Subcomité Sectorial de Desarrollo Económico y Empleo. Gobierno del Estado de México). Fourteen principal arterial roads linking the main cities, borders and ports are identified.

According to the Sectoral Programme of Transport and Communications, 2001-2006, in 2002 this network comprised more than 19 thousand kilometres covering approximately 54 percent of all interregional flows.

At the same time while some regions benefit from the existence of modern transport systems and good connectivity, others are marginalised due to the inadequacy and lack of transportation systems. This fact imposes important barriers to external and internal trade by preventing cohesion and integration among Mexican states. By looking at the total endowment of roads across states one finds that, for instance, Chiapas and Guerrero, which are considered backward states, have approximately the same number and length of roads as Estado de Mexico, one of the advanced states. However, the majority of roads in the two former states are rural or minor roads, while the majority of those in Estado de Mexico have two, four or more lanes. Therefore the mere existence of roads within a region does not give a good parameter by which to assess their condition with respect to that of other states.

Interregional differences in transport costs are to a great extent attributed to this lack of uniformity in road infrastructure, but even more to the lack of connections between broad zones of the country. The road system in Mexico particularly links the capital city with the north border, creating a limited and centralised configuration. The top Mexican domestic freight area pairs by mode show that the bulk of transit flows usually passes through or departs from Mexico City or the main industrial sites, while few or none include southern regions (North American Transportation in Figures, 2000). International trade concentrates at three crossing points at Mexico's northern border (Nuevo Laredo, Ciudad Juárez and Tijuana) which can be reached by three of the main arterial roads (Mexico-Nogales/Tijuana, Mexico-Nuevo Laredo and Querétaro-Ciudad Juárez) whereas internal flows use approximately the same routes as those for international trade.

Unlike road transportation, other modes of transport have been largely abandoned. Up to 1994, the railway system, administered by a public enterprise, was characterised by a low-quality service, obsolete equipment, high rates of robbery, limited number of routes, high cost and low productivity. It suffered from a long-run tendency to decreasing market participation, the infrastructure did not expand, new routes were not created for at least the previous 22 years and there were insufficient resources for modernisation of the existing infrastructure. A restructuring process began in 1995, when railways were privatised and 80 percent of the 26 thousand kilometres of main network was given to six private companies. Thus far, however,

the railway system has not been integrated into a multimodal structure to contribute to the dynamism of commercial flows and the strengthening of national competitiveness.

As a result of global tendencies air transportation has become strategic to competitiveness and to improving international integration. Although Mexico has no internal water transport routes, the country is mostly surrounded by ocean and so, ports are fundamental to international trade for the transport of huge volumes of goods. In Mexico this mode had a reorganisation in the 1990s which consisted in the opening up the sector to private investment and allowing infrastructure improvement and capacity expansion. As with other modes, ports were operated by the federal government a fact that affected its efficiency; declining quality and productivity emerged as prices and tariffs were subsidised. Restructuring was necessary in order to increase capacity, enhance productivity and reduce costs. Between 1995 and 2000 new commercial ports were built and the movement of containers increased.

The deficiencies in Mexico's transport system are particularly evident when compared to international standards. Even though Mexico has a relatively better position in the rank of road infrastructure compared to other modes (Table 1), the infrastructure of developed countries such as Canada, the US, France and the UK is evidently higher (Table 2). This goes in line with Berhens (2003) idea that there is a relative difference between countries such as Mexico and those with higher levels of development when affirming that poorer internal infrastructure of developing countries drives up interregional trade costs to greater levels than those of advanced economies.

Table 1. International Ranking: Competitiveness in Transport Infrastructure

| Country | Total | Roads | Railway | Air Transport | Ports |
|----------------|-----------|-----------|-----------|---------------|-----------|
| Argentina | 46 | 22 | 43 | 38 | 44 |
| Brazil | 42 | 51 | 51 | 58 | 48 |
| Canada | 12 | 6 | 10 | 7 | 7 |
| Chile | 45 | 42 | 55 | 45 | 42 |
| United States | 9 | 3 | 23 | 12 | 4 |
| Spain | 21 | 7 | 13 | 20 | 27 |
| France | 4 | 2 | 1 | 6 | 11 |
| Italy | 41 | 30 | 22 | 34 | 21 |
| Mexico | 54 | 25 | 49 | 55 | 52 |
| United Kingdom | 18 | 17 | 28 | 17 | 14 |
| Singapore | 2 | 40 | 15 | 1 | 20 |
| Taiwán | 25 | 64 | 18 | 26 | 13 |

Source: Ministry of Transports and Communications, SCT.

Table 2. Comparison of International Road Density (km of road per km² of territory)

| Mexico | US | Canada | France | Germany | Italy | Japan | United Kingdom |
|--------|------|--------|--------|---------|-------|-------|----------------|
| 0.14 | 0.64 | 0.1 | 1.62 | 1.77 | 1.04 | 3.04 | 1.61 |

Source: Mexican ministry of Transports and Communications

Apart from Mexico's poor infrastructure and its concentrated system, various other aspects have an effect on the competitiveness of its transport costs. The high price of fuel, high financial costs, fleet obsolescence, lack of vehicle maintenance, illegal importation of used vehicles, irregular operation of freight companies, uncertainty in the regulatory environment and so forth, increase average costs albeit the wages paid to vehicle operators are lower than in other countries.

4. An Empirical Model: Specification, Variables and Estimation

In this paper the link between internal and external trade costs and the spatial structure of national economies are the analytical relationships to be assessed empirically. Regions that have higher transport costs and those with higher import competition on final products are expected to be less competitive and hence attract less industry. This hypothesis is assessed empirically through econometric analysis of a reduced form equation that explains the interregional differences in the level of economic activity, which in this case is a measure of revealed competitiveness. The specification is based on the theoretical predictions derived in Crozet and Koenig-Soubeyran (2002), and Behrens (2003) as well as on the empirical study by Overman and Winters (2003). The general form is given by equation 1.

$$(1) AG = a + b \text{ TrCosts} + c \text{ DE} + e \text{ Cmef} + (\dots) + e$$

Broadly speaking Equation 1 relates AG, a measure of the amount of economic activity, to proxies for trade costs (TrCosts), demand externalities (DE) and competition effects (Cmef) which are regional attributes, while controlling for other possible sources of agglomeration. The general form is expressed more explicitly in equation 2 where FDI is included as the control variable.

$$(2): AG = a + b \text{ TrC1} + c \text{ TrC2} + d \text{ Exp} + e \text{ Imp} + f \text{ FDI}$$

For Equation 2 to become an estimable equation we add an error term and the parameters to be estimated:

$$(3): AG_{it} = \beta_0 + \beta_1 \text{ TrC1}_{it} + \beta_2 \text{ TrC2}_{it} + \beta_3 \text{ Exp}_{it} + \beta_4 \text{ Imp}_{it} + \beta_5 \text{ FDI}_{it} + e_{it}$$

Where:

AG_{it} = A measure of the amount of economic activity in region i at time t

$TrC1_{it}$ = Cost of transporting products from the region i to the country's capital city at time t associated with the friction of distance

$TrC2_{it}$ = Cost of transporting products from the region i to country's capital city at time t linked to the transport infrastructure

Exp_{it} = A measurement of exports in region i at time t

Imp_{it} = A measurement of import competition in region i at time t

FDI_{it} = A measurement of FDI in region i at time t

e_{it} = An error measurement

β_{it} = Parameters to be estimated

In order to measure interregional disparities in the level of economic activity Berhrens (2003) suggests two proxies regional shares and densities in GDP or employment. Combes and Overman (2003) stress that regional shares give an informative and complete account of agglomeration and location by providing a description of the complete distribution. We employ regional shares and densities of manufacturing GDP as dependent variables to carry out this analysis. On the other hand, Behrens (2003) suggests that transport infrastructure is a good indicator for regional transport costs. Crozet and Koenig-Soubeyran (2002) suggest measuring interregional transport costs as a linear function of distance. We take both aspects into consideration. $TrC1$ accounts for the shortest distance by road from the corresponding state's capital city to the largest domestic market, which in this case is Mexico City. We expect that the coefficient on this variable will cause a negative effect on each state's share, accordingly $\beta_1 < 0$.

$$TrC1_i = Dis_{ij}$$

Dis_{ij} = Distance in kilometres from region i capital city to Mexico City.

i = Region's capital city

j = Mexico City

An additional measure of transport cost is given by $TrC2$ which is a measure of regions' density of roads with four or more lanes in each region. As any increase in the density of this infrastructure is expected to bring about a reduction in transportation costs and therefore

afford the region a relative advantage we anticipate a positive coefficient on this variable, $\beta_2 > 0$.

$$\text{TrC}_i = \text{RI}_i / \text{Km}_i^2$$

RI_i = Roads with 4 or more lanes in region i in kilometres

Km_i^2 = Region i surface area in square kilometres

Exp is a proxy for external market access and is measured as the share of exports in the state on total GDP. We expect the coefficient of the export variable β_3 to positively affect regional shares.

$$\text{Exp} = X_i / Y_i$$

Y_i = Total GDP in region i

X_i = Total exports in region i

Similarly, Imp measures the relative intensity of import competition which in this case is measure as an import penetration rate which shows to what degree the states' demand is satisfied by imports:

$$\text{Imp}_i = M_i / (Y_i - X_i + M_i)$$

Where,

Imp_i = Import penetration in region i

M_i = Total Imports in region i

This variable reflects the exposure to international competition. The data do not distinguish between intermediate and final imports and therefore we cannot directly test the effect of foreign competition in the form of final goods, but we assess whether the dispersing impact of final imports dominates the agglomerative effect of intermediate imports. Thus $\beta_4 < 0$ is expected if the effect of final imports dominates, otherwise $\beta_4 > 0$, indicating that the region is positively rather than adversely affected by accessibility to foreign products in the form of capital goods and intermediate inputs necessary for productive activities.

We also control for FDI, which we assume helps to shape the outcomes. This variable is simply the inflows of Foreign Direct Investment in the state taking into account the states' territorial size. We use FDI as a control variable that relates to economic globalisation. We regard this variable as promoting increases in regional economic activity, $\beta_5 > 0$.

$$FDID_i = FDI_i / Km2_i$$

FDI_i = FDI inflows into region i

We estimate Equation 3 for a cross-section data set for 2002 considering the thirty-two Mexican states. A set of two estimates is given, one which incorporates regional shares in manufacturing GDP and other with regional manufacturing GDP densities as dependent variables. Initial high multicollinearity among exports and imports was found possibly because import penetration is calculated having exports within the formula. When included simultaneously in equation 3 or in the absence of imports, exports are never statistically significant whereas imports were significant when exports were excluded of the equation. Due to this we got rid of exports in further estimations.

As the presence of heteroskedasticity is not rare in cross-section data in order to achieve well-founded and robust results we employ the heteroskedasticity-consistent standard errors and covariance estimation. This heteroskedasticity-robust procedure makes estimates applicable whether or not the errors have constant variance (Wooldridge, 2002). The equation with the regional shares in national manufacturing in the left hand side behaves best with the logarithmic transformation of the dependent variable. Thus it is a log-lin model, in which the coefficients measure the constant proportional or relative change of the dependent variable for a given absolute change in the value of the regressor. In other words, we have the semi-elasticity of the regressand with respect to the regressor (Gujarati, 2002). Alternatively, we assess the impact of the same set of independent variables on regional production densities (table 3).

When regressing the regional shares in manufacturing against the domestic distance, the infrastructure density, the import penetration and FDI density the model performs acceptably in terms of the statistical assumptions. It explains 53 percent of the variation in regional GDP shares. All variables are statistically significant to account for regional shares in manufacturing GDP with the exception of infrastructure density. As expected the distance from the regions' capital cities to the main domestic market has a negative impact on states shares in manufacturing activity as each unitary increase in this variable reduce the participation of a given state in manufacturing GDP. In contrast, all other variables contribute to increase regional shares in manufacturing.

Table 3. Heteroskedasticity-robust Regression Results, 2002.

| <i>Dep.Variable:</i> | <i>Regional shares in manufacturing GDP</i> | <i>Densities in manufacturing GDP</i> |
|--------------------------|---|---------------------------------------|
| Constant | -4.7585 (0.3356) | 3.7296 (0.3297) |
| Domestic Distance | -0.0007*** (0.0001) | -0.0008*** (0.0002) |
| Import penetration | 12.2785*** (2.1554) | 9.5988*** (2.5661) |
| Infrastructure Densities | 14.6151 (22.3586) | 80.1453*** (19.5584) |
| FDI Densities | 0.3963*** (0.1322) | 0.5887*** (0.1115) |
| Adjusted R ² | 0.53 | 0.77 |
| Number of observations | 32 | 32 |

Dependent variable in logarithms

Heteroskedasticity-consistent standard errors in parentheses

*** Statistical significance at 1% **Statistical significance at 5% *Statistical significance at 10 %

Thus regarding regional shares we find that:

1. Distance, import penetration, infrastructure densities and FDI densities altogether explain regional shares variation in 53 percent on average.
2. Distance, import penetration, and FDI densities are all statistically significant in explaining the regional variation of GDP shares.
3. The infrastructure density variable is not statistically significant in accounting for regional shares but appears with a positive sign.
5. As expected distance to relevant markets affect negatively regional shares in manufacturing while FDI densities enlarge manufacturing GDP shares.
6. Import penetration appears with a positive coefficient which indicating that the agglomerative effect of access to intermediate and capital goods imports dominates the dispersing impact of imports of final products.

The results for regional production densities indicate that:

1. The specified model explains, on average, almost 80 percent of regional variation of manufacturing GDP densities.

2. All regressors have high statistical significance to account for variations in the dependent variable.
3. Regional FDI densities, import penetration and infrastructure densities contribute to higher regional densities in manufacturing GDP.
4. Increasing distance from a region's capital city to the main national market affect negatively a region's value added densities.

When comparing the models with the two alternative measures of regional disparities we find that regional densities in manufacturing are explained better than regional shares with the proposed specification. The infrastructure densities variable, in particular, is statistically significant to account for variations among states' value added densities but it is not relevant to explain variation of manufacturing GDP regional shares.

We rely on the preceding estimates in order to evaluate the predictions from the underlying theoretical statements. By and large the effects of transport infrastructure, FDI and distance to markets are as expected since improvements to infrastructure and high FDI densities lead to larger regional shares in manufacturing GDP and manufacturing GDP densities while higher interregional distances negatively affect them causing increasing disparities among regions. The results on import penetration point towards a positive and significant effect on regional shares and production densities, which is an indication that the intermediate imports effect dominates the dispersing force of final imports competition. The estimated year is under the NAFTA period hence the particular importance of FDI and imports in accounting for the internal economic geography of countries.

Conclusions

Although with considerable restrictions especially due to data limitations and time span, the econometric testing of some of the forces at work driving regional disparities in manufacturing GDP and thus reflecting the relative competitive position of regions has shown that both internal conditions such as domestic transport costs and external shocks, i.e. imports and FDI, affect the evolution of the spatial landscape of manufacturing production. The econometric test provides evidence that, as predicted by Behrens (2003), interregional differences in transport costs have an important effect on regional disparities in a domestic economy. This supports the argument that trade brings increasing agglomeration of economic activity in countries with poor infrastructure and high internal transport costs, as in the case of Mexico compared with industrialised economies. Likewise the internal allocation of

manufacturing is likely to be affected by worldwide forces. Import competition and FDI are variables that can have an impact on how value added is distributed among the thirty-two Mexican regions. According to the data both variables seem to favour the location of GDP in regions with high import penetration and FDI, but these might be regions with an existing or initial agglomeration of manufacturing, in which case the spread of production is geographically constrained. The positive impact of imports on location might reflect either, the dominance of the pro-production effect of intermediate and capital goods imports on the dispersing action of the competition coming from foreign products or the quantitative supremacy of intermediates over final goods in the data employed.

Although one can certainly quantify some effects by econometric analysis, a full consideration of the outcomes would likewise need to search for assessment of some other kind, perhaps in a more qualitative manner. Therefore in light of the results a warning is obviously necessary: quantitative analysis in general, and econometrics in particular, are greatly restricted by the way in which proxies for the variables are constructed and the lack or limited availability of data to construct the indicators; additionally the reliability of information is somewhat narrow. Consequently any discussion of the results should be cautious and we acknowledge this important restriction to empirical quantitative work.

Results rely on existing data and depend heavily on assumptions and on which aspects of the phenomenon we look at. For instance we find difficult to make any clear prediction about the effect of imports basically because the data of final goods, capital goods and intermediate imports are not separated. The imports variable may not reflect competition in final goods but instead imports of foreign intermediates or capital goods; this failure to distinguish between types of imports restricts our knowledge of the results of foreign competition. Similarly, the results of agglomeration and location are based on a trade-off between data reliability and availability and methods. In addition, because of the different aspects that determine overall competitiveness, any analysis can only be partial.

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