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COMPETITIVENESS AND THE REGIONAL EFFICIENCY OF THE MEXICAN SERVICE SECTOR

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TERRITORIAL COMPETITIVENESS IN A GLOBALISED ECONOMY: REGIONAL EFFICIENCY OF THE MEXICAN SERVICE SECTOR

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ABSTRACT

The existence of a solid service sector and some degree of specialisation in tertiary activities are among a number of territorial diversity of factors which need to be taken into account in relation to the creation of competitive capacities. In addition globalisation has presumably played a significant role in the productive restructuring of economies in which the service sector has had an increasing quantitative and qualitative importance over the years. Therefore an evaluation of the role of services in constructing regional competitive capacities is required. This paper aims at addressing indirectly the meaning of services on improving competitiveness by providing a wide-ranging analysis of regional efficiency of the Mexican service sector and its determinants as well as an overview of its territorial distribution and specialisation patterns. We evaluate the patterns of concentration of the third sector and its branches, and specialisation of regions. The efficiency of the service sector in the period of NAFTA operation is analysed further because of the impact of services on regional competitiveness. We employ state level data to examine technical efficiency's differentials across regions and their determinants. The methodology includes Data Envelopment Analysis to measure technical efficiency which is the dependent variable in a reduced form model that links regional performance with a number of proxies for various types of agglomeration economies such as specialisation, urbanisation and internal economies of scale.

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Introduction

The “Tertiary Revolution” or “tertiarisation” has been associated with the so called “New Economy”, driven also by globalisation and expressed by the improved functioning of the whole economy primarily in developed countries -although in less developed economies these processes may acquire other characteristics. Globalisation is believed to have played a significant role in the productive restructuring of economies in which the service sector has had over the years an increasing quantitative and qualitative importance. On the other hand, it has become commonplace that public and private actors located in a region concern about providing the conditions that make their countries, regions or cities more attractive for productive activities. They undertake actions to increase the attractiveness of their own territories often in response to actions of the same character that are undertaken in other regions. Territories compete to attract and retain investment and mobile productive resources as well as to dominate relevant markets. Regions, localities, cities and sub-national economic spaces in general often have to follow strategies oriented to face the changing forms of globalisation and to reach international competitiveness. It is argued that regional competitive capacities and competitive advantage can be engendered by the development of a territorial culture that integrates the local productive system, and that the construction of territorial competitiveness has to be one along the fundamental lines of action of sub-national governments. Therefore such competition is not infrequently tied to territorial policies.

This paper draws attention to the relevance of services in constructing regional competitive advantage. The focus is twofold since we present, on the one hand, a literature review that take in hand the role of services as a factor of competitiveness and, on the other, we evaluate empirically the performance of services due to its impact on the overall competitive performance of regions. The suggestion is that the presence of a solid service sector and some degree of specialisation towards tertiary activities are among a number of territorial diversity of factors which need to be taken into account in relation to the creation of competitive capacities. Furthermore it is not just the quantitative significance of tertiary activities what matters for being competitive but the nature of the service sector and its capabilities. It needs to develop a better integration with other economic sectors and be more competitive in order to boost overall competitiveness. For regional policy this is relevant as there is room for action to get the environment right for boosting overall productivity and competitiveness by means of supporting the development of an efficient service sector.

Mexico is a middle income country where the service sector grows at an annual rate of approximately 3% and represents about 65% of total GDP. The weight of the tertiary sector in the total economy makes it crucial its contribution to aggregate growth and regional development in a country that has based its economic strategy on industrial activities and where, on the other hand, there are significant regional disparities. The paper aims at providing a wide-ranging assessment of the performance of the service sector in Mexico and for that we exploit the approach based on the concept of economic efficiency. An examination of the territorial structure of services, specialisation patterns and productive structures is provided as well. In addition, the locational determinants of regional efficiency in the third sector are sought out. Searching for the location specific sources of regional efficiency reminds us to the role of agglomeration economies. The literature on agglomeration economies implicit or explicitly draw attention to the efficiency advantages of localisation and refers to the role of economies of scale, internal or external to industries in explaining regional economic performance.

Empirical analyses on the relationship efficiency-location have largely centred on the manufacturing industry (see for instance Beeson and Husted, 1989; Mitra and Sato, 2006; Erbertta and Petraglia, 2008; Ezura, Iraizoz and Rapun, 2008). In Mexico we find examples such as Bannister and Stolp (1995) for manufacturing or Becerril, et al. (2007) for the whole economy. Nonetheless, the increasing quantitative importance of services on productive structures justifies efficiency analyses of this sector (Navarro and Camacho, 2001; Heshmati, 2003; De Jorge, 2004). Navarro and Camacho (2001) stress the relevance of studies at the regional scale because instances where the regional efficiency of the aggregate service sector is evaluated are scarce. The article goes in line with this approach and examines the Mexican aggregate tertiary sector through the evolution of regional performance during a period of formal and enhanced integration with North America.

The first part of the manuscript presents the literature review on the role of services as a competitiveness factor and on the subject of geographic concentration and efficiency. Some stylised facts are depicted after a revision of the Mexican productive structure and regional specialisation patterns, geographic concentration and localisation, and sectoral and regional efficiency indicators. For that concentration and specialisation indices are computed whereas for the measurement of regional efficiency we use the Data Envelopment Analysis (DEA). The last part of the analysis refers to the econometric study of regional efficiency and its determinants. Finally a brief section of concluding comments is provided.

I. The role of services in the competitive position of regions

There has been intense and increasing discussion on the conceptualisation of regional/territorial competitiveness and about the issue of the appropriateness of the term itself (for instance, Krugman, 1994 and Camagni, 2002). Although theorising about territorial competitiveness is problematic this expression is broadly conceptualised in terms of three aspects: 1) the ability of regions to attract and maintain investment; 2) their capability to insert successfully in international markets as exporters; and 3) their ability to maintain high and sustainable living standards for their population. Increasing productivity –understood as the productive efficiency of factors of production- as well as economic growth and low unemployment are among the most employed measures of revealed competitiveness. A parallel discussion deals with the sources or factors of competitiveness. A comprehensive and schematic view of competitiveness and its components is the pyramid model (figure 1) which in three levels distinguishes between the *Basic categories* or ex post indicators and measures of competitiveness; *Programming factors* or ex ante factors improving competitiveness with an immediate impact on basic categories; and *Success determinants* which are conditions with an indirect impact on basic categories because they take shape over a longer period of time - they are necessary conditions for competitiveness and thus are at the bottom of the pyramid (Lengyel, 2004).

Figure 1. The pyramid model



Source: Lengyel (2004)

Success components with an indirect long-term impact on regional competitiveness cover a wide range of variables many of which relate to the existence of activities regarded as part of the third sector. Such variables include the regional *Economic structure*, namely the mix of economic activities in a region; *Regional accessibility* which involves transportation services (airports, trains, motorways, ports, etc.) and communications (traditional media, internet, data transfer, etc.); *Skills of the workforce* which depend to some extent on education services

(education serves the demands of a number of segments in the labour market and satisfies the requirements of business services and of an informational society); and the *Social structure* which is influenced by knowledge-intensive economic activities and the growth of economic services because these activities tend to strengthen middle classes.

Senn (1995) says that of all approaches to the analysis of territorial competition a number of common elements which are necessary for economic success can be identified and services enters practically all of them: a combination of both general and specific *locational factors* (production inputs, infrastructures, services, etc.); a *sophisticated demand* which stimulates innovation and provides the conditions for the establishment of new export bases; a *strong interdependence* among economic activities within the area (input-output flows); and a *multiplicity of actors* who operate within particular economic sectors and compete among themselves. Thus when asking the question of what are the competitive factors, services are a relevant and attractive locational factor; contribute to more sophisticated demands; enter into most input/output relations; and typically find their principal markets where there is intense competition for market shares.

There are a number of other instances where, at least implicitly, the role of services as a factor of competitiveness is addressed. Those approaches agree in that regional competitiveness is influenced by various interconnected factors, nevertheless key elements that they consider typically include the economic composition in a region and productivity. Certainly economic structure is the primary category in which services have an impact on competitiveness. Porter (2006) indicates that to explore the marked differences in regional performance it is useful to examine the differing types of sectors that constitute a regional economy. Likewise for Malecki (2006) urban and regional competitiveness is inherently multidimensional, including traditional factor of production, infrastructure and location, as well as economic structure. In attempting to explain the determinants of competitiveness, Kresl and Balwant (1999) argue for what they call 'economic' determinants -factors of production, infrastructure and economic structure; on the 'input' side, among the determinants of competitiveness are the sectoral trends which capture the main influences on the regions' prospects. Ionita et al (2009) use the expression 'pole of competitiveness' to refer to a sector or an industry whose contribution to the global performance of a region is significant and when the specific products or services of that sector have a top position on the regional or the world market. According to Begg (1999) the impact of economic sector is dynamic. In the short term, competitiveness depends on the structure of the economy and on its sectoral specialization as

well as other factors. In the long term, competitiveness depends on the ability to sustain changes in the factors that give rise to productivity growth (technology, human resources, etc.) but also in the structure of the economy.

Pertaining to productivity as a key indicator of sectoral performance Begg et al (1995) affirm that it is widely accepted as the ultimate source of competitive advantage. Productivity can be seen in this case in terms of the costs of activities complementary of industry, many of which have an indirect but critical impact on the competitive performance of industrial companies. Similarly, Senn (1995) emphasises that services contribute to productivity growth of manufacturing activities playing a crucial cumulative role in regional growth and competitiveness. The competitiveness of an economic sector or particular industry such as services is used therefore as an indicator of great importance for the competitive position of regions owing to the productivity transfer effects on the economy. On the supply side, services represent an increasingly important component of regions attractiveness due to its productivity growth effect, and on the demand side they are also a requirement for the quality improvement of the urban economy. This leads to the need to consider more explicitly the role played by services in initiating or consolidating cumulative growth processes (Senn, 1995). Despite this awareness on the relevance of regional economic structures little explicit attention has been paid to the role of services in enhancing territorial competition. On the contrary, numerous approaches of territorial competition that have been developed in relation to manufacturing consider a virtuous circle of growth in economically advanced areas but taking the role of services for granted. One of the few studies where the service sector is addressed explicitly as a factor of competitiveness is Senn (1995) who attempts to show how services play a role in territorial competition, specifically in an urban environment. He states that the quantitative growth of services serves essentially to boost the competitive position of a region or city vis á vis other regions while a qualitative development of the sector towards activities with higher value added is required to move regions towards upper hierarchies. He also stresses that the impact on competitiveness outcomes varies according to the types of services existing in a region. Ionita et al (2009) affirm that services are a complex sector and the way they are organized and provided varies depending on geographic conditions, the history and the cultural traditions of each community.

Actually, most analyses address the effect of specific branches of services paying particular attention to those services that further boost the competitiveness of territories and which could be priority in terms of competition strategies from public and private economic units. Bremm

(1995) identifies the existence of competitive regions whose specific function or structural dominance is oriented to International finance and service sector. These territories are characterised by their integration into worldwide markets and by their far reaching downstream and upstream connections to other sectors and other functions in the national and international economy. They are located in the core spaces of the large and dynamic agglomerations and are globally significant. Kresl and Balwant (1999), too, advocates for ensuring an adequate supply of business and financial service providers for increasing competitiveness. Indeed Business and producer services have been traditionally regarded as key condition for competitiveness, and their inexistence or their low productivity is considered a serious threat to the competitiveness. For Begg (1999) the lack of immediate or easy access to specialised business services might make it more difficult for a firm to upgrade quality or design. Therefore one of the targets of direct intervention of industrial policy is the provision of support services whether publicly or through the markets (Beg et al, 1995).

Ionita et al (2009) work tries to analyse the extent of the contribution of services of general concern (mainly public) to the emergence and development of regional competitiveness poles and how services could become themselves competitiveness poles. The development of services of general concern (for example, healthcare or education) can influence the performance level of a city and a region. Through public administration and different forms of combined administration (such as public-private partnerships) these services can bring some extra vitality to the attractiveness of regions. Education has an elemental role in forming and perfecting human resources, whilst utility services provide the industrial development with the necessary infrastructure. They emphasise the importance of branches such as high technology services, high education and knowledge, public expenses in R&D, public services, and in general services with high value added for generating poles of regional competitiveness. Under the circumstances of a knowledge-based economy the fields of education and research become priority. The availability of research support, whether in the form of publicly funded research institutes or universities interested in assisting business, or a range of consultancy expertise are likely positive factors (Begg, 1999). In relation to this Begg et al (1995) state that there is the challenge in the developed world to raise the productivity of knowledge and service workers in order to maintain and increase competitive advantages.

Bozzi (1995) reckons that among the key elements in the territorial structure which must be considered to assess the quality of the local environment at least two are related to the

existence of local services: *infrastructure*, which affect transportation and telecommunications services; and *innovation*, which involve several actors such as universities, private R&D laboratories, other producer services and innovation centres.

Overall the existence and efficiency of producer and business services, services of general concern, education and research, and financial services are considered crucial factors to trigger innovation and therefore to enhance overall efficiency and competitiveness of regions. On the whole the issues addressed by the works reviewed can be to a great extent related, we believe, to the issue of efficiency and productivity at which services themselves operate in a region and has to be also with the differentiated nature of services available in a region.

II. Concentration, Localisation, Specialisation and Economic Efficiency

The productivity/efficiency gains associated with geographic concentration has been a long standing theme in the regional economic literature. The basic idea is that there are gains from spatial agglomeration of economic activity in terms of enhanced efficiency, economic growth and development. Thus economic performance can depend on the magnitude of the presence of an industry within locally defined geographic areas. There are productivity gains that are external to firms but internal to industries, or external to industries but internal to regions (external economies of scale), and efficiency gains tied directly to a plant's scale of production (internal economies of scale). Internal economies of scale refer to the presence of firm-level increasing returns. Productivity gains associated with the geographic concentration of industry, in this case, follow rather simply from plant-level productivity effects. Therefore plant scale may actually be an important underpinning of agglomeration economies (Wheeler, 2004). There may also be economies outside the firm such as agglomeration economies derived from a variety of sources. The classic foundations of agglomeration economies are external economies of scale arising from the concentration of firms in the same industry (localisation economies) or from the concentration of a variety of economic activities in urban areas (urbanisation economies) (Glaeser et al., 1991).

By and large the theories which address the positive role of externalities belong to the Marshall's traditional view of the advantages of common location.¹ These advantages emerge from concentration in the same industry and from specialisation. However, in the process of

¹ The Marshallian school enumerates three sources of externalities 1) Producers within the same industry agglomerate to take advantage of the spillovers of specific knowledge. 2) There is the presence of an extensive array of inputs providers. 3) There is a pooled labour market that facilitates the firm-worker matching process. Marshall also considers the gains from internal economies of scale.

economic development urbanisation can have productivity-augmenting effects (Jacobs economies of scale). Urbanisation economies are considered economies of scale external to firms and external to industries but internal to a territory. They refer to the benefits of geographic concentration of a variety of industries and of the large markets arising in large urban settlements.

On the other hand, economic efficiency at the regional level refers to how close a specific territory is to its optimal production levels given a production technology and factor endowments. But unlike efficiency at the firm level the concept of regional efficiency entails the benefits from economies of scale (internal and external) and other agglomeration economies derived from market access, transport costs, etc. (Bannister and Stolp, 1995). Regional efficiency becomes an increasing function of the (geographically proximate) extent of economic activity and market (Wheeler, 2004). According to Mitra and Sato (2006) the assessment of whether in effect regions with different types of agglomeration economies reveal higher or lower efficiency are particularly relevant in countries at low levels of development with wide socio-cultural, geographic and economic variations and with no advanced channels for technology dissemination.

Productivity and efficiency are concepts employed as reference to measure economic units' performance. Generally they refer to processes where those units transform inputs into goods or services. One definition of efficiency is presented in the pioneer work of Farrell in 1957. There efficiency is defined as economic or global efficiency with two components: technical and allocative efficiency. Technical efficiency is the ability to maximize output from a given combination of inputs; this is a purely technical concept of optimal assignation of resources. Allocative efficiency is the capability of producers to combine inputs in the best way taking into account prices and marginal productivities (Fuentes, 2000). Economic units are globally efficient when they reach technical and allocative efficiency simultaneously.

Because generally a real production function is unknown, to obtain a measure of efficiency is necessary to estimate a theoretic efficient production frontier. Coelli, et al. (2003) suggests among others the Data Envelopment Analysis (DEA). DEA is a non-parametric method which uses linear programming and principles of frontier analysis which builds an efficient empirical production function using a data set of similar cross-section units. The frontier is used to compare observed and potential outputs which are obtained considering the best

practice technology from a given vector of outputs produced by the most productive units² in a sample. Units with the best practices are considered efficient and are referents of comparison for future improvement of inefficient units which are those below the estimated frontier. DEA provides a relative measure of performance because efficiency estimates are relative to the “best practice” and each unit is compared with those units that operate with similar sets of inputs or outputs. (Bannister and Stolp, 1995). DEA does not consider absolute efficiency and therefore the fact that a unit is on the production frontier does not mean that it has reached its maximum efficiency but that the inefficient units can improve their performance. The estimated production function may or may not represent the true production frontier depending on how close each observation is to the optimal production level.

The DEA model which represents a general case is the Variable Returns to Scale (VRS) (Banker, Charnes and Cooper (1984), cited by Coelli, et al., 2003). The VRS model, however, does not allow knowing if units operate with increasing or decreasing returns. For that an alternative model is the Non Increasing Returns to Scale (Coelli, et al., 2003). There are two orientations when measuring efficiency according to how one states the efficiency objective: 1) *Input oriented*: an input minimisation problem to reach a specific output level; 2) *Output oriented*: the objective is expressed in terms of output maximisation given a set of inputs. Among the extensions of the basic DEA methodology is the calculation of allocative efficiency. If one has price information of inputs and outputs, one can consider a behavioural objective such as costs minimisation or profits maximisation (Coelli, et al., 2003).

To sum up DEA is used to obtain efficiency indicators, compare units of analysis, identify efficient and inefficient units, establish objectives, and implement actions for the improvement of inefficient firms having the efficient units as benchmarks. Its advantages are that it does not require particular statistical assumptions about the production function, allows for multiple inputs and outputs, and gives indicators of the relative efficiency of economic units; unlike econometric methods DEA estimates maximum possible output rather than mean output. It estimates an efficient frontier within a deterministic framework. Yet shortcomings must be weighed up as well: it is not appropriate for the statistical testing of hypotheses; it does not take into account random factors; and it does not specify the optimal number of observation, output or input variables (Coelli, et al., 2003).

² In the DEA terminology these are named decision making units.

III. The Mexican Service Sector: a regional and sectoral overview

The New Economy is conceived as the product of various structural changes due to the effects of globalisation and increased international competition, better management practices, cost reduction mechanisms (guided by technological innovation) which translates into improvements in economic performance. The New Economy impinges on the quality not just the quantity of the service sector (Heshmati, 2003). In a process that dates back from the 1960s the third sector has showed its dominance in the Mexican economic structure accounting for more than 65% of total GDP; between 1993 and 2006 its Average Annual Growth Rate (AAGR) was around 3%. Despite its growing quantitative predominance, the Mexican service sector suffers from a number of deficiencies; unlike advanced economies the internal restructuring of the sector has been characterised by the increasing significance of informal or marginal activities. In addition, Ortiz (2006) finds that the tertiary sector shows the lowest relative performance from the 1980's. While the expansion of this sector in terms of production happened at the same pace of employment until the 1980's from the 1990's production has growth less rapidly than employment which is indicative of a considerable fall in productivity. This makes it questionable the nature of this tertiarisation process and its relevance for national development. In the following parts of this section we look at some aspects of the third sector in Mexico regarding specialisation, localisation and geographic concentration.

- **Regional Productive Structures and Specialisation**

We use data of the two-digit service activities (according to the North American Industrial Classification System NAICS) from the 1999 and 2004 economic censuses to look at the internal composition of the service sector. In 1998 Commercial services (Retail and wholesale) dominates the third sector at least in quantitative terms (34% of total gross output) followed by Finance and insurance (12%). In 2003 the Finance and insurance expands reaching 18%. This gives evidence of the recovery of this activity after a severe financial crisis in 1995. This was a post-election economic instability period that followed a radical change in policy that produced concerns about the level and quality of credit extended by banks during the preceding low-interest rate period, as well as the standards for extending credit. Nevertheless the financial sector does not generate as much employment as Wholesale trade, Retail, and Accommodation and Food services which employ more than 55% of the total labour force in the sector against only 3% of Finance and insurance. Wholesale trade, Retail, and Accommodation and Food services include most of the branches related with

tourism that has become an important engine of employment growth with capacity to generate foreign currency. The distribution of production and employment among branches is rather heterogeneous having Wholesale trade an outsized weight in employment.

There are interregional differences in specialisation and regional productive structures. Mexico is divided into 32 states which show this pattern of dissimilarity in their sectoral composition. The weight of services and commerce within national GDP was 65 and 67% in 1998 and 2003 respectively. In a number of states tertiary activities surpassed this percentage: Baja California, Baja California Sur, Distrito Federal, Guerrero, Quintana Roo and Yucatan in 1998, plus Chihuahua in 2003. Therefore those states show a relative specialisation in services and commerce as measured by the location quotient. Interestingly, in Quintana Roo the third sector accounts for 90% of total GDP. On the contrary, the economies of Campeche, Coahuila e Hidalgo are the less dependent on these activities.

Among the regional economies that most rely on services and commerce Baja California and Yucatan are more oriented towards Wholesale trade; Baja California Sur, Guerrero and Quintana Roo towards Accommodation and Food while Distrito Federal towards Finance and Insurance. The specialisation of Baja California Sur, Guerrero and Quintana Roo is as expected given that those states have some of the most important touristic destinations in the country. On the other hand, Mexico City is the biggest and most modern urban centre, located within Distrito Federal, and has developed into the most important financial centre.

- Geographic concentration and localization

The tertiary sector in Mexico is characterised by the unequal development within the regional economies but also by an unequal territorial distribution as already revealed on those works by Álvarez and Aguayo (2003), and Coll-Hurtado and Ordóñez (2006). The states that were formerly main industrial centres -Distrito Federal, Nuevo Leon, Estado de Mexico and Jalisco- became the core locations of the third sector. Together those states concentrated around 65% of the sector's output in 1998 and 63% in 2003 contrasting with a group of 15 states that participated with less than 1% each.

Within the sector there are also considerable differences in the way activities are distributed across geographic units. When looking at the Herfindalh Index of geographic concentration (table1) we identify three branches with the highest concentration: Information, Finance and Insurance, and Management of Companies and Enterprises which are specialised services that locate most of its activity in the biggest urban centre, i.e. Distrito Federal. These branches

account for about 30% of output but only 6% of employment. Wholesale trade, and Accommodation and food are the most dispersed branches having below-average concentration. Overall there is a tendency of the whole sector and its branches to disperse. Therefore during the NAFTA period there is a slight geographic dispersion of services accompanied by a tendency towards increasing specialisation of regions.

Table 1. Geographic concentration by activity, 1998 and 2003

	1998	2003	Change		Location
Total	0.22	0.20	-0.02	D	
Retail	0.13	0.10	-0.03	D	
Wholesale trade	0.07	0.069	-0.01	D	
Transportation and Warehousing	0.22	0.17	-0.04	D	
Information	0.63	0.51	-0.12	D	DF 63%
Finance and Insurance	0.77	0.74	-0.03	D	DF 77%
Real Estate and Rental and Leasing	0.15	0.12	-0.02	D	
Professional, Scientific, and Technical Services	0.26	0.25	-0.01	D	
Management of Companies and Enterprises	0.64	0.62	-0.01	D	DF 61%
Administrative and Support and Waste Management and Remediation Services	0.19	0.17	-0.01	D	
Educational Services	0.14	0.12	-0.01	D	
Health Care and Social Assistance	0.15	0.10	-0.04	D	
Arts, Entertainment, and Recreation	0.12	0.09	-0.03	D	
Accommodation and Food Services	0.07	0.07	-0.00	D	
Other Services (except Public Administration)	0.09	0.08	-0.00	D	
Average	0.28	0.25	-0.03	D	

Source: Own calculation with data from INEGI.

IV. The Regional Distribution of Technical Efficiency

We now address the issue of efficiency mainly from the regional point of view to see how regions behave differently in the use of resources and in their outcomes. The idea is to have an approximation about the competitive capacities of regions through the differentiated performance of services located there. We calculate indices of technical efficiency for each state in 1998 and 2003 using the DEA methodology specifically the output oriented VRS model (this implies that regional economies often do not operate at the optimal scale and that regions have limited resources and want to maximise production). The measure of output is value added and for inputs we use employment (labour) and fixed assets (physical capital). Data might suffer from the problems of sectoral and spatial aggregation as discussed in Bannister and Stolp (1995) whereas the quality and number of variables used as outputs and inputs might as well be questionable. Another problem is the lack of data on factor prices at the regional level which prevent us from calculating overall efficiency. In addition, we do not have annual information as the censuses are carried out every five years and data at the regional level is only available from this source.

The results in table 2 show that Distrito Federal is on the efficient frontier and operated at an optimal scale in 1998. One strange finding is that Campeche and Michoacan, two states that are considered among the least developed, are also on the frontier. Tlaxcala, another backward state, appears on the technical efficiency frontier but shows inefficient scale. In the Mexican manufacturing sector Bannister and Stolp (1995) find a similar situation in which small states such as Campeche appear on the frontier. He explains this by the unusual aggregate factor mixes in those regions so that there are no other economic units against which to compare them. In 2003 Campeche shows some technical inefficiency (15%) whereas Tabasco moves to the efficient production function and operates under increasing returns to scale.

Table 2. Technical efficiency by state, 1998 and 2003 (%)

State	1998				2003			
	crste	vrste	scale		crste	Vrste	scale	
Aguascalientes	70.3	72.3	97.2	drs	63.0	68.0	92.7	irs
Baja California	90.9	91.1	99.8	irs	97.1	97.4	99.7	irs
Baja California Sur	65.1	84.5	77	irs	58.6	93.9	62.4	irs
Campeche	100	100	100	-	73.9	85.3	86.6	irs
Coahuila	87.1	94.2	92.4	drs	82.6	82.7	99.9	irs
Colima	52.9	63.2	83.7	irs	56.3	75.7	74.3	irs
Chiapas	74.7	82.3	90.7	drs	72.7	74.5	97.6	irs
Chihuahua	93.1	95.5	97.5	drs	78.0	78.3	99.6	irs
Distrito Federal	100	100	100	-	100.0	100.0	100.0	-
Durango	64.2	65.7	97.7	drs	70.5	74.4	94.9	irs
Guanajuato	75.2	80.4	93.6	drs	58.6	71.1	98.1	irs
Guerrero	47.7	47.8	99.8	irs	64.2	65.0	98.7	irs
Hidalgo	57.4	61.6	93	drs	63.6	66.6	95.6	irs
Jalisco	84.3	94.8	89	drs	77.7	80.5	96.5	drs
México	86	95.8	89.7	drs	78.5	81.5	96.3	drs
Michoacán	100	100	100	-	100.0	100.0	100.0	-
Morelos	51.1	51.3	99.5	irs	62.1	64.0	97.1	irs
Nayarit	61.4	61.7	99.5	irs	63.5	74.7	85.0	irs
Nuevo León	82.3	82.4	100	-	76.8	80.5	95.4	irs
Oaxaca	60.8	67.2	90.4	drs	73.9	75.8	97.5	irs
Puebla	66.6	73	91.2	drs	79.0	79.9	98.9	drs
Querétaro	61.4	62.1	98.9	irs	72.4	74.9	96.7	irs
Quintana Roo	76.2	80.5	94.5	irs	49.1	50.3	97.5	irs
San Luis Potosí	68.9	72.8	94.5	drs	73.0	74.1	98.6	irs
Sinaloa	91.5	96.8	94.5	drs	82.7	83.2	99.4	irs
Sonora	89.1	89.2	99.9	irs	72.5	73.0	99.3	irs
Tabasco	92.1	94.6	97.3	drs	97.4	100.0	97.4	irs
Tamaulipas	82.3	84.6	97.3	drs	62.1	62.4	99.5	irs
Tlaxcala	44.9	100	44.9	irs	71.6	100.0	71.6	irs
Veracruz	50	52.9	94.5	drs	45.7	46.4	98.5	drs
Yucatán	78.3	83.9	93.2	drs	72.9	73.9	98.7	irs
Zacatecas	51.9	52.5	98.8	irs	52.4	68.0	77.1	irs
Mean	73.7	79.2	93.4		72.0	77.4	93.8	

Source: Own calculation with data from INEGI.

There are a considerable number of states below the average efficiency. The states showing the highest levels of inefficiency in 1998 are small states such as Guerrero, Morelos, Veracruz and Zacatecas revealing around 50% of inefficiency. Furthermore, on average states became more inefficient between 1998 and 2003; despite this Guerrero, Morelos and Zacatecas improved their relative performance. In a different case are Coahuila Chihuahua, Jalisco, Estado de México and Sinaloa that were relatively close to 100% efficiency in 1998 but worsen off in 2003. On the other hand, in 1998 seventeen states showed Decreasing Returns to Scale whereas in 2003 only four states were in such situation which tells us that there were some changes in the scale to which the service sector operates. Thus the increasing quantitative advancement of the sector has not necessarily translated into a qualitative improvement.

When one takes account of the relative size of states, measured by their participation within the total tertiary sector, the weighted efficiency represents the percent contribution of a region to total efficiency; thus the sum of all weighted indices is an approximate measure of the technical efficiency in the Mexican third sector. Distrito Federal, Jalisco, Estado de Mexico and Nuevo Leon are the states which matter the most in accounting for the total efficiency of the tertiary sector (table 3).

Table 3. Weighted Technical Efficiency by state, 1998 and 2003

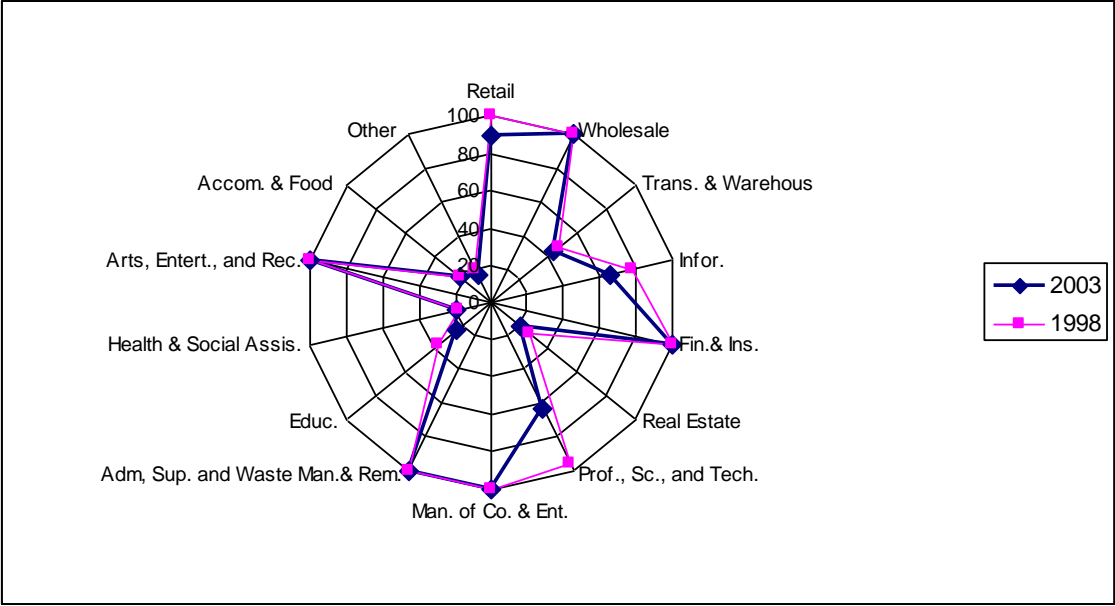
State	1998	2003	State	1998	2003
Aguascalientes	0.48	0.48	Nayarit	0.23	0.27
Baja California	2.90	2.30	Nuevo León	5.72	6.30
Baja California Sur	0.46	0.44	Oaxaca	0.54	0.71
Campeche	0.51	0.49	Puebla	1.47	1.80
Coahuila	1.92	1.60	Querétaro	0.63	0.98
Colima	0.21	0.32	Quintana Roo	1.26	0.78
Chiapas	0.77	0.70	San Luis Potosí	0.70	0.81
Chihuahua	2.78	1.84	Sinaloa	1.74	1.38
Distrito Federal	42.30	43.63	Sonora	1.88	1.35
Durango	0.45	0.50	Tabasco	0.87	1.08
Guanajuato	2.11	1.60	Tamaulipas	2.01	1.40
Guerrero	0.49	0.68	Tlaxcala	0.19	0.26
Hidalgo	0.32	0.43	Veracruz	1.42	1.04
Jalisco	5.93	4.57	Yucatán	0.88	0.84
México	6.80	5.28	Zacatecas	0.20	0.29
Michoacán	2.51	2.45	Mean	91.03	87.08
Morelos	0.36	0.47			

Source: Own calculation with data from INEGI.

To have a broad view of performance at intra-sectoral level we also calculate the technical efficiency for each of the 14 services branches. Overall the efficient activities in 1998 are

those with the largest weights within the sector’s gross output: Wholesale trade, Retail, Finance and insurance, and Management of Companies and Enterprises. On the other hand, Real estate, Education, and Health Care and Social Assistance are far from the optimal frontier. In 2003 the average efficiency falls and so do the efficiency of half of the branches, Retail included (figure 1).

Figure 1. Technical efficiency by activity, 1998 and 2003



Source: Own calculation with data from INEGI.

Thus the most efficient state, Distrito Federal, is where some important branches of services to boost competitiveness related to business and producer services and which also are among the most efficient activities, i.e. Finance and insurance, and Management of Companies and Enterprises, concentrate. Overall regions are rather inefficient and are not the location of service branches which are cited among the most relevant to contribute to regional competitiveness.

VII. Determinants of the Mexican Third Sector’s Regional Efficiency

In this section we deal with the role played by various sources of agglomeration economies in explaining regional efficiency differentials. Reduced form specifications, which make use of a set of region characteristics as explanatory variables, are an empirical framework frequently used to explain cross-regional variation of efficiency. Here this approach is exploited for an analysis of the regional services performance. We have the following specification:

Equation 1: $TE_{rt} = \beta_0 + \beta_1 Se_{rt} + \beta_2 Urb_{rt} + \beta_3 Agg_{rt} + \beta_4 Con_{rt} + \beta_5 Spec_{rt} + \beta_6 FDI_{rt} + \epsilon_{rt}$

Technical efficiency (TE) is the dependent variable. As the value of the efficiency scores calculated by DEA are bound on the unit interval and a proportion of values are equal to one (censored data) we use a relative score defined as the ratio of the individual score between the mean efficiency.

Se_{rt} captures the effects of internal economies of scale measured by the relative average plant size defined as:

$$Se_r = (FA_r/P_r) / (\sum FA_r / \sum P_r).$$

As a proxy for the existence of urbanization economies Urb_{rt} in the form of population/market size we use relative population density:

$$Urb_r = (Pop_r / Km^2_r) / (\sum Pop_r / \sum Km^2_r).$$

Relative concentration Con_{rt} is a proxy that captures local industry-specific economies (the share of services in the region within the national compared to the average share):

$$Con_r = (y_{s_r} / \sum y_{s_r}) / (\sum (y_{s_r} / \sum y_{s_r})) / N.$$

Relative agglomeration Agg_r is a proxy that captures the effect of economies derived from the relative size of the regional economy rather than just the service sector:

$$Agg_r = (y_r / \sum y_r) / (\sum (y_r / \sum y_r)) / N.$$

To measure the regional specialisation $Spec_{rt}$ in the tertiary sector we use the location quotient:

$$LQ_r = (y_{s_r} / y_r) / (\sum y_{s_r} / \sum y_r)$$

Where,

FA_r = Fixed assets in the service sector in the r region.

P = Number of Plants in the service sector in the r region.

Pop_r = Region's total population

y_{s_r} = Total Regional output in services

N = Number of regions

y_r = Total Region's output

Even though trade is an essential parameter to measure the globalisation of the economy, given that in Mexico there is no official regional data on trade, we do not include exports as

an explanatory variable. Yet in Mexico export capacity is highly driven by FDI and so the effects of exports can be, at least partially, captured by the FDI variable FDI_{rt} .

With equation 1 we test simultaneously the effects of internal economies of scale, urbanization economies (population density and agglomeration) and localization economies (concentration and specialisation) on regional technical efficiency while controlling for FDI. We estimate a panel of 32 states r in two periods t 1998 and 2003 and compute the Swamy and Arora estimator of component variances assuming random effects for the cross-sections by reason of the characteristics of data and after testing for model misspecification.³ In order to obtain a robust estimation, we employ a Cross-section SUR-PCSE (Panel Corrected Standard Error) estimation which corrects for the presence of contemporaneous correlation and allows for more general serial correlation (Beck, 2001). We are interested in the statistical significance of the regressors and the direction of their impact on technical efficiency rather than the magnitude of the effect. The results are reported in table 4.

Table 4. Estimation Results for Equation 1

<i>Variable</i>	<i>Equation 1</i>
SE	-0.2626** (0.1219)
Urb	-0.0290** (0.0143)
Agg	-0.1228 (0.1340)
Con	0.2877** (0.1528)
Spec	0.0602 (0.1137)
FDI	0.0367*** (0.0115)
R ²	0.23
Num. of obs	64

*** Significant at 1% level

** Significant at 5% level

* Significant at 10% level

Standard errors in parenthesis

The estimates suggest that FDI and Concentration have a positive impact on the dependent variable indicating that the largest the state's share in FDI and the more concentrated is the tertiary sector in that region the more efficient it becomes. That is, tertiary sector's self-

³ We employ the Hausman test to compare the fixed and random effects estimates of coefficients and the result does not lead us to reject the null hypothesis that the random effects model is not a misspecification.

concentration appears to spur technical efficiency which stresses the importance played by sector-specific agglomeration economies. Similarly, regions concentrating FDI are more likely to be close to the efficient frontier confirming the idea of a foreign investment-driven efficiency. In fact, statistically FDI appears to be the most important determinant of spatial technical efficiency. On the contrary urbanisation and internal economies of scale exercise a significantly negative effect on efficiency. Urbanisation has an impact on efficiency but this seems to be a negative effect implying that states more densely populated are more inefficient. Thus the tertiary sector undergoes some congestion costs rather than benefits from population size. There are internal diseconomies of scale which supports the idea that small firms use their resources more efficiently. Specialisation is not statistically significant but shows a positive sign that in the end would be a sign of favourable impact on efficiency. Agglomeration of aggregate economy is not significant but shows a coefficient such that service activities would be less efficient due to agglomeration. Whether urbanization economies are caused by general agglomeration of the economy or population size the effects are negative for efficiency suggesting the existence of diseconomies associated with congestion.

The estimates indicate that concentration of services generates external economies. But small and not big firms (with some monopoly power) benefit from this concentration. Overall results do not sustain Jacobs's idea that economic activities benefit more from diversity and population size but instead some support on the idea that small firms enjoy the benefits of agglomeration economies is found. Therefore the evidence gives partial support for these two different approaches to agglomeration economies.

Even though there might be some other factors influencing technical efficiency which are not in the model, not considering agglomeration economies in the analysis of regional efficiency would be an important omission. We also have to bear in mind that a fraction of the impact of agglomeration economies on a region's performance is perceived in terms of technical efficiency but it is not limited to it. Technical efficiency is a component of economic efficiency complemented by allocative efficiency. There are market mechanisms related to the efficiency in the processes of commercialisation of goods and services which are not reflected in the technical relations within the productive process. The evaluation of the full impact of agglomeration economies on the performance of services would ideally allow for allocative efficiency and thus one would be able to get a wider perspective on the real competitive position of regional services.

Concluding Remarks

In this paper the regional efficiency of the Mexican tertiary sector has been assessed because of the significance of services in boosting regional competitiveness. On the one hand, states are becoming more specialised and their economic structures more dependent on tertiary activities. This is specially the case of Distrito Federal oriented towards the financial sector and other states which depend to a considerable extent on tourism. Services in Mexico have become, on average, more dispersed but the whole sector is still highly localised in the traditionally industrialised regions. Finance and insurance, Information, and Management of companies and enterprises –which account for a considerable share of output within the whole sector-, are extremely concentrated in those territories.

We found that regions and activities became more inefficient with respect to the best practices –particularly that of Distrito Federal and Financial, Management and Administrative services-, contradicting one of the expected outcomes from NAFTA and the New Economy. There are few states on the efficient frontier and this fact is reflected on an average efficiency below 80%. When looking at the weighted average concentration the findings about increased inefficiency are supported. Regarding the geographic foundations of interregional differences in technical efficiency estimates indicated that the high geographic concentration of services has a positive impact for augmenting technical efficiency but does not affect if other sectors of the economy get together geographically in that region. This can be because diversity does not matter for efficiency or alternatively due to the weak economic linkages among economic sectors. Population size seems to work against the technical efficiency of services and commerce; a population size effect seems to exist, but a too large population generates net diseconomies. In this aspect it seems that is localisation rather than urbanisation economies that explains technical efficiency. Other diseconomies appear at the firm level since the existence of large plants translates into more inefficiency contradicting the idea that monopoly power stimulates efficiency.

Particularly interesting is the positive effect that the geographic concentration of FDI in the industrial sector exercises on the economic performance of services. This adds empirical evidence on the idea that FDI can potentially increase economic performance by means of technological transfer and spillover effects which can manifest itself in the forms of new ideas, new products, advanced managerial skills, advanced production processes, advanced equipment and machinery etc. Thus technology can spread through the whole economy which can be interpreted as a form of an externality emerging from the geographic concentration of

FDI. However the increasing inefficiency at the aggregate level in the Mexican third sector between 1998 and 2003 is a signal of the limited effect of efficiency-enhancing mechanisms. These effects are very sector and region specific that only some states and branches get the benefits. The unequal performance of the services sector can help to explain the asymmetries in the competitive position of territories in Mexico. The general lineaments found here have to be interpreted with caution. The sectoral aggregation and the geographic unit of analysis may matter a great deal. Likewise the data and methodology are imperfect, and the span time quite short. Yet this is an important exploratory study on the regional efficiency and concentration of the Mexican tertiary sector related to its role on improving or generating competitive advantages of territories. However the analysis of regions and branches of activity, the role of trade and FDI on inducing efficiency, and its effect on competitiveness, economic growth and development are lines of research to be explored further. The development of services and its integration with the rest of the economic sectors is essential to modern economic development of countries, regions and cities by means of productivity and income-augmenting effects; through these effects services can contribute to the improved performance of the whole economy. But the effects of services as a source of growth and development depend not only on their quantitative advancement but also on the characteristics of specific service branches and the quality of jobs they create.

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