Spatial Analysis Of Regional Input Output Of The Automotive Supply Chain And Its Impact On Economic Development Of Northeast Economic Functional Region of Mexico. ID 2628

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Abstract:

The automotive industry has great economic importance for the generation of value added and employment, so it is considered by the national industrial policy as a key to development. Even state governments in Mexico encourage its establishment as a factor of regional growth and exploit the export market giving economic openness for three decades. However, the productive chain of local firms with transnational companies that lead the automotive industry is a goal unfulfilled and is evidenced by the strong dependence on imports from their links. This separation does not allow the benefits of economic liberalization model to achieve regional development.

This paper analyzes the functional economic region of northeast Mexico, which contains one of the most important automotive cluster in Mexico and spacially is structured in a metropolitan corridor that runs from Saltillo to Monterrey but that articulates other cities specializing in supplying inputs branches located in various internal sub-regions including the border, generating not only intrasubregional interaction but with other national regions, and of course with the rest of the world where many inputs are imported. Therefore, the aim of this article is to answer the question of what degree of impact of the automotive industry in regional development through analyzing its productive chain functional economic region in the northeast. For this, the regional input matrix product (MIPR) is constructed by the bottom-up methodology, using the main regional economic accounts and analysis of economic interactions. For this purpose, the main economic subregions are identified validating their economic interaction with spatial dependence as measured by rates Moran and Lisa; then identify and develop the main economic accounts of every subregion, focusing on key sectors and which correspond to the automotive industry, proceeding to the

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analysis of economic interactions and to build arrays of uses and sources of means, with reference to the national tables.

From this result, the regional input output matrix is constructed through economic transactions and of technical and total coefficients, which is complemented by the identification of key links, drag links, basis links and independent links in the region and its subregions by Rasmussen methodology focusing on the branches associated with the automotive industry. Subsequently, by analyzing vertical specialization proportion of external and regional added value is estimated, incorporating automotive exports. Additionally, the connectivity of the northeastern region with and without imports is calculated by the analysis of the determinants matrices of total regional intermediate consumption and without imports.

To analyze the contribution to regional development multipliers subregional matrices are analyzed and the impact of the growth of value added in the automotive industry on local employment. To complement this we do a statistical evaluation of the impact on main variables of economic and social development of the region.

Statistical information is of economic censuses 2014 and earlier, GDP and national accounts National Institute of Statistics and Geography (INEGI) of Mexico, which present information by industry and by municipality; as well as officials and business surveys available statewide.

The contribution of the above methodology is based on an effort to collect and estimate data from an approach "bottom up" and regional accounts, not made in Mexico and allows us to know more precisely the heterogeneity and impacts of local functional economic structure. Also, the degree of contribution to regional development obtained by the local industrial policy that attracts foreign direct investment is inferred.

Introduction:

Economic activity is not homogeneous in space, because the production of goods and services does not match the territory where the goods are consumed because the location of resources is distributed specifically in the territory and not generally in anywhere; and secondly that the market areas generally concentrated in cities and urban areas, so that trading companies and their investments are based the territory to make a selection of optimal spaces that minimizes the costs of companies in phases production and distribution, including in such planning to nations and regions developed and underdeveloped fragmenting production processes. This means that, according to the structure developed or underdeveloped in which foreign investment flows to settle, socioeconomic impacts will be different every time in the international production chain of a good or service there are links with a greater contribution in the generation value, as a result of the regional structural heterogeneity.

In the case of Mexico, during the middle decades of the twentieth century in which an industrialization process took place, economic activity is concentrated in entities center, consolidating Mexico City and its metropolitan area as the market area's most important country to date. However, during the last two decades of this century the opening of the Mexican economy gave way to a series of foreign investments and manufacturing activities especially that oriented their production towards exports. Many were receiving economic branches of multinational companies and relocated certain activities such as the automotive, electronics and textiles to border regions.

This work will focus on the study of the northeastern economic-functional region of Mexico in 2013, which concentrates strong industrial and economic center, led by Monterrey and at the time of the opening contains one of the automotive cluster of greater relevance in the export country located in Saltillo and Ramos Arizpe. Geographically this cluster has an easy access to the US market not only because of its relative proximity to the border, but for the vast network of roads that have in the region and connects to several of the sub-regions that make up and that terms of automotive production have conditions of complementarity. However, the entry into force of the North American Free Trade Agreement and changing the rules of regional content in automobile manufacturing for export meant a substantial change in production linkages in the region. With the arrival of more foreign investment on the part of proveeduría standards they were changed input requirements and thus the source profile of providers spatially concentrated at different levels of linkage and set the subregional complementarity of the study area. With the arrival of more foreign investment

on the part of suppliers of inputs standards they were changed and thus the source profile of providers spatially concentrated at different levels of linkage and set the subregional complementarity of the study area.

With a simple exercise structural analysis through a multisubregional input-output matrix is intended to see the degree of sectoral and territorial coordination that has the economy of this region, focusing on the fields of vehicle manufacturing. However, these observations are made under an economic-functional approach which allows us to appreciate that economic activity is concentrated in certain points in space and the interaction between these areas form areas and economic regions are not confined to the political and administrative boundaries so this article offers a definition of the northeastern region of Mexico and its subregions in those terms, from the previous methodological application of probabilistic models such as the model Reyli, so the result gives an economic and not political boundaries in the 158 municipalities that are productively connected and administratively belong to 6 states that are all of Nuevo Leon and Tamaulipas, and the states of Coahuila, Zacatecas, San Luis Potosi and Veracruz are included.

In the absence of local information, many jobs have constructed tables input-output procedures inference from an input-output matrix National (top-down method), however, this research part of a methodology for building regional accounts from an estimate of variables such as production, income, consumption, savings and local investment, regional exports and inter- and intra-regional trade, from having general variables such as value added, intermediate consumption and Total gross production at the municipal level. This process seeks to get as close as possible to build regional accounts with available data from the region (bottom-up method).

The estimate of intersubregional flows is done with the RAS method, identifying production chains that are key, drag, base or enclave, through Economic Census data 2014, so that such analysis would provide the most current perspective possible production conditions of economic concentration in northeastern Mexico.

Northeast Mexico Region: Overviews:

Within the economic-functional regionalization of Mexico, 12 macro-regions can be identified in which the country is divided. In our analysis we will take the northeast region, which is detailed as follows:

MAP 1. MEXICO: THE LIMITS OF THE ECONOMIC FUNCTIONAL NORTHEAST REGION

NORTHEAST REGION MEXICO MACRO. Made up of 158 municipalities.

Source: Own calculations based CEDRUS proposal, UNAM. Data from the National Geostatistical System, INEGI.

Except for the central region, which is still a region with a large population and economic weight, the northeast and north central agglomerated just under 10% in total population in 2010, however the northeast concentrated higher percentage of economically active population 9.7% against 9.2 of the north-central and 5.1% of the north in the same year. In a comparison between 2008 and 2013, the total gross production is higher in the Northeast than in the north central and north for both years. For 2008, the northeastern region doubled in value added to the north-central and almost triple the north. Overall productivity, the northeastern region is above the national average.

Cuadro 2.1. Variables económicas, nacional y por algunas regiones.						
	Población Total	PEA, 2010	PO_08	PBT_08	PBT_2013	VA_08
NACIONAL	112,336,538	44,701,044	20,116,834	8,049,359,076	13,983,942,484	3,696,268,389
RNE	9.6%	9.7%	11.9%	15.2%	16.2%	12.5%
RCN	9.6%	9.2%	8.7%	7.6%	9.0%	6.0%
RC	32.9%	34.0%	36.1%	35.8%	38.4%	34.7%
RN	5.2%	5.1%	6.1%	4.4%	4.2%	4.3%
Fuente: Elaboración propia con datos de Censos de población y Vivienda 2010 y Censos Económicos 2008 y 2014.						

Physical environment:

In the region crosses a mountainous system that even crossing the US border: the Sierra Madre Occidental, which divides into two altitude levels the northeast region. West Side an important set of hills are appreciated and whose climate is mostly dry. The east side, at a much lower level that gives better conditions for vegetation due to the presence of water from tributaries of the Sierra Madre Oriental and to the level of the sea in the Gulf of Mexico.

The conditions of altitude, longitude and latitude of the northeastern region of Mexico give a combination of especially dry climates, semi-dry and predominantly warm and semi-warm, being practically the north, northwest, north-central and southwestern parts of the region. The zones located along the southern coast and to the south-central that concentrate the wet and mild climate. While predominantly dry and hot weather, however, the temperature conditions in the region are very different result because of the variety of altitudes and physical conditions ranging from a climate saw more than 3000 meters above level large expanses of sea and plains that do not exceed 500 meters above sea level and climate of coastal areas. The states with the highest temperature are San Luis Potosi, Veracruz and Nuevo Leon with a maximum in summer 32 °, while Zacatecas is the state with lowest temperature in winter with a minimum 3 °.
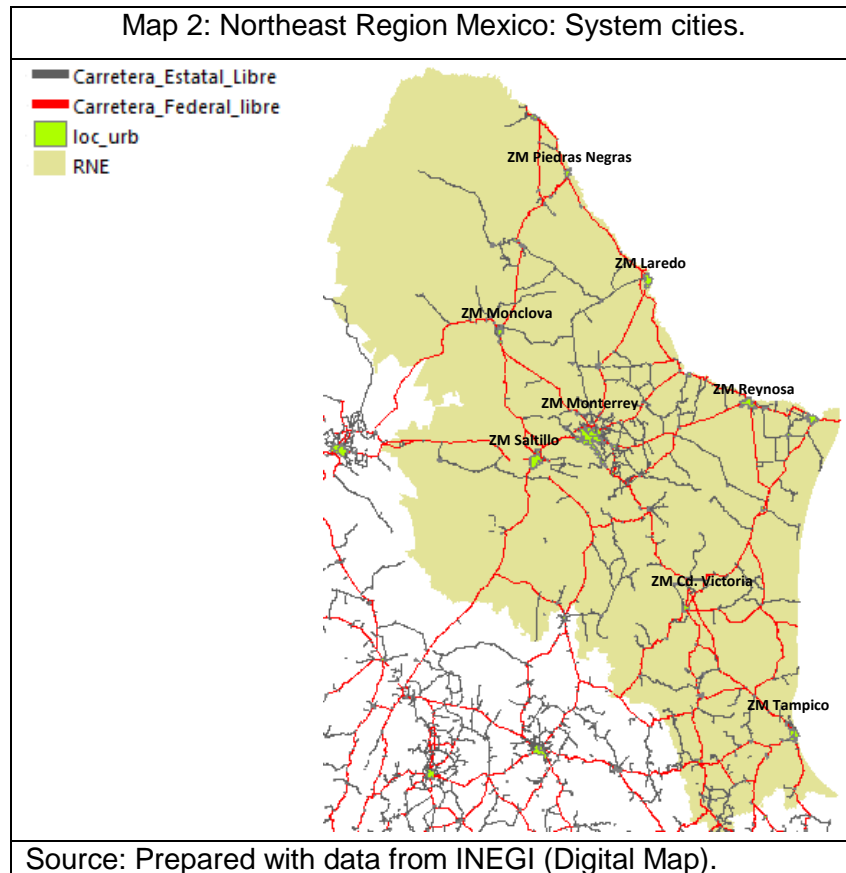
The highest elevations could be a physical barrier to traffic and shows that major road routes connecting major metropolitan areas in the region such as the runner coming from the southwest of Coahuila established in the northern part of the highest elevations and passing through Saltillo and Monterrey connects with major routes that lead to border cities like Nuevo Laredo, Acuna and Piedras Negras or places of supply of raw materials like Monclova. South and southeast of the region there is also communication via state and federal road south of Tampico and Veracruz north, where major ports are.

Urban concentration and economic regionalization criteria Northeast Mexico.

In the northeastern region of Mexico 29 cities and metropolitan areas according to the National Urban System account for more than 76% of the total population (PT) in the region, 86% of employment or employed population (PO), 94% are located the Gross production Total (PBT) and 92% of Gross Value Added Census (VACB), as shown in table 2.3.

Cuadro 2.3. Región Noreste de México: importancia económica de las áreas urbanas, 2008.				
	PT	PO	PBT	VACB
Actividad Económica Total 158 municipios del Noreste	9,901,745	2,373,984	1,664,592,346	628,334,895
Actividad Económica Total 29 ciudades y ZM existentes del Noreste	7,504,122	2,035,536	1,558,153,401	580,606,055
Actividad Económica Total 29 ciudades y ZM existentes del Noreste (%)	76%	86%	94%	92%
Fuente: Elaboración propia con datos del Sistema Urbano Nacional (2010).				

Map 2 metropolitan areas and major cities in the region and its major transport networks are appreciated.

Map 2: Northeast Region Mexico: System cities.

Source: Prepared with data from INEGI (Digital Map).

The economic-functional region of northeastern Mexico is made up of 158 municipalities, which are scattered in the states of Coahuila, Nuevo Leon, Tamaulipas, Zacatecas, San Luis Potosi and Veracruz. As a variable that allows you to view the agglomeration of economic activity is the total gross output, which is the sum of value added and intermediate consumption.

A first analysis of the region as a whole is made and shows the following:

Map 3. Northeast Region: Index Morán in the PBR, 2013.

Source: INEGI data CEDRUS, GEODA 1.6.5
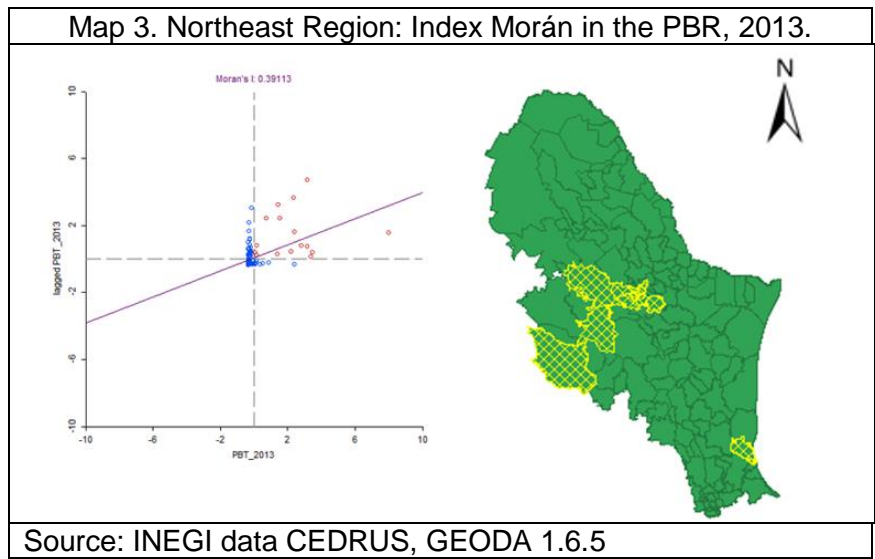
The index for the Northeast region Morán (0.39), overall shows a positive spatial association of 16 municipal demarcations between which include the metropolitan area of Saltillo in Coahuila; several municipalities of the metropolitan area of Monterrey in Nuevo Leon, Tamaulipas and Tampico Altamira include; while in Zacatecas is Mazapil.

Map 4 Northeast Region: LISA Analysis of PBT 2013.

Source: INEGI data CEDRUS, GEODA 1.6.5
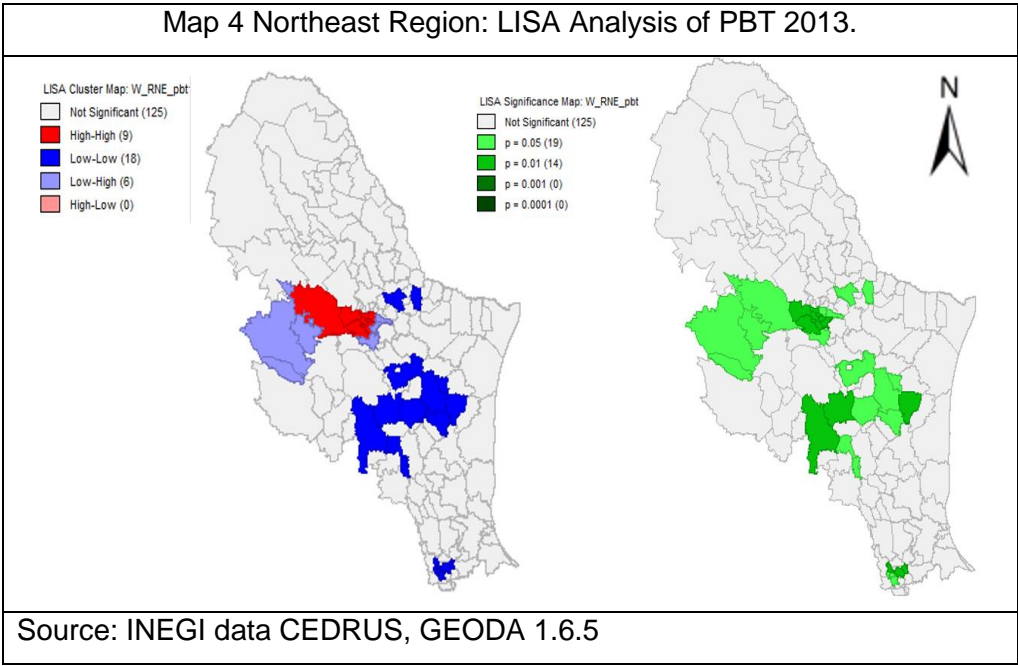
According to LISA analysis, spatial cluster are located in terms of PBT with statistical significance in 9 municipalities, which are: Ramos Arizpe, Coahuila; Apodaca, García San
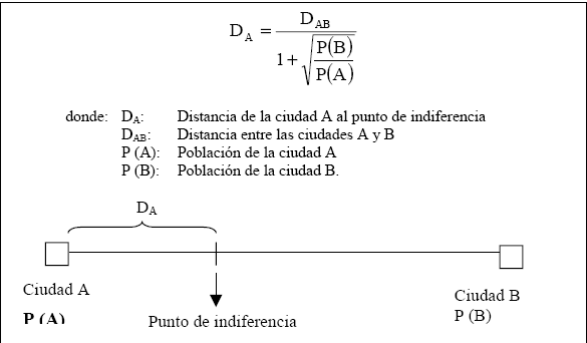
Pedro Garza Garcia, General Escobedo, Guadalupe, Juarez, Monterrey, San Nicolas de los Garza and Santa Catarina in Nuevo Leon.

Cartogram 1. Northeast Region: Regional Outliers in PBT, 2013.

Source: INEGI data CEDRUS, GEODA 1.6.5
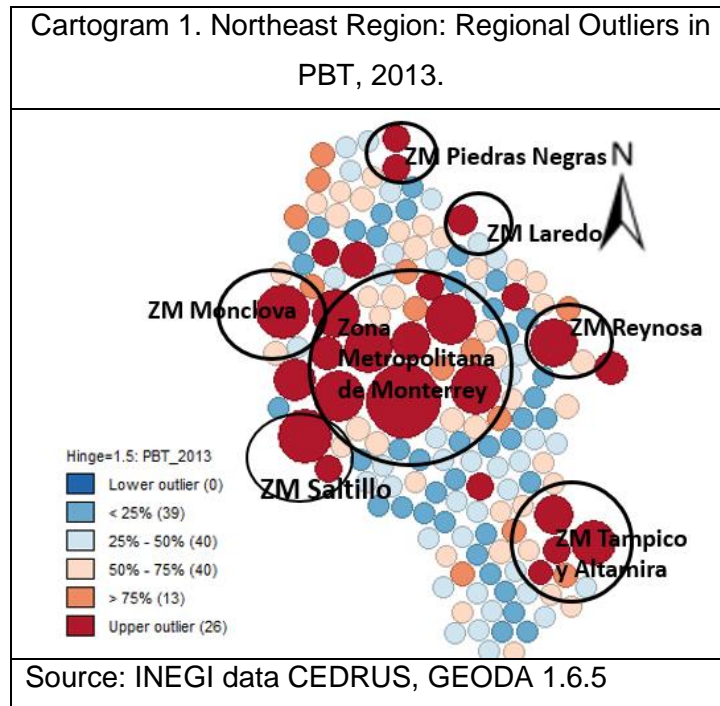
The cartogram 1 identifies metropolitan areas with extreme values where the metropolitan areas of Monterrey, Saltillo, Tampico, Altamira, Monclova, Reynosa, Laredo and Piedras Negras stands. Regionalization of Northeast Mexico through economic functionality, is established from the distribution of these metropolitan areas and city systems that concentrate economic activity and also for their communication networks and transportation routes. The influence inversely dependent on the distance and directly from economic and population size of the centers. So that larger and smaller distance is greater economic interaction. Moreover, there is an order by the hierarchy in the size of the centers, which according to its size the influence of the centers is greater. Economically, this is explained by economies of scale generated in production by size effect concentrated demand in this economic site and sites that are attracted.

Moreover, the structure and direction of the transport network corroborates the role of center or outskirts of the towns. So that if the transport network is converged at one point means it is a destination location and serves as the principal market and its catchment area is composed of the towns smaller than those from transport networks .

Then it proceeds to the index Reilly used to establish areas of influence. This rate determines the boundary point between two dominant sites, in which the influence of both is equal, is calculated by the expression:

$$D_A = \frac{D_{AB}}{1 + \sqrt{\dfrac{P(B)}{P(A)}}}$$

donde:
- D_A: Distancia de la ciudad A al punto de indiferencia
- D_{AB}: Distancia entre las ciudades A y B
- $P(A)$: Población de la ciudad A
- $P(B)$: Población de la ciudad B.

Ciudad A
P (A)
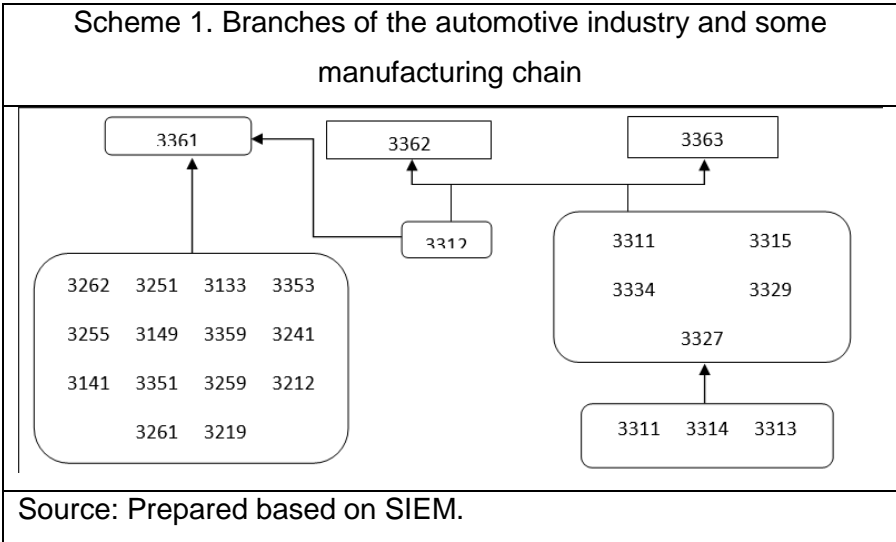
D_A

Punto de indiferencia

Ciudad B
P (B)

Of the 29 metropolitan areas and cities that account for more than 85% of employment, 92% of value added and 76% of the population of the northeastern region you can locate the various urban locations connected by their transport networks as federal highways, state and railway lines, highlighting the urban sprawls of Monterrey and Saltillo in the central part of the study region, Reynosa, Matamoros and Nuevo Laredo in the northeast, Tampico in the southeast, Monclova and Piedras Negras in the north and northwest.

Map 5. NORTHEAST REGION: DEFINITION OF AREAS OF INFLUENCE OF MAJOR CITIES DISTRIBUTED.

Source: Made by myself.
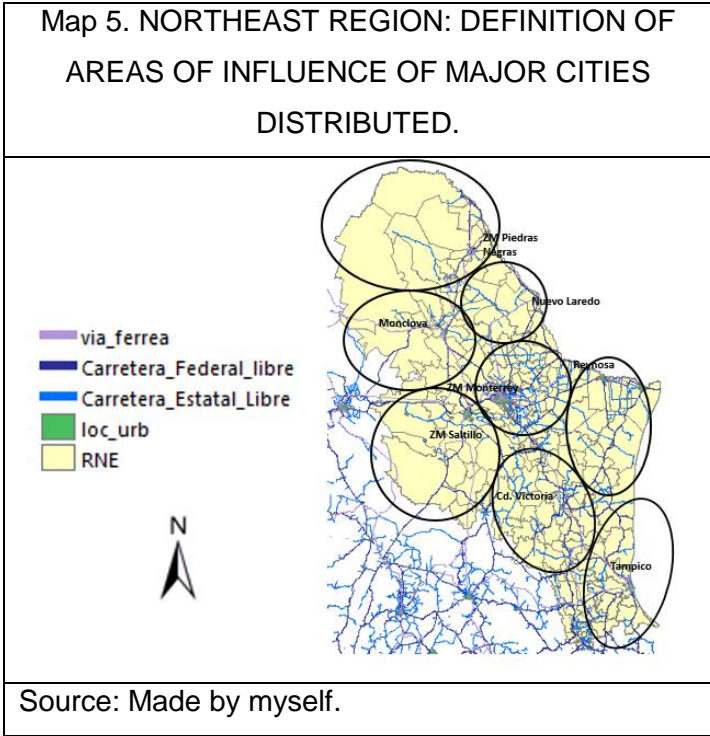
From establish those areas of territorial influence of the mentioned economic centers 8 Space Units Economic Functional (UEEF) were calculated in the Northeast Region which will set the analysis of each in order to identify specialization in the regional automotive industry.

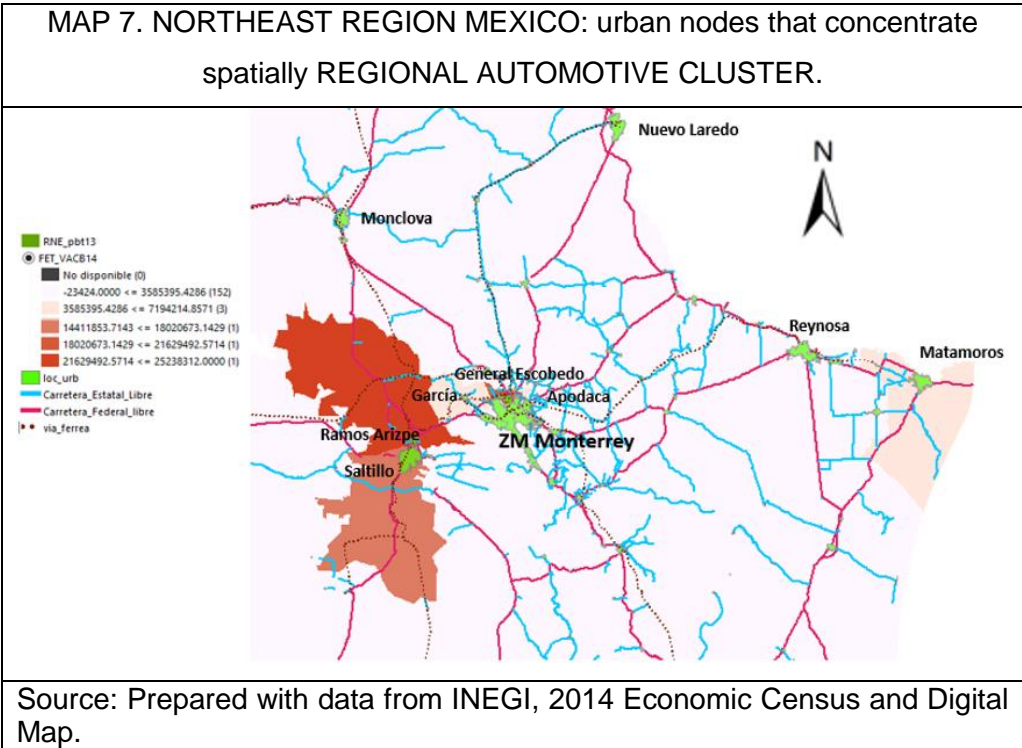Map 6. Northeast Region: Spatial Economic Functional Units (UEEF).

Source: Made by myself.
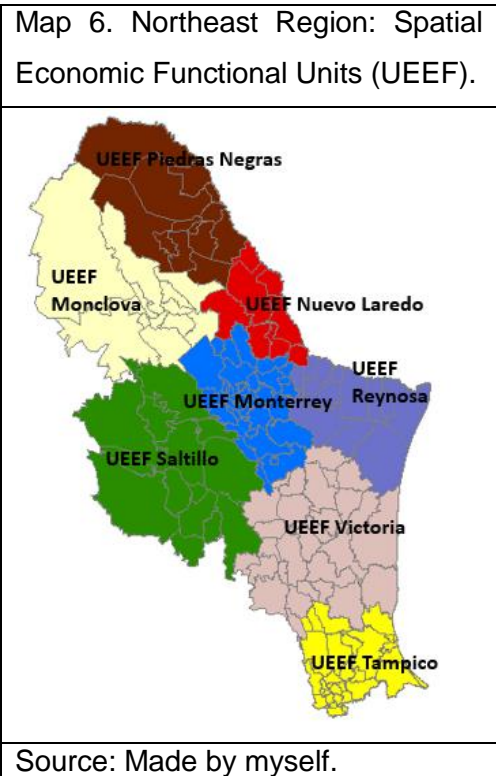
For analysis of the automotive chain branches are as follows:

Scheme 1. Branches of the automotive industry and some manufacturing chain

Source: Prepared based on SIEM.

Functionally, to see the degree of interaction between these cities and in order to ascertain the degree of representative flows in the automotive industry in the northeastern region of Mexico internal functional regions are, through the gravity model.

Using data from the 2014 census, you can see the concentration of branches related to the automotive industry, which are 3361 Manufacture of vehicles and trucks, 3362 Manufacture of Trailers and Bodies, 3363 Manufacture of vehicles and 3369 Manufacture of other equipment Of transport. The following map shows the regional automotive corridor:

MAP 7. NORTHEAST REGION MEXICO: urban nodes that concentrate spatially REGIONAL AUTOMOTIVE CLUSTER.

Source: Prepared with data from INEGI, 2014 Economic Census and Digital Map.

In this map various aspects are detailed, the first of which is that it is obviously an automotive corridor starts from Saltillo, passing Ramos Arizpe, followed by Garcia, General Escobedo and Apodaca, these three municipalities in the metropolitan area of Monterrey, and Matamoros. This municipality and urban area, does not have a neighborhood or spatial contiguity with the automotive corridor mentioned in the region, however, transport networks (road and rail) connecting the automotive corridor Saltillo to Apodaca is the same as connecting with Matamoros and other border urban areas like Reynosa and Nuevo Laredo. Matamoros shows a certain degree of concentration, which, being a border point, may be the last link in the regional automotive chain for export.

An analysis of sectoral-regional and identification of production centers[4] for the automotive industry concentration has the following regional demarcations such as concentrating the regional automotive production chain:

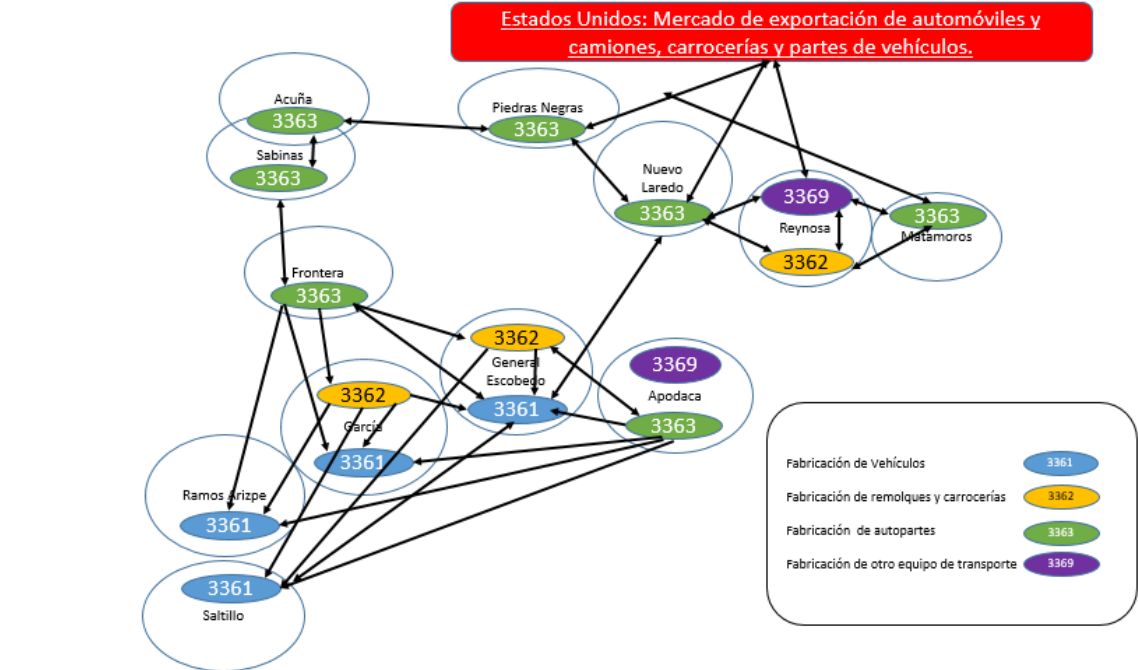| Municpios	CEPO	ICE_PO14	ICE_VA14
05002 Acuña	5.9	2.10%	2.60%
05010 Frontera	4.2	0.93%	1.25%
05025 Piedras Negras	2.9	2.00%	3.19%
05027 Ramos Arizpe	4.4	2.59%	26.23%
05028 Sabinas	2.9	0.70%	0.65%
05030 Saltillo	1.4	6.32%	17.77%
19006 Apodaca	1.8	5.83%	7.01%
19018 García	3.2	0.97%	6.03%
19021 General Escobedo	1.7	2.30%	21.43%
28022 Matamoros	2.6	4.66%	4.14%
28027 Nuevo Laredo	1.1	3.10%	1.70%
28032 Reynosa	1.1	6.99%	1.93%
Criterios	1	0.63%	0.63%
Fuente: Elaboración propia con base en INEGI, Censos Económicos, 2014.			

The 12 districts together account for 38% of employment in all sectors of the northeastern region, but regional automotive industry account for 85% Economic Census data 2014. In terms of value added, the 12 demarcations conjoined 36% of the total regional economy northeast, but 94% of automobile production in the region in 2014. of the four branches being considered in this section, the 12 districts account for almost 100% of employment in manufacturing vehicles and trucks in the northeast region; 53% of the manufacture of trailers and bodies, 84% of the manufacture of parts for vehicles and 98% of the manufacture of other transport equipment.

Seeing the geography of the distribution of the main links in the automotive supply chain there are two interesting aspects: the first is that in terms of spatial agglomeration, vehicle production is given in the corridor forming Saltillo-Ramos Arizpe -García-General Escobedo-

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[4] For this analysis is taken as criterion those districts that meet the condition: Index of Economic Concentration (ICE)> the regional average μ and coefficient of Specialization in Employment (CEPO)> 1.

Apodaca, and these same companies are present demarcations of the four branches directly associated with the automotive industry, and are in fact, in terms of what it means cluster[5]. On the other hand, there is a network of urban nodes and cluster spatially separated demarcations and is formed by providing terminal branches of the automotive industry, predominantly automotive parts manufacturing (3363). These specialized demarcations in automotive proveeduría probably associated with the export market and not the regional cluster of vehicle production.

SCHEME 1: NORTHEAST REGION OF MEXICO: MEXICO: NETWORKS AND BRANCHES FLOWS ASSOCIATED EQUIPMENT MANUFACTURING AUTOMOTIVE TRANSPORT BETWEEN MAJOR URBAN REGIONAL NODES.
Source: Made by myself.

True flows are observed with the multiregional input-output analysis. By now you can see that the industrial activity related to the automotive industry in the northeastern region of Mexico makes interact inside in 6 UEEF of the 8 that constitute it.

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[5] A group of motor and suppliers that are grouped in order to achieve increasing returns to scale to reduce transportation costs, dissemination of knowledge and technological innovation, a specialized labor market, among other benefits

NORTHEAST REGION MEXICO: THE INTERACTION OF BRANCHES AUTOMOTIVE BETWEEN ECONOMIC SUBREGIONS (UEEF).								
	PURCHASES							
UEEF	Saltillo	Monterrey	Reynosa	Nuevo Laredo	Monclova	Piedras Negras	Otras Regiones	Resto del mundo
Saltillo	3361	3361	3361	3361	3361	3361		3361
Monterrey	3361, 3362, 3363, 3369	3362, 3363, 3369	3361	3361	3361, 3362.	3361		3361, 3362, 3363, 3369
Reynosa		3362, 3363, 3369	3363, 3369	3362, 3369		3362, 3369		3362, 3363, 3369
Nuevo Laredo		3363	3363	3363		3363		3363
Monclova	3363	3363	3363		3363			3363
Piedras Negras				3363	3363	3363		3363
Otras Regiones	3361, 3362, 3363, 3369	3361, 3362, 3363, 3369	3361, 3362, 3363, 3369	3361, 3362, 3363, 3369	3361, 3362, 3363, 3369	3361, 3362, 3363, 3369	3361, 3362, 3363, 3369	3361, 3362, 3363, 3369
Resto del mundo	3362, 3363, 3369	3361, 3362, 3363, 3369	3361, 3362, 3363, 3369	3361, 3362, 3363, 3369	3361, 3362, 3363, 3369	3361, 3362, 3363, 3369	3361, 3362, 3363, 3369	3361, 3362, 3363, 3369

(Row label: SALES)

Methodology for the construction of input-output matrices subregional or multi UEEF.

For this methodology a series of steps that allow obtaining input-output tables by subregion contained in northeastern Mexico are followed. This methodology is explained by 4 large stages, and these in turn into phases, which are detailed below:

Stage I: Construction of matrices by UEEF.

Phase 1. Establishment of regional accounts of northeastern Mexico, for the formation of a multisubregional input-output matrix.

Given the importance of knowing the generated economic aggregates and balances within national and state boundaries arises the need to establish a system of economic accounting that allows to see the sectoral and productive interactions from a regional dimension, under a functional economic criteria. It is part of the accounting identity of production-income-spending[6].

In Mexico only it has national information but has state information of gross domestic product, which can be made estimates of income and expenditure. These estimates can be transferred to the municipal level via the Economic Census to account activity establishments.

Through a system of regional accounts the basis for the creation of components supply and use tables of production is established, which later will be the basis for regional input-output matrix.

System of regional accounts.

The main difference of the system of national accounts and regional accounts is precisely that in the latter prevails an open economy where no tax or trade barriers are given but the flow of goods, money, labor and financial are given without regulation as would between countries. They can establish a simplified diagram of the regional accounting accounts with only 4, taken from Asuad (2001) which is detailed below:

I.	Product Account.
II.	Income and Expenditure Account.
III.	Savings and investment account
IV.	Account of the rest of the country.

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[6] In Mexico only it has national information but has state information of gross domestic product, which can be made estimates of income and expenditure. These estimates can be transferred to the municipal level via the Economic Census to account activity establishments.

To calculate the production account of goods and services locally generated as a result of the use of resources, the source of which are derived from consumer spending of households, businesses and government (C), local investment (I), are taken into account sales outside the region (X) and regional purchases abroad (M). So the following expression simplifies the above:

$Y = C + I + X - M$

Then accounts are as follows:

Product Account.		Income and Expenditure Account.	
Applications	Sources	Applications	Sources
Y (Product)	C (Consumption of families, businesses and government)	C (Consumption of families, businesses and government)	Y (Product)
	I (Local investment)	S (personal savings and government)	
	X (Exports from the region)		
	M (Imports)		

Under this scheme it can be seen that the product is less than the consumption and investment and that imports may be higher than exports. Production generates an income that is consumed i and the difference between the two results in savings:

$Y = C + S$

$S = Y - C$

In the above equations it is assumed that all income is consumed, and if not saved [7].

On the other hand, the product and spending financed by funds of the town or the rest of the country, with the other two emerging regional accounts:

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[7] In this simplified version taxes, transfers and spending of the federation are abstracted.

Savings and investment account		Account of the rest of the country.	
Applications	Sources	Applications	Sources
I (Local investment)	S (personal savings and government)	X (Exports from the region)	M (Imports)
IR (Investment rest of the country)			IR (Investment rest of the country)

The regional funding comes from two uses: local investment and the rest of the country as well as local savings, under this the following identities are given:

$I = S$

Where investment equals savings.

$I = IR + I$

When $I > S$ is flows from outside of the region and this leads to the following identity:

$I = S - IR$

The account of the rest of the world can see the interaction between the region and the rest of the country through exports and regional imports. Of the foreign exchange earned by exports are financed imports and investments in the rest of the country are made, so it results in the following equations:

$X = M + IR$ O well

$IR = X - M$

This means that the positive balance of regional trade $(X > M)$, own regional investment funds. Otherwise $(X < M)$ the region will be financed by inflows from the rest of the country.

All the above scheme is applied to each of the UEEF that make up the northeast region. accounts are taken from the 2014 economic census INEGI and from the information we have at the municipal level for each total subregion are conjoined. 8 UEEF accounts that make up the region.

Therefore you have the accounts of the region and each of the subregions.

This is passed to Phase 2, which is part of an estimate of the regional Final demand sectors. Once the regional accounts were estimated you have the variables that form the components of final demand. Production account can be obtained consumption (which groups the expenses of families, businesses and government final consumption goods), which was obtained by differences in local investment, exports and local imports[8].

In phase 3, the relative location coefficient and the weighting factor is estimated size. For this purpose the intermediate consumption taken by industry, placing the relative concentrations of each. In turn, the relative specialty in gross production and added value is analyzed. The coefficient obtained is represented by λ. In a step 4, with the coefficients of sectors obtained Its generated a matrix wich multiply crosswise these coefficients for each sub-sector, by multiplying each element of the element rows for each column is generated. Subsequently, in Step 5, the production multiply the value of cross coefficient for every subsector of activity and values of the coefficients of the main diagonal are replaced by weighted coefficient corresponding size. Already in phase 6 the highest values are converted to 1 to this value to estimate the distribution of purchases by subsector, according to the methodology of the coefficients crossed.

In stage 7, the demand is multiplied for the coefficients to obtain the distribution of production by sub-sectors of economic activity. In Phase 8 technical coefficients are obtained through participation of all inputs of each subsector between total inputs purchased from other subsectors.

In phase 9 intersectoral transactions matrix is obtained by multiplying the technical coefficient for gross output. For phase 10, the value of gross output is estimated on the side of sales and purchases.

Stage II: Analysis of purchases and sales by UEFS

In Phase 1, the global spatial dependence between subregions Moran is analyzed to establish the spatial association between sectors of economic activity UEEF. Later, in a

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[8] Value Added estimates of each state through the 2014 economic census, disaggregated at the municipal level and by economic branch were obtained, and considering only those in sectors 21, 31, 32 and 33; the index of economic specialization is estimated. Later the export base is calculated, which should contain only positive values, so it is purified of negative values. They total is the export base and shares of totals are obtained export base. a matrix is generated with the total amounts of state exports by subsector and said matrix of shares multiplied by the matrix of export amounts.

phase 2 economic specialization pair of UEEF is discussed and this is the basis for Phase 3 in which buyers and sellers are identified by UEEF, where the criterion is that the highest score of the coefficient of economic specialization is equal a seller.

In Phase 4 distribution tables are produced per pair of UEEFs sectors of economic activity and analysis of their holdings.

For Phase 5, the spatial dependence analysis is performed to determine the interactions of buyers and sellers sectors of economic activity between UEEFS by applying local Moran index.

Phase 6, the matrix is multiplied by the shares of Moran Index to determine the size and importance of purchases and sales between sectors of economic activity UEEFs analyzed.

Stage III: Estimation and balance of flows between UEEFS sales and purchases by the method of RAS.

This stage consists of a single stage in which through the computer program R, RAS technic is applied to obtain regional arrays and matrices resulting Morán Index.

In this procedure, the R program makes an estimate of the flow of sales and purchases between sectors based vectors adjustment such as intermediate consumption and Intermediate demand of each subregion Northeast Mexico. After 71 intersubregional interactions matrices relations were thrown.

MULTISUBREGIONAL OF NORTHEST OF MÉXICO.								
UEEF Laredo	Iv12	Iv13	Iv14	Iv15	Iv16	Iv17	Iv18	Iv19
Ic12	UEEF Monclova	Iv23	Iv24	Iv25	Iv26	Iv27	Iv28	Iv29
Ic13	Ic23	UEEF Monterrey	Iv34	Iv35	Iv36	Iv37	Iv38	Iv39
Ic14	Ic24	Ic34	UEEF Piedras	Iv45	Iv46	Iv47	Iv48	Iv49
Ic15	Ic25	Ic35	Ic45	UEEF Reynosa	Iv56	Iv57	Iv58	Iv59
Ic16	Ic26	Ic36	Ic46	Ic56	UEEF Saltillo	Iv67	Iv68	Iv69
Ic17	Ic27	Ic37	Ic47	Ic57	Ic67	UEEF Tampico	Iv78	Iv79
Ic18	Ic28	Ic38	Ic48	Ic58	Ic68	Ic78	UEEF Victoria	Iv89
Ic19	Ic29	Ic39	Ic42	Ic52	Ic62	Ic79	Ic	Resto del País
Own calculations. Based on the application of the RAS method with data from INEGI 2014 Economic Census. Mexico.								

UEEF = Economic Space-Functional Units

Ic = Interactions shopping

Iv = Interactions sales

Stage IV: Estimation of multi matrix –UEEF

At this stage it is possible to observe the interactions not only intrasubregión but the interaction between sub-regions and identify the movements of any element of the final demands affect each sub-sector in spatial terms. Hence it is possible to see the direct, indirect and total impacts on production linkages in any given subregion any variation in final demand of said set of subregions.

Having an input-output matrix of the UEEF that make up the northeast region of Mexico and its relationship with multisubrregional the same territory is possible to do linkages conventional analysis. Among the methods for analyzing chain considered classic, Chenery and Watanabe must (1958), which proposed coefficients from which the existing linkages between different sectors of an economy are determined.

These criteria are based on two types of linkages: backward linkages measure the ability to drag a sector directly related with it, demand for intermediate goods, then an exogenous shock stimulates the activity of these sectors. The forward linkages measure the ability of a sector to encourage others by their supply capacity or another way to serve as an input into other sectors. The work of Chenery and Watanabe (1958) proposes direct indicators to calculate backwards and forwards easily through the means of purchases and sales of Input Output matrix.

Considered most relevant chains which have effects above average. The formulas for obtaining these coefficients are as follows expressed in relative terms to facilitate comparison between different situations:

$$BL^{CH-W} = i'A/((i'Ai)/n) \qquad (1)$$

$$FL^{Ch-W} = Ai/(i'Ai) \qquad (2)$$

Where I` is a matrix row with values equal to unity, A is the matrix of technical coefficients and i is a column matrix with values equal to one. By BL denote backward linkages (backward linkages) and FL (forward linkages) forward linkages, the superscript refers to the methodology for determination. These coefficients only to quantify the direct

relationships between the branches, because, as noted used for its calculation, the matrix of technical coefficients.

The typology of Chenery and Watanabe, of sectors that can be found in a certain economy:

	$BL^R < 1$	$BL^R > 1$
$FL^R < 1$	independent sectors	Drivers of the economy sectors
$FL^R > 1$	Base or strategic Sectors	Key sectors

In strategic sector or base scattering power is less than the average sensitivity and greater than the average absorption. The sectors with strong drag or drivers of the economy demand intermediate inputs from other sectors, highlights, therefore, due to the stimulus generated in the production of intermediate goods. Independent sectors or islands are generally unattractive, as they cause less impact on the economy because development does not affect too much the sectors that demand their products, or those who employ them as intermediates . Key sectors have called a backward and forward over the average.

Obtained exploration results of the analysis of production chains in the automotive industry in the region is, according to Chenery and Watanabe for three types of regional and sectoral relations: Intra-regional regions of Saltillo and Monterrey, and the case of the inter-relationship between the two sub-regions in same industry.

Case 1: Saltillo.
In the case of the subregion of Saltillo, it begins with the analysis of the chains of the automotive industry. A general analysis of the subregion UEEF Saltillo is that 15 out of 25 branches of the automotive chain are in the category of independent economic activities, no chains backward or forward, which puts as economies of regional enclave. Among these, it is the manufacturing sector of trailers and bodies (3362).

You can see that the branches that make up the manufacture of transport equipment, related to the automotive industry, like making cars and trucks (3361) and manufacture of auto parts (3363) turn out to be economic activities with strong drag in the region all once they demand a lot of input in the region.

TYPES OF CHAINS IN UEEF SALTILLO		
	$BL^R < 1$	$BL^R > 1$
$FL^R < 1$	3362, 3133, 3141, 3149, 3212, 3219, 3262, 3311, 3313, 3315, 3327, 3329, 3334, 3351, 3353.	3361, 3363, 3312,
$FL^R > 1$	3255, 3259, 3261, 3314, 3359,	3241, 3251,

Among the branches that are key, with backward linkages and forward, are the manufacture of petroleum products (3241) and manufacture of basic chemicals (3251).

The conclusion to this region in the automotive industry is that apparently the branches that form a strong link between suppliers in the region, except the manufacturer branch bodies and trailers (3362), pointing to the tendency to an enclave in this activity. On the other hand, the branch of automotive parts (3363) while buying local inputs not listed as a strong supplier of the terminal automotive industry (3361), which reveals a possible break in the most significant link in the automotive production chain region.

Case 2: Monterrey.

For the subregion Monterrey UEEF a more pronounced tendency branches of the automotive chain unlinked with the rest is shown, being 18 of 25 branches in the category of independent economic activities or enclave. This category is rehomed the manufacture of bodies and trailers (3362).

Among the sectors with strong regional inputs drag is making cars and trucks (3361), together with the manufacture of iron and steel (3312). In this subregion the auto parts manufacturing branch (3363) is among the key branches of many chains backward and forward, along with the manufacture of petroleum products (3241) and manufacture of basic chemicals (3251).

TYPES OF CHAINS IN UEEF MONTERREY		
	$BL^R < 1$	$BL^R > 1$
$FL^R < 1$	3141, 3149, 3212, 3219, 3255, 3259, 3261, 3311, 3313, 3314, 3315, 3327, 3329, 3334, 3351, 3353, 3359, 3362.	3312, 3361,
$FL^R > 1$	3133, 3262,	3241, 3251, 3363

Unlike grounds for Saltillo, the only substantive branch in the automotive industry in the UEEF Monterrey has strong purchases input is properly the assembly of trucks (3361), but the manufacturer parts (3363) is listed as strong supplier, so we can see a more chain integrated in the most significant link in the automotive industry in the area of influence of Monterrey.

Case 3: Interregional Monterrey-Saltillo.

On the other hand, it is of particular interest to see the degree of articulation between two UEEF that concentrate the activity of the automotive industry such as Saltillo and Monterrey and try to establish preliminarily industrial complementarity in this sector.

In terms of economic relationship it is possible to see a similar trend in the relationship between the two UEEF that particular way. 17 of 25 branches of the automotive chain are as separate activities or branches that are not linked to the regional economy by buying inputs or being suppliers of raw materials. None of these is a substantive branch of the automotive industry.

The manufacturer branch trucks (3361) is between Saltillo and Monterrey UEEF activity strong chain backwards for being a driving and demanding regional inputs sector. In parallel, the manufacturer of trailers and bodies (3362) and autoparts manufacturer (3363), both branches are strong UEEF activities supply of inputs. This can be a complementary and strong chain between substantive branches of the regional automotive industry automotive industry, however it might assume that the core of the automotive industry, comprised of these three branches mentioned, serve as a conglomerate of activities integrated but turn separated from other manufacturing activities associated with the automotive supply chain.

TYPES OF CHAINS IN INTERREGIONAL UEEF SALTILLO-MONTERREY		
	$BL^R < 1$	$BL^R > 1$
$FL^R < 1$	3141, 3149, 3212, 3219, 3255, 3259, 3261, 3311, 3313, 3314, 3315, 3327, 3329, 3334, 3351, 3353, 3359	3312, 3361
$FL^R > 1$	3133, 3262, 3363	3241, 3251.

CONCLUSIONS:

This work establishes a different methodological proposal in several respects regional analysis of input conventional product, since part of an economic-functional approach, establishing patterns of areas of economic and demographic influence of urban nodes in the system of cities the northeastern region of Mexico, which is a more attached to reality and not as those who make a regional division with political or administrative boundaries criteria. Therefore, this is already innovative.

On the other hand, it can be seen that it is possible to derive a system of regional accounts that supports a framework that allows the construction of matrices of input-output regional from a very high percentage of information "from below" as are the Census 2014 economic data available at the level of municipalities and by economic activity. While there are limitations to complete all variables in some economic activities this if it was possible for the automotive industry and the manufacturing industry as a whole because census information is taken from formal establishments so it is not needed to complete additional data or estimates.

The methodology of the construction of the matrices input-output included estimates "from above", especially for the construction of regional accounts production and exports and imports and balance of trade flow, which is continuing to work on new proposals to estimate regional data to assess the regional reality. Despite these conditions, this article achieves significant progress in building regional input-output matrices and although perfectible aims to establish a route to the regional development methodology from the region.

Regarding the results, you can see two aspects: the first is that methods like RAS were used to estimate with a high degree of reliability estimators a multisubregional matrix designed to show a more attached to the local reality economic structure and which corroborates the importance of sectors such as the automotive industry, which is the engine of the local economy, however, also it corroborates the hypothesis that the chain in this industry presents limitations for comprehensive regional joint. In the particular case and exploratory presented in this document, only the two sub-regions with the highest concentration as are the UEEF of Saltillo and Monterrey are analyzed. They articulated an auto industry with its supplier branches top level but with strong industries unchainings with second-tier suppliers and are the originating or regional capital companies, unlike the first ones that are transnational in nature is presented.

This analysis should be complemented by observing the chains of the other subregions that have significant presence in the branches of the automotive industry and its relationship also with the same branch from the other regions of the country

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