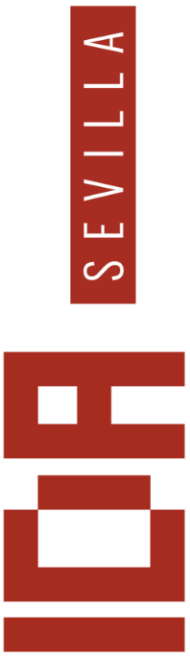

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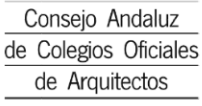

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LT 2

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URBAN ECONOMY AND SPACE CONFIGURATION AS A CONSTRUCTION OF CONTEMPORARY CITY DYNAMICS

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Abstract: This work is a part of a doctoral work that focuses on quantitative data of the urban economy that, being statistically validated, allow the representation and explanation of certain phenomena in the cities, such as concentration, dispersion or new centralities in territorial processes. The study has other aspects worthy of being analyzed as the territorial fragmentation or the social inequality united to the spatial configuration like a spatial configuration of the cities.
The linkage of urban planning, or more recent sciences of the city, with other disciplines such as statistics, sociology, economics, among others, allows to approach the construction of new visions on the territorial space and to determine significant patterns that help to understand a complex phenomenon within the city and its spatial behavior, so this work aims to generate a Multivariate Analysis to measure the most influential Economic Activities in Xalapa City to be able to highlight the special patterns that shape their dynamics.
The Multivariate Analysis is a statistical technique that allows to relate and obtain dependencies on the variables of interest and with this to be able to elaborate maps that allow to explain the spatial dynamics of a city, in this case, the flows and concentrations of the work units to determine the function of a city, with the aim of generating a model that represents the variables, which is validated and can be explained graphically

Key Words: Urban Economics, Spatial configuration, Contemporary City.

1. Introduction

Over the years, architects have sought not only the delimitation of spaces as part of architectural projects but also the organization of spaces within a territory that are in keeping with the new demands of contemporary living, as part of a professional work to provide our societies with the quality of life that by right has.
From the city planning letter, better known as "The Athens Charter" (1931), which exposes and proposes the creation of an orderly city, conformed by a progressive urban model, research and treaties have been developed to try to analyze, explain and understand the city in an appropriate way, as well as models have been proposed to outline the different ways in which the contemporary city evolves.
The contemporary city reflects a large number of relationships between people and economic flows, presented and distributed in territorial (spatial) growth to represent its dynamics, but the following questions arise: What are the interactions that have both concepts? How much do these concepts interpret to the contemporary city that contains them? How are the economic spaces structured in the city? Or What are the paradigms necessary to obtain a contemporary representation of the contemporary city from different disciplines?
Given these dilemmas it is clear that the union of different paradigms is needed through some disciplines that manifest a more concrete reality to explain the city. There is no knowledge if one does not question the seemingly antagonistic methodologies; while society allows for evaluation based on sociological, philosophical and psychological theories and assumptions, population, economic, and spatial growth can be estimated by more accurate sciences such as geography, statistics, or economics. Finally, in a problem, to generate dialectical models when the processes and phenomena that interact in the city come from qualitative and quantitative models of opposite form, but in turn this rupture is detonating to carry out an intellectual

exercise of analysis that allows us to approach to represent the dynamics of the city under sociological, economic and spatial paradigms.
This paper aims to answer the questions presented previously. It is opportune, in the first instance, for the unification of some paradigms that could be fragmented for the territorial analyzes of the cities. In the contribution to knowledge is intended to open different veins in the complement of urban, social, methodological, statistical, economic and geographical sciences as an interdisciplinarity that can approach an objective and global vision. For this, it is necessary to contextualize a case study that allows validating the theories and postulates already exposed by scholars of the subject to see the compatibilities to that city, nevertheless there is the intellectual purpose to continue contributing other methodological views little explored for the current issues and that arise from particular case studies in an inductive manner.
In a second instance, it is important to emphasize that, by understanding and explaining in a complex way the dynamics of a city, concrete problems can be evidenced and exemplified in order to form and lay the foundations for action appropriate adjustments to existing urban development plans.
It is not possible to act from the political, social, urban, economic, etc. perspectives, if one does not understand the situation in which a city is placed, for that reason it is necessary the approach of models that explain the behaviors of the city and that, in turn, these allow to promote and activate economic developments, market studies, impacts and feasibility and that society presents a better quality of life.

2. Approach

Any settlement creates a systemic network that functions as a vector structure for the sustainability of the city. If these nodes are seen as a set of relations in which the elements of the structure are interdependent with each other (autonomous), but a variation of one of them has an impact on the others, the importance of the development of economic activities for the development of localities (Leff, 2011).
In this regard, Cuadrado-Roura & Fernández Güell (2005) refer that the analysis of cities as functional economic systems cannot ignore the existence of the metropolitan phenomenon, given the complexity and relevance it brings to contemporary economies. Economic activity then becomes an important element for the development of cities as, by making introspection from the structuralist point of view, the population node allows linking with other nearby localities, which in turn form a network system which provide the elements that make the city work. These systemic relations that move the dynamics of a city is reflected when the characteristics and variables of its inhabitants and workers are crossed.
Placing structuralist thinking as an economic current, especially in Latin America, part of the way in which the capitalist economic system works tries to evaluate changes in the structure that foster lack of development in regions or cities.
It is necessary to start from the fact that cities grow due to the phenomena that are setting the stage for their development. The rhythm and dimensions in which the urban centers are increased are the result of changes that directly affect the spatial configuration. Some of the most relevant complications are: New patterns of urban and regional development, emergence and consolidation of global cities, dispersion versus spatial concentration of productive activities (apparently contradictory), new organization of the city system, physical-spatial reconfiguration of the metropolis by the productive processes and the increasing awareness of the necessity of a more sustainable development. (Rojas, Cuadrado-Roura, & Fernández Güell, 2005, pp. 70-71).
In the contribution to knowledge is intended to open different veins in the complement of urban, social, methodological, statistical, economic and geographical sciences as an interdisciplinarity that can approach an objective and global vision. For this, it is necessary to contextualize a case study that allows validating the theories and postulates already exposed by scholars of the subject to see the compatibilities to that city, nevertheless there is the intellectual purpose to continue contributing other methodological views little explored for the current issues and that arise from particular case studies in an inductive manner.
Xalapa City is not exempt from all of these problems and in 2015, along with 12 other cities, it will seek the ISO 37120 (International Organization for Standardization) certification granted by the Global Organization of Cities Indicators (GCIF) with the objective of generating public policies and generate greater competitiveness and better infrastructure, as well as growth and

social welfare. Some cities that already possess with this certification are Boston, Buenos Aires, Sao Paulo, Bogota, Barcelona, London, Dubai, Guadalajara and Shanghai.
Based on the dynamics of the city is determined by the economic activities produced by the population of Xalapa, the objective is to analyze the relationship between the Occupied Personnel and the Economic Units in the internal dynamics of the city of Xalapa in an established period of 2010 from the Geostatistical approach, not without first examining the arithmetic and geometric behavior of the Urban Structure of Xalapa, to establish the spatial behavior of the concentrations of Economic Activities and the concentration of Occupied Population in the city of Xalapa and with that to be able to compare structures of Economic Units and Occupied Population define the dynamics of the city through its morphology.

3. Methodology

In order to achieve this objective we first obtain the necessary variables that explain the problem of seeing the dynamics of the city through Economic Activities and Occupied People and analyzed a relationship that allowed us to describe the behavior of the city. The city of Xalapa was analyzed taking as base the Basic Geostatistical Unit (AGEB), which according to INEGI (2010), is the territorial extension that corresponds to the subdivision of the municipal Geostatistical areas. Urban AGEBS is a geographical area occupied by a set of blocks perfectly delimited by streets, avenues, walkers or any other feature easily identifiable in the land and whose land use is mainly housing, industrial, services, commercial, and so on. are only assigned to the interior of the urban localities.
It is important to take into account that this division of AGEB allows to study them as if they were the "statistical subjects", that is to say the individual i, which will be measured their characteristics j of employment divided into economic and demographic variables. This will give a panorama of the phenomena, relations, patterns or structure of the behavior of Xalapa at interurban level, that goes from the statistical (numerical) level to the (geometric) level represented in maps.
It is necessary to emphasize that the elements observed were initially N = 171; that is to say, the total of the AGEB of the municipality taking into account the castle, Santa Bárbara, Lomas Verdes and Fraccionamiento The sources also belonging to Xalapa. From this total only a sample of n = 137 was taken under the criterion of analyzing those AGEBs whose data are not protected and were registered by the National Institute of Statistics and Geography (INEGI).
In Fig. 1, the 137 AGEBs that are part of the sample are shown with blue color, while in the red color that AGEB were not part of this analysis due to lack of data in some items.

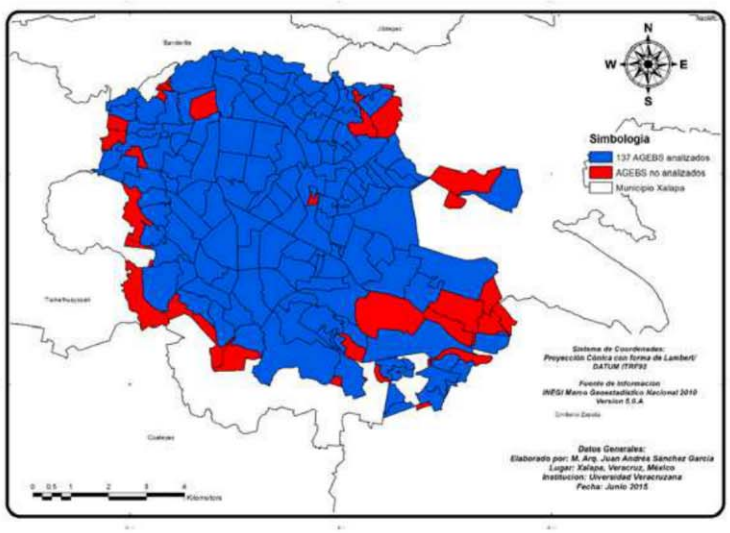

Fig. 1 This figure shows the distribution of AGEB analyzed and not analyzed in the study

In order to measure the characteristics of the AGBs, the census data were collected as a basis for data collection. Censuses allow us to analyze the behavior, over the years, of a particular population. The variables of economic activities are concentrated in a database developed by INEGI. To categorize these variables, a classification of categories has been made based on

the statistical definition proposed by Nelson (1995) to determine their functional specialization based on the Economically Active Population (PEA) and thus to appreciate the changes that the cities experience in their functions economically predominant.
Each economic activity takes place in an economic unit that can be an establishment to carry out the production or commercialization of goods and services. The database that was used is the one referring to the National Statistical Directory of Economic Units (DENUE) since it allows to have a count of the same in different areas of the geographical space.
The database was worked under the scheme of a data matrix. It is necessary to consider a data matrix of n individuals on which characteristics or variables are measured. Subsequently we must express xij as the measure of the characteristic j on the individual i to generate the rectangular array. Each AGEB is the i-th multivariate observation Xi = (Xi1, Xi2, ..., Xip) corresponding to the measurements in the p variables X1, X2, ..., Xp, for the i-th subject.
The information with which the analysis was carried out was taken from the National Institute of Statistics and Geography (INEGI), in which the variables were presented as follows:

Table 1 Variable Abbreviations Used in Analysis.

Variable	Abbreviation	Type of Variable	Scale
Economic Unit	UE	Discreet	Reason
Occupied Population	PO	Discreet	Reason
Economically active population	PEA	Discreet	Reason
Economic activity	AE	Discreet	Reason
Mining	MI	Discreet	Reason
Financial and Insurance Services	SFS	Discreet	Reason
Corporate	CO	Discreet	Reason
Electricity, Water and Gas Supply by pipelines to the final consumer	EAG	Discreet	Reason
Building	CT	Discreet	Reason
Manufacturing industries	IM	Discreet	Reason
Wholesale trade	CMA	Discreet	Reason
Retail trade	CME	Discreet	Reason
Transportation, Mail and Storage	TCA	Discreet	Reason
Information in Mass Media	IMM	Discreet	Reason
Real estate and renting services of movable and intangible assets	SIB	Discreet	Reason
Professional, Scientific and Technical Services	SCT	Discreet	Reason
Business support services and waste management and remediation services	SND	Discreet	Reason
Educational services	SE	Discreet	Reason
Health and social care services	SS	Discreet	Reason
Cultural and Sports Recreation Services, and other recreational services	SCD	Discreet	Reason
Temporary accommodation and food and beverage preparation services	SAA	Discreet	Reason

By their nature it is said that the variables are discrete since the data are counts of people or economic units within the AGEB, that is to say the measurement of the characteristics of the subjects. For the interest of the investigation variable responses and exploratory variables are presented from a sampling product.
Multiple Linear Regression is applied to study the possible relationship between independent variables (predictive or explanatory) and another dependent variable (criterion, explained, response). To use the multivariate analysis is necessary to have continuous variables since the results are expressed in decimals and it is not possible to have fractions of economic units or people analyzed. To solve this situation, the variables of counts are standardized, converting them to percentages

4. Analysis

The phenomenon studied is the behavior that the UE generate in the Population, that is to say that both a variable Y (dependent) advances with respect to the variables X (independent) that cause the observed relation. To describe the phenomenon it is necessary to point out that in a city people will have occupation as long as the number of economic establishments that allow to employ the individuals grows; otherwise, if there were not enough EU, the OP would decrease and increase the Unemployed Population (PD), its complement.
Based on the logic described above, the variable Y (dependent) would be the PO that would be described by each of the UEs that provide employment to the people of each AGEB, ie each of the X variables (independent) would contribute in In order to establish causality, the relationship between the regressor variables and the response variables is subject to the aforementioned logical idea and this model will confirm this cause-effect relationship given that the data are representative of the urban structure of the city.
Starting from the assumption of having 13 independent variables (UE) to explain a single dependent variable (Y), we opt to use the following model:

Equation 1. Multiple Linear Regression Equation:

$$Y_t = \beta_0 + \beta_1 X_{t1} + \beta_2 X_{t2} + \cdots + \beta_p X_{tp} + e_t; \quad t = 1, 2, \ldots, n$$

The hypothesis under which the model is constructed is that the Xs contribute significantly to explain the Y. This regression hypothesis implies the rejection of the null hypothesis, in favor of the postulated alternative (Ojeda Ramírez, 2000). the following way:

$H_0 : \beta_j = 0$ for j= 1, 2,3,…, p. (X_j doesn't influences)

vs

$H_a : \beta_j \neq 0$ for at least one j (X_j yes it influences)

This hypothesis is evaluated with the Analysis of Variance table evaluating the R2 and the p-value associated to the Fc, as well as the analysis of assumptions of homoscedasticity, independence and normality in the residues. When running the Regression analysis in the MINITAB 15 program, the following equation is obtained according to the least squares method that minimizes the sum of squared residuals:

Equation 2. Multiple Complete Linear Regression Model of the Occupied Population

PO = 0.351 + 0.0042 **SCD** - 0.0193 **TCA** + 0.0070 **SIB** - 0.0353 **IMM** + 0.383 **CME** + 0.0177 **CMA** - 0.0358 **SAA** + 0.117 **IM** + 0.00684 **EAG** + 0.0448 **CT** - 0.0444 **SND** + 0.0668 **SE** + 0.0102 **SS.**

From the above equation it is observed that some βi have a very small value with respect to the others and that multiply to the X (Type of Economic Activity); this suggests that some X variables do not contribute significantly to explain the value of Y, so it is necessary the analysis of results.

Table 2 Analysis of significant variables of the First Multiple Linear Regression of PO vs EU

Predictor	Coef.	Coef. de EE	T	P
Constant	0.35133	0.02687	13.08	0.000
SCD	0.00421	0.02587	0.16	0.871
TCA	-0.01931	0.01171	-1.65	0.102
SIB	0.00699	0.02206	0.32	0.752
IMM	-0.03528	0.01569	-2.25	0.026
CME	0.38302	0.04394	8.72	0.000

CMA	0.01770	0.01956	0.90	0.367
SAA	-0.03579	0.04244	-0.84	0.401
IM	0.11651	0.03224	3.61	0.000
EAG	.006843	0.005877	1.16	0.247
CT	0.04479	0.01588	2.82	0.006
SND	-0.04439	0.02381	-1.86	0.065
SE	0.06676	0.03211	2.08	0.040
SS	0.01015	0.01761	0.58	0.565

From the previous table we conclude that, with a confidence level of 95% (1-α) and a .05, the X values of CME, IM, CT, IMM, and SE are statistically significant for regressor variable, this based on the evidence of p-value. Evaluating the complete model of this Multiple Linear Regression we have the following results:

Table 3 Results of the Multiple Multiple Linear Regression Model

S= 0.178348	R^2= 78.6%	R^2 (ajustado)= 76.4%

A value of 78.6% was obtained which subtracts variability and explains in greater proportion the variability occurred in the variable Y explained by the model. This value yields a good model given that if the value of | R2 | is between 0.5 and 0.85 is a good model.

In the analysis of variance of the model we have the following results:

Table 4 Anova Table; Analysis of Variance of the First Linear Regression Model.

Source	GL	SC	MC	F	P
Regression	13	14.2896	1.0992	34.56	0.000
Residual Error	122	3.8806	0.0318	--	--
Total	135	18.1702	--	--	--

Taking into account the table above, the value P is focused, which, being close to 0.000, determines that the model is significant and there is statistical evidence to be able to reject the Ho and stay with the Ha to assert that $\beta j \neq 0$ for at least one and therefore Xj if it influences Y. To further adjust the Regression predictive model, the model is re-run only with the 5 X variables (CME, IM, CT, IMM, and SE) that were most significant and see if increases the level of the Determination Coefficient; therefore the Regression Equation is as follows:

Equation 3 Multiple Linear Regression Model of the Occupied Population with Significant Variables

PO = 0.352 + 0.370 **CME** + 0.117 **IM** + 0.0550 **SE** - 0.0512 **IMM**+ 0.0317 **CT**

Table 5 Analysis of significant variables of the Second Multiple Linear Regression of PO vs EU

Predictor	Coef.	Coef. de EE	T	P
Constante	0.35160	0.02565	13.71	0.000
IMM	-0.05118	0.01019	-5.02	0.000
CME	0.36964	0.04002	9.24	0.000
IM	0.11659	0.02882	4.05	0.000
CT	0.03174	0.01310	2.42	0.017
SE	0.05504	0.02256	2.44	0.016

De la tabla anterior se concluye que, con un nivel de confianza del 95% (1-α)% y un α de .05, todos los valores de las X son estadísticamente significativos para la variable regresora, esto con base en la evidencia del P-value.

Table 6 Results of the Second Multiple Linear Regression Model.

S= 0.1772	R^2= 77.5%	R^2 (ajustado)= 76.6%

Regarding model results, it can be observed that the variance of the MRLS with the significant UEs decreased very little with respect to the MRLS using all EU; the Determination Coefficient is also reduced in the MRLS with significant variables, however it must be taken into account that, although the Determination value is reduced, it is still a coefficient that conforms to a good model.

Table 7 ANOVA Table; Analysis of Variance of the second Linear Regression Model

Análisis de varianza

Source	GL	SC	MC	F	P
Regression	5	14.0844	2.8169	89.62	0.000
Residual Error	130	4.0859	0.0314		
Total	135	18.1702			

In the same way, when studying the analysis of variance, it is observed that the model has a value p = 0.000, so that it can also be considered a suitable and significant model. In this model comparison it is observed that, although the second reduces the Coefficient of Determination, both models are good; this decrease is due to the reduction of the number of variables, ie a similar coefficient was obtained with less than half of variables.

5. Results

As part of the objective of this work, the spatial distribution of the Multiple Linear Regression Model is mapped, that is, the behavior of the EU ratios taking into account the 5 significant variables and then compare them with the actual EU distribution. In the following comparison, it is shown that the spatial distributions form a very similar Urban Structure between the Real representation and the one made based on the MRLM, that is to say, similar patterns are observed that develop the concentrations and dispersions of UE in the City of Xalapa.
The MRLM allows you to see the relationship between the amount of UE and the amount of PO, in other words visualize what activity the people are working in the work sector. By means of a statistical model it is possible to appreciate numerically this relation but, as mentioned in the justification, it is necessary to value the city as a living being that has characteristics and that maintains a certain dynamism in its internal structure. Finally, it is necessary to compare the structure that was obtained from EU based on the MRLM with respect to the structure of the Occupied Population (OP), that is to say the form that presents Xalapa with respect to the areas where the people that are working in the EU. To do this, we compare the two distributions and analyze the flow that suggests when they are spatially correlated.

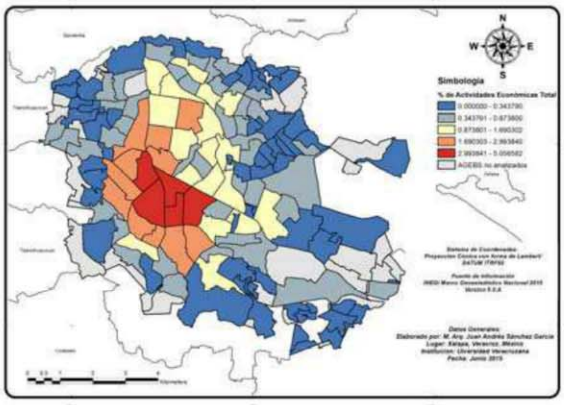

Fig. 2 Concentration of the Percentage of Economic Units in the Urban Structure of the City of Xalapa in 2010.

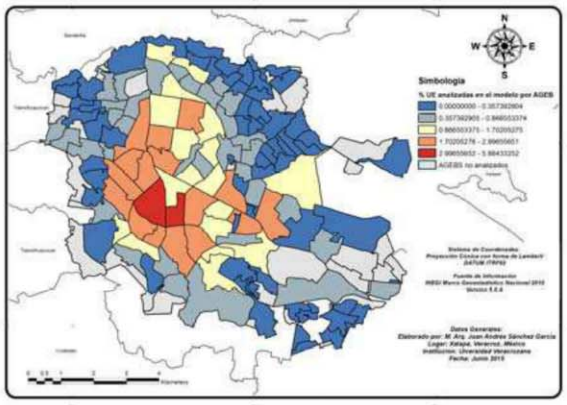

Fig. 3 Concentration of the Percentage of Economic Units in the Urban Structure of MRLM elaborated in the City of Xalapa in 2010.

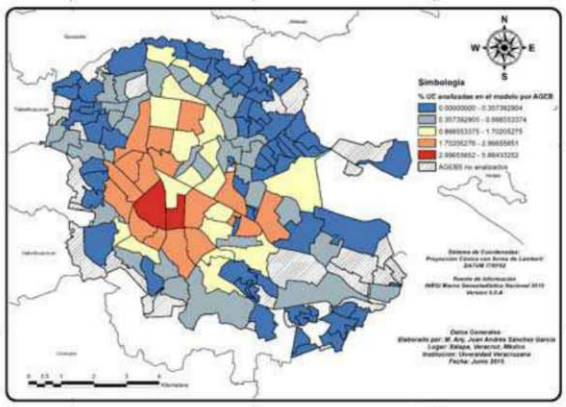

***Fig.* 4** Concentration of Percentage of Economic Units in the Urban Structure of the MRLM of the City of Xalapa in the year 2010 analyzed in table 4, and where the greater the greater the dispersion in the periphery and the greater concentration in the center.

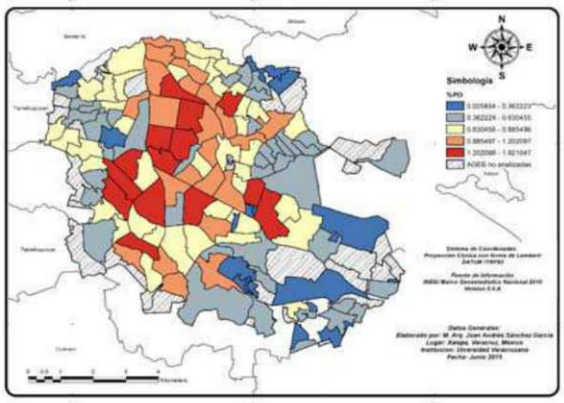

***Fig.* 5** Concentration of Percentage of Occupied Population in the Urban Structure of the City of Xalapa in 2010, where it can be seen that the highest concentration is in the center with a tendency to the north where the popular zone of the city of Xalapa.

Both configurations are compared in the figures; while figure 5 corresponds to the Occupied Persons (PO) concentration, figure 4 represents the concentration of the Economic Units (UE) that respond to the work source of the inhabitants of Xalapa. When viewing Figures 4 and 5, it is observed that they have different configurations and patterns; Figure 4 shows that EU concentrations are in the center of the city, while figure 5 shows that concentrations of PO are more dispersed with a tendency to the North and Northeast. This latter pattern is similar to that of CME because, as mentioned earlier, this type of AE is embedded in the housing sectors as a mixed housing morphology.

Seeing this separation from a dynamic perspective, the City of Xalapa does not respond to the principles of the Charter of Athens but has arguments that define and structure the City in Housing and Work Zones separately. By the type of variables it is complex to verify if the distance that people travel to get to their work is adequate because of this it is necessary to visualize it as components of a whole.

The important points of the relationship between EU and PO statistically fluctuate at their intersection that is to say if one has two city patterns and the combined ones obtain the points of the city where the demographic and economic dynamics interact. In the following map shows with blue color the greater amount of PO concentration, in red color the greater concentration of UE and in purple color the AGEB that show concentration of both UE and PO, which allows to visualize which are the parts of the spatial configuration with greater demographic and economic flow.

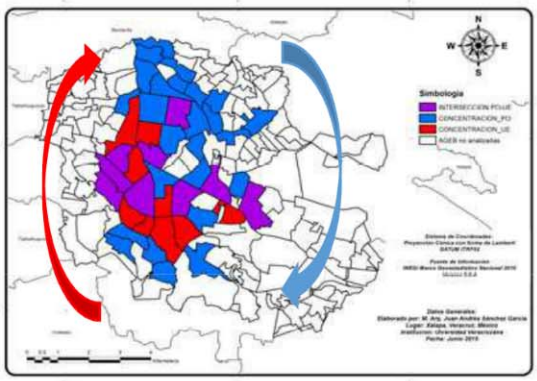

Fig. 6 System of Interaction between the Occupied Population and Economic Units (purple), overlapping the highest EU concentration of Figure 4 (red color) and the highest concentration of Occupied Population shown in Figure 5 (blue color)

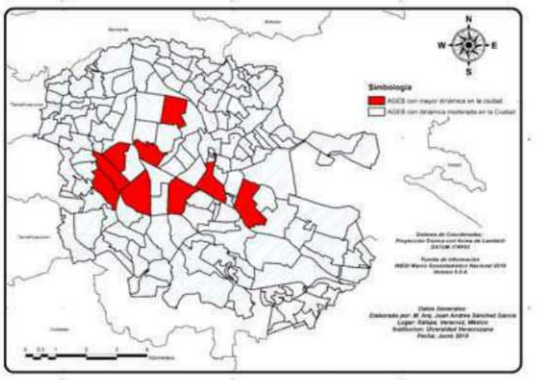

Fig. 7 The above illustration shows the most dynamic AGEB in the city, obtained from the PO and UE interaction of Fig. 6 (AGEB in red).

Finally, a figure with the AGEBs that present the greatest dynamics in the entire City of Xalapa is presented. This result is a consequence of analyzing different dynamics according to the variables of the 136 observations. It is important that before concluding it is observed that the contemplation of an urban-statistics vision allows to outline a behavior from the structuralism approach and to be preamble of the diagnosis of for the formulation of solutions in the City.
This concentration of dynamics, shown in the previous map, suggests that the big proposals about social problems, mobility, environmental pollution, social inequality, urban economy, housing, services, roads, equipment, among others, sectors and expanding.

6. Conclusion

The Urban Structure is conceived by the level of disaggregation that was used in the analysis, that is to say a structure determined by the AGEB. If you had the opportunity to go to a more defined level of disaggregation, apples would be used to determine the patterns that define the city and its growth form: reticular, broken plate or concentric;
Most of the AEs proposed in this paper converge the same pattern that estimates that the spatial distribution phenomenon occurs with greater concentration in the center of the city and greater dispersion in the peripheral areas of Xalapa, in other words there is a heterogeneity in the AGEB as a result of the Urbanization process.
This phenomenon is due to the fact that the peripheries are still in the process of urban consolidation and have repercussions on social segregation with lack of services and work in these sectors. This division of sectors deserves an independent analysis to determine the quality of life of the people in each of these zones and, in another study, to be able to make the comparison with the processes that are presented in the downtown area of the city. All these characteristics presented by the city are attributed to the form as a spatial quality.
The concentration that presents the Economic Activities is linked to the function that determines the Classification of the city. When talking about a function of the city, reference is made to what the majority of the population is engaged in or on which its economy depends; as he says (Ducci 1989: 80): "No city can dedicate itself exclusively to a single activity, since the existence of one function necessarily generates others, so the functional classification of cities refers to the predominant function of the city".
Based on the established analysis, the five ECAs that predominate in Xalapa are Retail Trade (CME), Manufacturing Industry (IM), Education Sector (SE), Construction (CT) and Mass Media Information IMM); of which the CME proved to be more significant in both the MRLM and its proportion with respect to the Total of AE, that is to say that the majority of the population of the City of Xalapa is dedicated to the commerce, activity that served for the emergence of several cities and is reflected in the spatial homogeneity of this EA as part of the Urban Structure and the Form of the City.
Although each AE is statistically different and manages a different variability. Geographically they coincide in a behavior of territorial inequality that is to say, it is not homogeneous the

percentage of UE by AGEB which propitiates the partition, segmentation and conformation of strata of concentration of UE within Xalapa. Therefore, Geostatistical analysis allows to disaggregate and synthesize the components and elements that lead to complex structures such as the city, that is, not only to understand how they work, but also to establish the measure and proportion in which each part of the system interacts.

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