

## Statistical and econometric techniques for employment in the informal sector in Mexico

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A set of statistical and econometric techniques is applied in order to know if there is relationship between variables that are considered implied with the informal sector. Relation of the Occupation in the Informal Sector with the Gross Domestic Product and the Index of Human Development are analyzed. Also it is investigated if there are statistically significant differences in the proportion of men and women who work in the informal sector. is also analyzed the relation that exists between the age of people and the rate of participation in informal economy, on the one hand the adolescents and young people from 14 to 19 years and by another one adults majors of 60 years; both ends of the labor pyramid are related with respect to the adults in primary labor age: people aged 30 to 39 years. It is also analyzed how much “urban”, is the Urban Informal Sector.

### Informal Sector, tests of hypothesis, linear regression.

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**Introduction**

From the second half of the past century, the growth of countries developing was accompanied by increased micro unregistered owned by households, over time was coining the term "informal sector" to refer to these micro. Mexico is not exempt from this phenomenon, an important fraction of the economically active population works in this sector. The National Institute of Statistics and Geography (INEGI 2004) emphasizes that those employed in the informal sector represent more than a quarter of total employment in the country.

The growth of the informal sector in the world, has led to institutions such as the International Labour Organization (ILO), the United Nations (UN), and many others, have dedicated resources and research efforts in order to meet adequately the situation of this sector. As a result international recommendations have been issued to allow progress in understanding the informal sector and the generation of statistical information on the same; has also been improving the international comparability of the figures, to the extent that different countries in this sector generate statistics based on international recommendations.

**Defining the informal sector**

For the purpose of proposing a solid foundation of scientific conceptual, presented here the definition of informal sector established by the ILO (1993) at the XV International Conference of Labour Statisticians (ICLS XV) and the UN in the SNA 93 (UN et, al 2000).

This methodological conceptualization is a key aspect of this research and in particular the quantification and study of employment in the informal sector.

Extract from the resolution adopted on January 28, 1993, by the XV International Conference of Labour Statisticians (ICLS XV), convened by the International Labour Organisation

Concept: The informal sector may be broadly characterized as consisting of units engaged in the production of goods or services with the primary objective of generating employment and incomes to the persons involved in such activity. These units typically operate at a small scale, with a rudimentary organization in which there is little or no division between labor and capital as factors of production. Labour relations-where they exist - are based mostly on casual employment, kinship or personal and social relations rather than contractual arrangements with formal guarantees.

Production units of the informal sector have the characteristic features of household enterprises. Fixed assets and other securities not belong to the company itself, but to their owners. The units as such can not engage in transactions or enter into contracts with other units, nor incur obligations in its name. The owners have to raise the necessary funds on their own risk and are personally liable, without limit, for any debts or obligations contracted in the production process.

In many cases, it is impossible to clearly distinguish between the portions of expenses allocable to production activities of the company and simply corresponds to the normal household expenses also certain goods, such as buildings or vehicles may be used interchangeably for commercial purposes and for personal home use.

The activities carried out by the production units of the informal sector are not made with the deliberate intention of avoiding payment of taxes or social security contributions, or infringing labor legislation and other legal provisions or certain requirements and administrative procedures. Thus, the concept of informal sector activities should be differentiated from hidden or subterránea. Inside the economy of the household sector, the informal sector comprises: i) "informal business people who are self-employed," and ii) an additional component consisting of "enterprises of informal employers." Informal sector is defined irrespective of the workplace where it is carried out productive activity, the degree of utilization of fixed capital assets, the duration of the activity enterprise (perennial, seasonal or occasional) and the fact that the case of the main activity or a sideline of owner households empresa. Empresas: According to the System of National Accounts of the United Nations, business households (ie, firms that belong to households that are unincorporated).

They differ from corporations and quasi-corporations based on the legal organization of the units and the type of accounting they carry.

Household enterprises are units engaged in the production of goods or the provision of services that do not constitute a separate legal entity from the home owner or the members thereof, and no complete sets of accounts (including balance sheets of assets and liabilities) to allow a clear distinction between the production activities of the company and the other activities of their owners, as well as income flows and capital between the company and the owners. Companies households include unincorporated enterprises owned and operation are controlled by one or more members of a household.

### **Studies in Mexico on the informal sector in Mexico and purpose of this work**

In the case of Mexico there have been several efforts to understand the situation of the informal sector and have made significant advances. The informal subsector of households in Mexico generates approximately 12% gross (INEGI, 2004A; INEGI 2006) Domestic Product, and occupies more than a quarter of the economically active population. Of all those employed in manufacturing in Mexico 34% are informal; on the other hand informal microenterprises building occupy 67% of all employed in construction in the country; A very large proportion of those employed in trade (42%) and personal services (16%) do so in the field of informality.

It follows from the urgent need to continue research on the Informal Sector, that factor in determining the occupation of manufacturing and construction and services in Mexico.

Work in the informal sector is characterized by low productivity, precarious and low living standards. Required to develop public policies and programs for this population improve their welfare and working condition. This research aims to contribute to this knowledge, to this end different empirical analysis with data obtained from surveys of employment and population censuses are conducted in Mexico, and the results offered by the System of National Accounts, and information published by UN agencies related to economic development and analyze social. Se is used, inter alia, the relationship between the evolution of gross domestic product (GDP) compared to the rate Industry Occupation Informal (Tosi); also studied the functional link between the Human Development Index (HDI) and the informality rate for each of the entities of the Republic. Moreover, it is investigated whether there were significant differences in the proportions of men and women working in the informal sector. Also, is analyzed the relationship between age of individuals and the rate of participation in the informal economy, the intention is to show that in the informal sector focus or are more involved age groups found in the extreme age of the population trabaja. Esta research has been carried out with the intention of making inferences in support of decision making and the design of public policies in Mexico, for the development of labor markets and improving in the living conditions of the population employed in the informal sector and their families.

### Is there a relationship between movements in real GDP and Employment Rate in the Informal Sector?

Here we analyze the growth rate of employment in the informal sector, with respect to the evolution of real GDP. The underlying assumption in this study finds that these variables have divergent trends, showing that increasing real gross domestic product tends to decrease the rate of employment in the informal sector. Table I.1 shows the information collected for the purposes of this analysis.

Necessary Information for comparative analysis of changes in real GDP and Employment Rate in the Informal Sector, 2005-I to 2010-IV

| Periodos          |   |                 | Variaciones              |                           |
|-------------------|---|-----------------|--------------------------|---------------------------|
| Trimestre inicial |   | Trimestre final | Variación porcentual PIB | Variación porcentual TOSI |
| 2005/01           | A | 2005/02         | 4.4                      | 0.4                       |
| 2005/02           | A | 2005/03         | 0.3                      | -0.4                      |
| 2005/03           | A | 2005/04         | 3.5                      | 1.4                       |
| 2005/04           | A | 2006/01         | -2.0                     | -2.8                      |
| 2006/01           | A | 2006/02         | 3.6                      | -1.4                      |
| 2006/02           | A | 2006/03         | 0.2                      | -1.5                      |
| 2006/03           | A | 2006/04         | 2.3                      | -0.7                      |
| 2006/04           | A | 2007/01         | -3.0                     | 1.1                       |
| 2007/01           | A | 2007/02         | 3.5                      | 0.7                       |
| 2007/02           | A | 2007/03         | 0.7                      | -0.7                      |
| 2007/03           | A | 2007/04         | 2.6                      | 1.5                       |
| 2007/04           | A | 2008/01         | -4.3                     | 0.4                       |
| 2008/01           | A | 2008/02         | 4.0                      | 0.4                       |
| 2008/02           | A | 2008/03         | -0.4                     | -1.5                      |
| 2008/03           | A | 2008/04         | 0.1                      | -0.4                      |
| 2008/04           | A | 2009/01         | -10.5                    | 4.4                       |
| 2009/01           | A | 2009/02         | 1.3                      | -0.4                      |
| 2009/02           | A | 2009/03         | 4.1                      | 0.4                       |
| 2009/03           | A | 2009/04         | 3.8                      | 0.4                       |
| 2009/04           | A | 2010/01         | -4.5                     | 1.1                       |
| 2010/01           | A | 2010/02         | 4.4                      | 0.7                       |
| 2010/02           | A | 2010/03         | 1.8                      | -2.8                      |
| 2010/03           | A | 2010/04         | 3.1                      | -2.9                      |

**Table I.1**

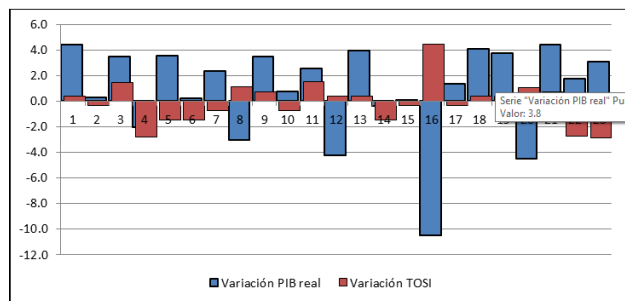
Source: Own elaboration with data from INEGI, Information System of National Accounts of Mexico (SCNM) and the National Survey of Occupation and Employment (ENOE), various years.

For this analysis the information published by INEGI was consulted, real GDP recorded since the second quarter of 2000 to the fourth quarter of 2004; information for those quarters on the proportion persons employed in the informal sector to total employment was also obtained. It then calculated the changes in GDP QoQ along the time series under study and the same was done with the proportion of workers in the informal industry. The numbers shown in most cases, the variables in study move in different directions, that is, during periods when real GDP increased, the rate of informal employment and vice versa. To better observe this different behavior of the variables were plotted together their variations (Graphic I.1) allowing a visual assessment of this phenomenon.

The next step was to decide on a list of technical analysis, which was the most suitable to study this phenomenon and to determine whether the observed could be attributed to random or chance variations or maintained a pattern that would make it more rigorous inferences hereinafter.

In Graphic I.1 can be seen that often manifest changes in opposite directions, real GDP increases while the rate of employment in the informal sector decreases. Therefore, it was decided that the appropriate statistical analysis technique to study these variations was proof Spearman rank correlation, as to determine whether there is statistical evidence that there is a certain correlation between these two variables.

Changes in real GDP and the Employment Rate in the Informal Sector



Graphic I.1

Source: Own elaboration with data from INEGI, Information System of National Accounts of Mexico (SCNM) and the National Survey of Occupation and Employment (ENOE), various years.

With the data sorted by rank, we proceeded to perform the test of Spearman. Needless to say before showing the results of this test, the null hypothesis (H0) is the assertion that there is no correlation between changes. In contrast, the alternative hypothesis (H1) if there prove to be accepted any correlation between these two variables or rather, between changes in these variables. The significance level was 5% test for which the limit test value obtained from the statistical tables was -0.3430.

We proceeded to apply the test for based on their results, draw some conclusions. Table I.2 shows the test cases and results.

Test Spearman rank correlation

|   |                     |         |
|---|---------------------|---------|
| <b>Hipotesis:</b><br>H0: No hay correlación<br>H1: Hay correlación<br><br><b>Resultado:</b> Se rechaza H0 | <b>Rs calculado</b> | -0.3678 |
|   | <b>Alfa</b>         | 0.05    |
|   | <b>Rs en tablas</b> | -0.3430 |

**Table I.2**

Source: Own elaboration with data from INEGI, Information System of National Accounts of Mexico (SCNM) and the National Survey of Occupation and Employment (ENOE), various years.

**Test Results:** The estimated value of the Spearman coefficient was -0.3678, therefore, because the estimated value is greater than the table value (-0.3430) Spearman coefficient; H0 is rejected and the alternative hypothesis H1 is accepted, with the above is accepted that there is a correlation between the variables, as well as the sign of the estimated coefficient is negative, it was concluded that the relationship between the variables is reversed, ie, if the Real GDP increases the rate of employment in the informal sector decreases and vice versa.

**Women, informal more than men for necessity**

The purpose of this section, such as the three subsequent, is to help design appropriate to support the sectors most vulnerable population and occupation of public policy, taking into account the particular characteristics of these sectors. This section is intended to demonstrate that the rate of employment in the informal sector is different when you take into account the gender of the person. The data reported by employment surveys, often show greater informality rate for women than for men, the intention is to see if this happens by chance and really equal informality rates of men and women.

It seeks to establish whether there were significant differences that allow us to say with certainty that informality rates are higher for either sex. Informality rates for men and women over a series of time from the first quarter of 2005 to the third quarter of 2010: the information necessary to perform this test are shown in Table II.1.

Employment Rate in total Informal Sector and sex 2005-I to 2010-III

| Año  | Trimestre         | Total | Hombres | Mujeres |
|------|-------------------|-------|---------|---------|
| 2005 | Primer trimestre  | 27.97 | 27.56   | 28.72   |
| 2005 | Segundo trimestre | 28.11 | 27.47   | 29.22   |
| 2005 | Tercer trimestre  | 28.01 | 26.97   | 29.82   |
| 2005 | Cuarto trimestre  | 28.43 | 27.89   | 29.36   |
| 2006 | Primer trimestre  | 27.63 | 27.14   | 28.45   |
| 2006 | Segundo trimestre | 27.22 | 26.73   | 28.05   |
| 2006 | Tercer trimestre  | 26.76 | 26.09   | 27.88   |
| 2006 | Cuarto trimestre  | 26.62 | 25.95   | 27.88   |
| 2007 | Primer trimestre  | 26.87 | 26.55   | 27.42   |
| 2007 | Segundo trimestre | 27.13 | 26.75   | 27.77   |
| 2007 | Tercer trimestre  | 26.87 | 26.39   | 27.65   |
| 2007 | Cuarto trimestre  | 27.28 | 26.53   | 28.52   |
| 2008 | Primer trimestre  | 27.44 | 27.12   | 27.97   |
| 2008 | Segundo trimestre | 27.5  | 26.85   | 28.57   |
| 2008 | Tercer trimestre  | 27.13 | 26.71   | 27.83   |
| 2008 | Cuarto trimestre  | 26.99 | 26.39   | 27.99   |
| 2009 | Primer trimestre  | 28.21 | 27.7    | 29.06   |
| 2009 | Segundo trimestre | 28.12 | 27.49   | 29.18   |
| 2009 | Tercer trimestre  | 28.17 | 27.4    | 29.43   |
| 2009 | Cuarto trimestre  | 28.32 | 27.25   | 30.07   |
| 2010 | Primer trimestre  | 28.58 | 28      | 29.53   |
| 2010 | Segundo trimestre | 28.78 | 27.98   | 30.09   |
| 2010 | Tercer trimestre  | 27.98 | 27.05   | 29.5    |

**Table II.1**

Source: Own elaboration with data from INEGI. National Survey of Occupation and Employment (ENOE).

A first observation of the series of data on the occupancy rate in the informal sector for men and women shows that in most cases latter reported a higher rate of informality; in order to establish whether there is a difference that is statistically significant between informality rates reported by men and women decide to apply hypothesis testing for differences in sample means.

The test conditions are: the significance level is 2.5%; the null hypothesis (H0) states that there is no difference in the sample means observed for men and women and therefore can be considered equal the rate of informal employment in both sexes, on the other hand, if H0 is rejected and therefore accepts the alternative hypothesis (H1) is set accordingly, any of the two sexes has a higher rate of informality than the other.

II.2 The table shows the calculations and the results obtained from the application of the test mean difference.

Test for difference of sample means for occupancy rates in the informal sector of men and women.

| INDICADORES   | X1: TOSI mujeres | X2: TOSI hombres | Diferencia de medias        |
|---|------------------|------------------|-----------------------------|
| Media   | 28.69            | 27.04            | 1.65                        |
| Varianza  | 0.71             | 0.34             | Valor de Z calculado= 7.705 |
| Desviación estándar   | 0.84             | 0.59             | Alfa= 0.025                 |
| Error estándar  | 0.21             |                  | Valor de Z en tablas= 1.960 |
| H0: Las mujeres tienen igual tasa de ocupación en el sector informal que los hombres  |                  |                  |                             |
| H1: Las mujeres tienen mayor tasa de ocupación en el sector informal que los hombres  |                  |                  |                             |
| RESULTADO: Se rechaza H0 por amplio margen, por lo tanto hay evidencia empírica de que las mujeres tienen una tasa de ocupación en el sector informal mayor que los hombres |                  |                  |                             |

**Table II.2**

Source: Own elaboration with data from INEGI. National Survey of Occupation and Employment (ENOE), various years.

The acceptance limit value was obtained in table 1.96. The obtained value of the test statistic in the foregoing table is 7.705 can be seen immediately that the statistic obtained far exceeds the acceptance limit, so you should reject H0 and accept H1.

This shows that there is a statistically significant difference between the two sample means, in this case we can establish that the informality rate of women is higher than men.

The explanation of this phenomenon is mostly in women of reproductive age should share the time of economic work, domestic, regarding the parenting and housework; therefore some informal activities that have higher barriers to entry such as the sale of food or other items in the street or at home, and do not have a strict schedule requirements, are often the only options for women want to have some occupation and income derived therefrom.

### The Urban Informal Sector

It has been said that informality is a phenomenon of the big cities, some researchers even call SIU (Urban Informal Sector), characterizing it as a proper economic phenomenon of major cities (Rendón and Salas 1991, 1992 and 2000, Abeles 1978; STyPS 1975, 1976 and 1977).

With quarterly data from the National Survey of Occupation and Employment proceeded to review the empirical evidence that was in this respect; point of interest here was the proportion of people employed in the informal sector in the more urbanized areas, cities with 100,000 inhabitants or more; and certainly its counterpart, the less urbanized locations ranging from rural communities to small towns with a population under 100,000 inhabitants. Table III.1 shows the information needed for this analysis.



Employment Rate in total Informal Sector and more and less urbanized areas, 2005-I to 2010-III

| Año  | Trimestre         | Total | Áreas más urbanizadas | Áreas menos urbanizadas |
|------|-------------------|-------|-----------------------|-------------------------|
| 2005 | Primer trimestre  | 28.0  | 26.1                  | 30.0                    |
| 2005 | Segundo trimestre | 28.1  | 26.2                  | 30.2                    |
| 2005 | Tercer trimestre  | 28.0  | 26.8                  | 29.3                    |
| 2005 | Cuarto trimestre  | 28.4  | 27.2                  | 29.8                    |
| 2006 | Primer trimestre  | 27.6  | 25.5                  | 30.0                    |
| 2006 | Segundo trimestre | 27.2  | 25.3                  | 29.3                    |
| 2006 | Tercer trimestre  | 26.8  | 24.2                  | 29.6                    |
| 2006 | Cuarto trimestre  | 26.6  | 23.5                  | 30.1                    |
| 2007 | Primer trimestre  | 26.9  | 23.9                  | 30.2                    |
| 2007 | Segundo trimestre | 27.1  | 24.5                  | 30.1                    |
| 2007 | Tercer trimestre  | 26.9  | 24.3                  | 29.8                    |
| 2007 | Cuarto trimestre  | 27.3  | 24.9                  | 30.0                    |
| 2008 | Primer trimestre  | 27.4  | 24.7                  | 30.6                    |
| 2008 | Segundo trimestre | 27.5  | 25.0                  | 30.3                    |
| 2008 | Tercer trimestre  | 27.1  | 24.5                  | 30.2                    |
| 2008 | Cuarto trimestre  | 27.0  | 24.7                  | 29.6                    |
| 2009 | Primer trimestre  | 28.2  | 25.4                  | 31.4                    |
| 2009 | Segundo trimestre | 28.1  | 25.4                  | 31.2                    |
| 2009 | Tercer trimestre  | 28.2  | 25.7                  | 30.9                    |
| 2009 | Cuarto trimestre  | 28.3  | 26.1                  | 30.8                    |
| 2010 | Primer trimestre  | 28.6  | 26.4                  | 31.1                    |
| 2010 | Segundo trimestre | 28.8  | 26.6                  | 31.3                    |
| 2010 | Tercer trimestre  | 28.0  | 25.7                  | 30.5                    |

Table II.1

Source: Own elaboration with data from INEGI. National Survey of Occupation and Employment (ENOE), various years.

As you can see higher informality rates are not in the big cities of over 100,000 inhabitants, but rather these are observed in the less urban areas, so this does not remain a mere superficial observation without statistical support, the test appears in table III.2.

Test for difference of sample means for occupancy rates in the informal sector into more and less urbanized areas.

| Indicadores  | X1: test en áreas menos urbanizadas | X2: test en áreas más urbanizadas | Diferencia de medias         |
|--|-------------------------------------|-----------------------------------|------------------------------|
| Media  | 30.27                               | 25.33                             | 4.94                         |
| Varianza   | 0.37                                | 0.95                              | Valor de z calculado= 20.609 |
| Desviación estándar  | 0.61                                | 0.97                              | Alfa= 0.025                  |
| Error estándar   | 0.24                                |                                   | Valor de z en tablas= 1.960  |
| <b>H0:</b> zonas menos urbanizadas (< 100 000 habitantes) tienen igual tasa de ocupación en el sector informal que las grandes ciudades (>= 100 000 habitantes)  |                                     |                                   |                              |
| <b>H1:</b> zonas menos urbanizadas (< 100 000 habitantes) tienen mayor tasa de ocupación en el sector informal que las grandes ciudades (>= 100 000 habitantes)  |                                     |                                   |                              |
| <b>Resultado:</b> se rechaza H0 por amplio margen, por lo tanto hay evidencia empírica de que las zonas menos urbanizadas (< 100 000 habitantes) tienen mayor tasa de ocupación en el sector informal que las grandes ciudades (>= 100 000 habitantes) |                                     |                                   |                              |

Table III.2

Source: Own elaboration with data from INEGI. National Survey of Occupation and Employment (ENOE), various years.

The results of this test are categorical; informality rate is higher in large cities, but in less urbanized areas.

The explanation for this situation is the fact that in rural communities and peoples of no economic formal sector units: no stores, no banks, no universities, and federal offices and state government where people can be employed; all those companies and institutions that represent the formal sector are located in large cities. Logic is that if there is no formal employment in rural communities and small towns, there are people not employed in the formal sector in these localities.

### The adolescent and youth work occurs primarily in homes and frequently in the Informal Sector

One hypothesis that has been shown in previous research (ILO, 1993; Fernández, 2007) is that teenagers and young adults (14-19 years) participating in the informal sector to a greater extent than adults in primary working age (30 to 39 years), in fact the International Labour Organization in the recommendations issued in 1993 to generate statistics of employment in the informal sector, warns about the fact that this sector is largely concentrated in children working. With this in mind this test was designed, in Table IV.1 shows the information available to perform the same.



Informality rates in adolescents and young adults 14 to 19 years, and primary working age adults 30 to 39 years. 2005-I to 2010-III

| Año  | Trimestre         | Total | 14 a 19 años | 30 a 39 años |
|------|-------------------|-------|--------------|--------------|
| 2005 | Primer trimestre  | 28.0  | 30.5         | 27.0         |
| 2005 | Segundo trimestre | 28.1  | 31.2         | 26.9         |
| 2005 | Tercer trimestre  | 28.0  | 29.7         | 26.9         |
| 2005 | Cuarto trimestre  | 28.4  | 30.1         | 27.2         |
| 2006 | Primer trimestre  | 27.6  | 29.9         | 26.9         |
| 2006 | Segundo trimestre | 27.2  | 29.2         | 26.2         |
| 2006 | Tercer trimestre  | 26.8  | 28.8         | 26.5         |
| 2006 | Cuarto trimestre  | 26.6  | 28.9         | 25.6         |
| 2007 | Primer trimestre  | 26.9  | 30.3         | 25.5         |
| 2007 | Segundo trimestre | 27.1  | 29.8         | 26.7         |
| 2007 | Tercer trimestre  | 26.9  | 29.3         | 26.2         |
| 2007 | Cuarto trimestre  | 27.3  | 30.5         | 26.6         |
| 2008 | Primer trimestre  | 27.4  | 31.1         | 26.6         |
| 2008 | Segundo trimestre | 27.5  | 31.9         | 26.2         |
| 2008 | Tercer trimestre  | 27.1  | 29.2         | 26.4         |
| 2008 | Cuarto trimestre  | 27.0  | 31.5         | 25.8         |
| 2009 | Primer trimestre  | 28.2  | 32.8         | 27.3         |
| 2009 | Segundo trimestre | 28.1  | 32.8         | 27.1         |
| 2009 | Tercer trimestre  | 28.2  | 31.0         | 27.1         |
| 2009 | Cuarto trimestre  | 28.3  | 32.3         | 27.2         |
| 2010 | Primer trimestre  | 28.6  | 33.9         | 27.4         |
| 2010 | Segundo trimestre | 28.8  | 32.6         | 27.5         |
| 2010 | Tercer trimestre  | 28.0  | 34.2         | 26.5         |

Table IV.1

Source: Own elaboration with data from INEGI. National Survey of Occupation and Employment (ENOE), various years.

Child labor is present in developing countries like Mexico and other Latin American countries (INEGI, 2004b) and this work occurs primarily within the home, whether in agriculture, domestic work or informal subsector of households above is because children under 14 years can not legally work in formal enterprises, so when necessity must work, do so within their own homes, frequently in the informal sector. When People meet the legal working age (which in Mexico is 14 years), regularly continue to work within households in the informal sector, and only to be increasing age, are gradually integrated into the formal sector. Data provided by the Mexican employment survey allowed to accept or reject the hypothesis above. IV.2 shows the results of the test for this purpose.

Prueba para diferencia de medias muestrales para comparar la ocupación en el sector informal de adolescentes y jóvenes frente a los adultos en edad laboral primaria (ELP)

| INDICADORES  | X1: TOSI adolescentes y jóvenes | X2: TOSI adultos (ELP) | Diferencia de medias         |
|--|---------------------------------|------------------------|------------------------------|
| Media  | 30.92                           | 26.64                  | 4.28                         |
| Varianza   | 2.51                            | 0.31                   | Valor de Z calculado= 12.235 |
| Desviación estándar  | 1.59                            | 0.55                   | Alfa= 0.025                  |
| Error estándar   | 0.35                            |                        | Valor de Z en tablas= 1.960  |
| <b>H0:</b> Adolescentes y jóvenes tienen igual tasa de ocupación en el sector informal que los adultos en edad laboral primaria  |                                 |                        |                              |
| <b>H1:</b> Adolescentes y jóvenes tienen mayor tasa de ocupación en el sector informal que los adultos en edad laboral primaria  |                                 |                        |                              |
| <b>RESULTADO:</b> Se rechaza H0, por lo tanto hay evidencia empírica de que adolescentes y jóvenes tienen una tasa de ocupación en el sector informal mayor que los adultos en edad laboral primaria |                                 |                        |                              |

Table IV.2

Source: Own elaboration with INEGI Data. Encuesta Nacional de Ocupación y Empleo (ENOE),

With the obtained results our hypothesis is confirmed, established with OIT base; rejecting H0 states that the sample means are not equal and therefore adolescents and youth (age 14 to 19 years) have an occupancy rate in the informal sector significantly greater than adults in primary working age (persons aged between 30 and 39 years).

This should be considered in the design of public policies both to improve the conditions of workers in the informal sector and plan to run a determined fight against child labor in the country and to generate formal jobs where teenagers and young people deal reach working age.

**We have opportunities for people 20 to 45 years older at this age, please do not occur**

Many formal firms to carry out their recruitment set not to hire people after a certain age, therefore, as the age is older than 45-50 years, often the only option is to work informality.

Another hypothesis considered in this research is in certain formal employment is difficult hired after 45 or 50 years, this is exacerbated as people reach retirement age, ie 60 years or more, for those without an opportunity to obtain a retirement pension and have to continue working into old age working the natural choice for them is precisely the informal sector.

Table V.1 presents the available data to perform this test.

Employment Rate in the Informal Sector in older adults and people in primary working age, 2005-I to 2010-III.

| Año  | Trimestre         | Total | 30 a 39 años | 60 años y más |
|------|-------------------|-------|--------------|---------------|
| 2005 | Primer trimestre  | 28.0  | 27.0         | 35.5          |
| 2005 | Segundo trimestre | 28.1  | 26.9         | 35.3          |
| 2005 | Tercer trimestre  | 28.0  | 26.9         | 35.7          |
| 2005 | Cuarto trimestre  | 28.4  | 27.2         | 37.1          |
| 2006 | Primer trimestre  | 27.6  | 26.9         | 36.3          |
| 2006 | Segundo trimestre | 27.2  | 26.2         | 35.5          |
| 2006 | Tercer trimestre  | 26.8  | 26.5         | 33.9          |
| 2006 | Cuarto trimestre  | 26.6  | 25.6         | 34.5          |
| 2007 | Primer trimestre  | 26.9  | 25.5         | 34.1          |
| 2007 | Segundo trimestre | 27.1  | 26.7         | 33.9          |
| 2007 | Tercer trimestre  | 26.9  | 26.2         | 34.4          |
| 2007 | Cuarto trimestre  | 27.3  | 26.6         | 34.7          |
| 2008 | Primer trimestre  | 27.4  | 26.6         | 34.6          |
| 2008 | Segundo trimestre | 27.5  | 26.2         | 35.5          |
| 2008 | Tercer trimestre  | 27.1  | 26.4         | 35.0          |
| 2008 | Cuarto trimestre  | 27.0  | 25.8         | 33.8          |
| 2009 | Primer trimestre  | 28.2  | 27.3         | 36.3          |
| 2009 | Segundo trimestre | 28.1  | 27.1         | 36.1          |
| 2009 | Tercer trimestre  | 28.2  | 27.1         | 36.2          |
| 2009 | Cuarto trimestre  | 28.3  | 27.2         | 36.1          |
| 2010 | Primer trimestre  | 28.6  | 27.4         | 36.4          |
| 2010 | Segundo trimestre | 28.8  | 27.5         | 37.4          |
| 2010 | Tercer trimestre  | 28.0  | 26.5         | 35.5          |

**Table V.1**

Source: Own elaboration with data from INEGI. National Survey of Occupation and Employment (ENOE), various years.

One of the major deficiencies that manifests the informal sector is that it has no access to social security or pension funds, the elderly, who have worked in the informal sector or in other of occupation of the household sector, having no way to get a pension are forced to continue working for their livelihood until their forces allow them, their jobs is logically the informal sector, therefore, in countries with underdeveloped labor markets, it is foreseeable that the informality rate is higher under the age of employed increases. Table V.2 shows the calculations and results to the test in which the rate of informality of seniors 60 years reached contrasted against adults in primary working age, people who are between 30 and 39.

Test for difference of sample means to compare employment in the informal sector of elderly people compared to adults in primary working age (ELP) os.

| Indicadores   | X1: tosi adultos tercera edad | X2: tosi adultos en elp | Diferencia de medias  |
|---|-------------------------------|-------------------------|---|
| Media   | 35.38                         | 26.64                   | 8.74  |
| Varianza  | 1.03                          | 0.31                    | Valor de Z calculado= 36.218  |
| Desviación estándar   | 1.02                          | 0.55                    | $\frac{\text{Área del gráfico}}{\text{Valor de Z en tablas}} = 0.025$ |
| Error estándar  | 0.24                          |                         | 1.960   |
| <b>H0:</b> Adultos mayores tienen igual tasa de ocupación en el sector informal que los adultos en edad laboral primaria  |                               |                         |   |
| <b>H1:</b> Adultos mayores tienen mayor tasa de ocupación en el sector informal que los adultos en edad laboral primaria  |                               |                         |   |
| <b>Resultado:</b> Se rechaza H0 por amplio margen, por lo tanto hay evidencia empírica de que los adultos mayores tienen una mayor tasa de ocupación en el sector informal que los adultos en edad laboral primaria |                               |                         |   |

**Table V.2**

Source: Own elaboration with data from INEGI. National Survey of Occupation and Employment (ENOE), various years.

From the results we can say that the elderly or persons (60 years or more) deal in greater proportion in the informal sector that people in primary working age (30-39 years), this confirms the hypothesis posed at the beginning.

**Relation between Human Development Index (HDI) reached by the states of the country, and the occupancy rate in the Informal Sector in each of these entities**

We are interested in analyzing the relationship of the Human Development Index with the Employment Rate in the Informal Sector.

The hypothesis is that the HDI represents to some extent the economic and social development of a state, is related to the proportion of workers in the informal sector in the state, that is, entities economically less developed (poorer), with lower per capita income, lower literacy rates, fewer children enrolled in school, and lower life expectancy, , if is true what is said, a greater proportion of the population is working in the informal sector.

The first thing we did was get the information needed for this test, it came to the databases that have the INEGI and Programme of United Nations Development Programme (UNDP) nations; with the information published by these two institutions was obtained HDI and Tosi for each of the states in 2005; The state with the highest HDI Federal District was 90.5 (on a scale of 1 to 100) and the lowest with 73.0 Chiapas. Then included in the Information Box, the rate of employment in the informal sector (Tosi) for each of the entities in that year, this rate had values ranging from 38.8% (Tlaxcala) and 15.1% (Chihuahua). Table VI.1 shows information of the variables that are supposed functionally related.

Occupancy rate and the Informal Sector Human Development Index for the states of the Mexican Republic, 2005

| Entidad Federativa               | Tasa de Ocupación en el Sector Informal (TOSI) | Índice de Desarrollo Humano (IDH) |
|----------------------------------|--|-----------------------------------|
| Aguascalientes                   | 23.4   | 83.9                              |
| Baja California                  | 18.8   | 85.2                              |
| Baja California Sur              | 16.7   | 85.2                              |
| Campeche                         | 23.3   | 84.3                              |
| Coahuila de Zaragoza             | 23.3   | 84.7                              |
| Colima                           | 16.1   | 82.3                              |
| Chiapas                          | 25.5   | 73.0                              |
| Chihuahua                        | 15.1   | 85.2                              |
| Distrito Federal                 | 27.8   | 90.5                              |
| Durango                          | 23.7   | 81.6                              |
| Guanajuato                       | 29.1   | 79.1                              |
| Guerrero                         | 36.3   | 74.9                              |
| Hidalgo                          | 32.3   | 78.1                              |
| Jalisco                          | 29.6   | 82.0                              |
| México                           | 35.1   | 80.8                              |
| Michoacán de Ocampo              | 35.8   | 77.0                              |
| Morelos                          | 34.7   | 81.9                              |
| Nayarit                          | 25.6   | 78.8                              |
| Nuevo León                       | 21.8   | 86.7                              |
| Oaxaca                           | 34.3   | 74.9                              |
| Puebla                           | 31.6   | 78.9                              |
| Querétaro                        | 24.2   | 82.9                              |
| Quintana Roo                     | 24.2   | 84.4                              |
| San Luis Potosí                  | 26.9   | 80.2                              |
| Sinaloa                          | 22.4   | 80.8                              |
| Sonora                           | 23.5   | 84.2                              |
| Tabasco                          | 22.0   | 79.7                              |
| Tamaulipas                       | 23.3   | 83.7                              |
| Tlaxcala                         | 38.8   | 79.0                              |
| Vera cruz de Ignacio de la Llave | 26.2   | 77.2                              |
| Yucatán                          | 30.6   | 80.0                              |
| Zacatecas                        | 23.5   | 78.7                              |

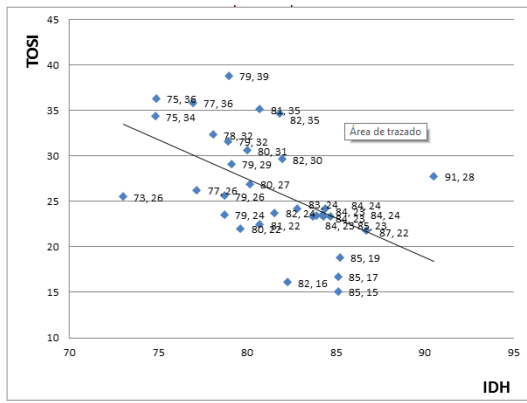
**Table VI.1**

Source: Own elaboration with data from INEGI. National Survey of Occupation and Employment (ENOE) 2005. Programme for the United Development Programme (UNDP) Human Development Index in 2005 Nations Mexico.

Correlation test of Spearman rank was used, the calculated Rs started the rejection region having negative sign implying that there is a correlation between the variables and is reverse, ie, while the HDI is high, the Tosi is low and vice versa. Once HR has shown that variables are correlated Tosi proceeds to apply a technique that gives us more information on how the variables are correlated, the aim is to determine the nature of the functional relationship between the index variables of Human development and Employment Rate in the Informal Sector, and estimate the parameters governing this function.

The first step was to determine the type of technique to be applied given the information and study needs raised, it was considered that the technique can be applied on regression fitting the data to a curve whose mathematical expression can be a linear polynomial a exponential or logarithmic function, or a polynomial of degree greater than one. To decide what type of model to apply in this regression proceeded to plot the dispersion map (Graphic VI.1) to visually assess any linear or other curve between these variables conformation.

Dispersion map Tosi vs IDH

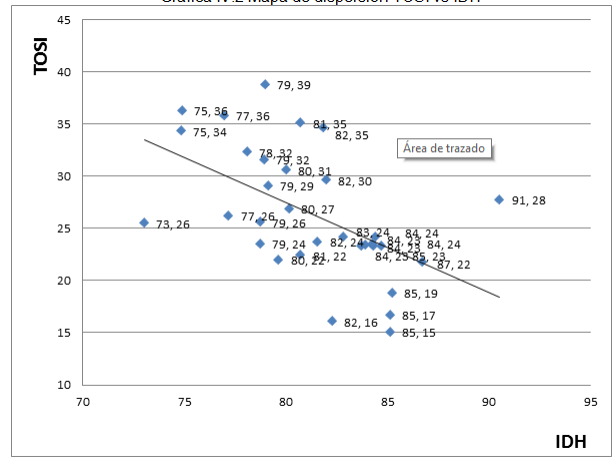


Graphic IV.2

Source: Own elaboration with data from INEGI. National Survey of Occupation and Employment (ENOE) 2005. Programme for the United Development Programme (UNDP) Human Development Index in 2005 Nations Mexico.

As can be seen in the scatterplot, the points cluster in the vicinity of a line with negative slope, according to this, it was decided to use a methodology of linear regression, adjusted by the method of least squares to an equation of first grade. Contingency Table VI.2 shows results.

Linear regression by least squares method



Fuente: elaboración propia con datos de INEGI. Encuesta Nacional de Ocupación y Empleo (ENOE)

Table IV.9

Source: Own elaboration with data from INEGI. National Survey of Occupation and Employment (ENOE) 2005. Programme for the United Development Programme (UNDP) Human Development Index in 2005 Nations Mexico.

First it is necessary to say that an acceptable correlation coefficient indicating that the association between the variables is significant. As for the estimates of the regression parameters, the value of the intercept (B0) was 89.36 and the slope (B1) was -0.770.

The regression results are quite acceptable and can explain how they are related functionally in the study variables; in this case the informality rate is the dependent variable and this varies largely as a response to changes in the Human Development Index observed in each of the states.

The negative correlation coefficient of -0.508 indicates that over 50% of the variation in informality rates are explained by the observed changes in the HDI for each of the states.

On the other hand the negative slope of -0.770 states that for every point increase in the Human Development Index which achieves a given entity, decreases by 0.77 informality rate in that state. In other words as entities that manage to increase their level of development, decreases the rate of informality and precarious employment in these same entities.

It is prudent to mention here that the Federal District is an entity with atypical behavior because it has the highest HDI (90.5 on a scale of 1-100) and should have a rate of informality in the lower levels, around 20%, without But this does not occur because the Federal District also focuses a great deal of informal jobs.

The HDI in DF is above average due to various services in this state are concentrated universities and major hospitals in the country, increasing life expectancy and education indicators. Also are here, the federal powers, the executive, the legislature and the judiciary and also a significant amount of business in this state have their head offices and therefore their executive level positions tend to have income well above the average increasing national GDP per capita. Another feature in this entity is that there is a high concentration of income, and therefore associated with very high income there is a considerable number of people in poverty who are dedicated largely to work in the informal sector, so even the highest HDI in the country, also has a relatively high rate of informality.

While it is a little unusual entity, it was decided to leave the Federal District in the dataset for regression, in order to consider all Mexican states and found that the permanence of this entity in the regression significantly affect the data, the regression results remain reliable and have the advantage of considering in the calculations to all entities of Mexico.

### **Conclusions**

Different methods of statistical and econometric used analysis showed that the assumptions made in this study are correct, and the analysis of information in a more comprehensive way, in fact here have shown the numbers, can be used as input in the design of public policies to improve the situation of people working in the informal sector in Mexico.

Particularly important is the demonstration concerning the relationship between occupancy rate in the informal sector with the insufficient economic and social development of the institutions of the country, (which in this case was associated with the Human Development Index), for this we show that the main reason that there is a high rate of informality in certain states and regions of the country is the lack of economic development.

The analyzes performed in this study also showed that the employed in the informal sector is not a homogeneous population but everything.

For example, women have a higher rate of informality than men, with little impact on access to social security and pension funds.

Also shown the tests applied to the employment in the informal sector is concentrated at the ends of the age groups, ie, adolescents and young people on the one hand and the people of the third age on the other. Finally, the statistical tests show evidence of a widespread misconception among scholars of the informal sector, who believe that this is a typical phenomenon of large cities; the results of this research show beyond doubt, that informality is higher in less urbanized areas.

This is because in indigenous communities in rural areas and in small towns do not have economic units in the formal sector, to work there, there are only subsistence farming and employment in the informal sector, so the employment rate in this sector is higher in such localities.

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