Dynamics, Economic Growth, and International Trade, DEGIT-X
Mexico City, Mexico
June 3-4, 2005

Sectorial Economic Growth and Employment in Mexico, 1996-2001

Aniel A. Altamirano Ogarrio
Universidad de las Américas-Puebla
Mario M. Carrillo Huerta
Universidad de las Américas-Puebla/El Colegio de Tlaxcala, A.C.
José A. Cerón Vargas
Universidad de las Américas-Puebla/Instituto Politécnico Nacional

Abstract

This paper shows the results from a study of the impact of sectorial economic growth on unemployment in Mexico for 1996-2001, by applying a disaggregate approach on data from the National Employment Survey (Encuesta Nacional de Empleo). The paper includes a discussion of the theoretical aspects of the sectorial contributions to growth (emphasizing the case of agriculture), as well as of the relationship between production and employment and the working of labor markets, but also describes the recent evolution of unemployment in Mexico. The core of the paper rests upon the analysis of panel data to estimate the open unemployment rate; it also includes the study of regional urban/rural growth through the analysis of unemployment in different sectors for ten different mexican regions. The results from the estimations at the regional level show that unemployment in Mexico has a statistically significant negative effect on sectorial economic growth. Also, evidence was found suggesting that promoting sectorial-regional (urban/rural) growth is an effective way to reduce unemployment. The paper, which is divided into five sections and draws upon some previous work on Okun's law, also shows the impact that growth among economic activities within sectors has upon unemployment for the period.

E-mail: mmch@prodigy.net.mx
Key words: *Sectorial Growth; Unemployment; Okun's Law; Panel Data; National Employment Survey*

Sectorial Economic Growth and Employment in Mexico, 1996-2001

Aniel A. Altamirano Ogarrio[*]
Mario M. Carrillo Huerta[**]
José A. Cerón Vargas[***]

1. INTRODUCTION

Empirical evidence on the relationship between employment and production show it positive with an important impact on wellbeing at the individual and social levels. Most of the studies on this subject follow the methodological approach known as Okun's Law, which looks upon the change in the rate of employment resulting from a deviation of the rate of growth of production with respect to a rate considered as normal.[1]

However, models which estimate Okun's Law offer good results only when applied to the United States of America.[2] This is mainly because when considering other countries, the estimated coefficients for production are relatively small, and therefore do not give a strong coefficient for Okun's Law.

Chavarín (2001) has used some theoretical and econometric extensions of Okun's model (1962) to study the mexican case. For the Mexican case, the results show a coefficient for Okun's Law equal to –0.024 (Chavarín, 2001), thereby implying that a one percent increase in the unemployment rate will have a cost of 2.4 percent as the decrease on Gross Domestic Product (GDP).

The studies on the subject are usually applied to the general situation of a country at an aggregate level; however, there still remains the preoccupation about the structural composition of product growth and unemployment. For policy matters, it is important to disaggregate those effects at sectorial (rural *versus* urban), regional or state levels so that one can have a better understanding of the composition on the product-unemployment relationship.

This paper follows a disaggregated approach, and it is based on the information from six employment national surveys realized by the mexican government annually in 1996-2001. [3]

Through the analysis of a model with regional panel data, the paper estimates the rate of open unemployment for ten Mexican regions and for the six years mentioned above. Thus, the model allows the analysis of the impact of growth on general unemployment as well as the impact that the structure (rural-urban) of such growth has on unemployment at different sectors of economic activity.

---

[*] Universidad de las Américas-Puebla
[**] Universidad de las Américas-Puebla/El Colegio de Tlaxcala, A.C.
[***] Universidad de las Américas-Puebla/Instituto Politécnico Nacional

[1] The normal rate results from the addition of the rate of growth of labor productivity and the growth rate of the labor supply. That is the rate at which production must grow so that the unemployment rate remains unchanged.

[2] The model normally used for the estimation of Okun's Law is as follows: $\text{Unemployment}_t = \beta_0 + \beta_1 \text{Product}_t + \varepsilon_t$.

[3] Encuesta Nacional de Empleo (National Employment Survey) realized by realizada por e Instituto Nacional de Estadística y Geografía (INEGI).

The paper is divided into five sections. Section 2, describes the theoretical framework for the analysis of the relationship between economic growth and unemployment. Section 3, describes the methodology and specifies the data used to estimate regional unemployment rates. Section 4, includes the testing of the model on the basis of Mexican regional panel data for 1996-2001. Section 5, includes the conclusions from the study.

2. THEORETICAL FRAMEWORK

2.1. The relationship between product and unemployment

The World Bank argues that economic growth reduces poverty and inequality in industrialized and developing countries. (World Bank, 1995b). Also, the Internacional Labor Organization (ILO) maintains that in general, a dynamic economy (whose growth responds to an expanding demand for goods and services) must provide sufficient productive employment opportunities. Such opportunities help in satisfying the needs of all the unemployed and underemployed workers and also of those just entering the labor market. Thus, it is important for economic growth to be strong, but it is also needed for it to be constant.[4]

González Anaya (1999) did one of the pioneering studies of the Latin American labor market. Such a study analyzes the flexibility of the labor market in thirteen Latin American countries for the period 1960-1995, and it compares them with the United States of America. Specifically, it estimates the sensibility of unemployment, employment and the wage rate with respect to production, both in the short-run and in the long-run.

The author argues that in the long-run, countries with stable price levels had increases in the wage income shares as the workers had better salaries because of their increased productivity levels. The argument suggests the alternative to estimate the response of unemployment to changes in production through Okun's law. Such law establishes that a drop by one percent in unemployment is associated with a three percent increase in product.[5] This ratio of three to one is known as Okun's law.[6] But it is also known as Okun's coefficient. (González Anaya, 1999).

In fact, as it was said before, it was found that for the United States, a one percent drop in the unemployment rate is associated with a three percent increase in production,

[4] Another growing preoccupation is the structural (rural-urban) behavior of employment. The impossibility for the non-agricultural sectors to absorb large increments of the labor force and the strong migration of workers from the countryside to the cities have led to many people to suggest that in the present stage of development, one has to look more closely at the expansion of rural employment as the only way to provide employment for everybody.

[5] See: Dornbush & Fisher (1984).

[6] The literature on the subject has been divided following the original Okun's convention about the wording of the coefficient, as the percentage change in product as a result of percentage changes in unemployment (which is 3.0), *versus* its reciprocal, which indicates the percentage changes in unemployment associated with a percentage change in product (which is 0.33). Because we almost always have labor market variables as dependent variables in the regressions run, we used the second option; that is, the reciprocal. Thus, a large coefficient indicates a great sensibility of the labor market with respect to production.

thus invalidating the basic postulates of the diminishing marginal profits from labor, and also the ones on the constant returns to scale.[7] On the contrary, Okun's employment and unemployment coefficients vary between 1.0 to 3.0 percentage points for Latin America, whereas for the United States they vary between 3.0 to 4.0 percentage points.(González Anaya, 1999).

For the Mexican case, González Anaya (1999) finds that Okun's unemployment coefficient (1.7%) is small as compared to the one for the United States. In that study, it is shown that Mexico was one of the few countries which did not have an increase in the Okun-unemployment relationship for the period 1971-1995. Such behavior was found because there was a drop in the relationship Okun-wage rate, causing an inflexibility of the labor markets, due to the reduced number of channels available for the transmission of the perturbances of the product on employment. And since in Mexico there were no changes in the wage rate channel during the period of macroeconomic stabilization, it is not surprising to find small increments in the Okun-employment and in the Okun-unemployment relationships only after the economic crisis of 1995.

From the traditional estimations of the effects of the product on unemployment for some countries such as Mexico, Okun's law does not offer adequate explanations about the effects of unemployment on production. Okun postulated some mechanisms for the transmission of the effects on the unemployment rate, including the following:

- *A pro-cyclical behavior of the labor force.* This happens when there is an increase in the labor force during a period of growth of the product. Nevertheless, during the economic cycle there are two opposing forces working on the size of the labor force: the substitution and the income effects.
  a) *The substitution effect which generates a pro-cyclical labor force.* During a period of growth of the product, wages increase causing an increase in the opportunity cost of leisure. This is shown through an increase in the number of participants (particularly women and youths) in the labor force. On the contrary, when the product falls one can observe discouraged workers (because of the discourage effect). [8]
  b) *The income effect causes a counter-cyclical behavior of the labor force.* This happens when the head of the family is unemployed and therefore other members are induced to enter the labor force.[9]
- *Labor accumulation.* This implies that the average number of hours worked by each worker has a pro-cyclical behavior, enhancing therefore the unemployment fluctuations. In the cases of product expansions, the firms prefer to increase the number of hours per worker and the number of shifts, rather than to increase the number of workers, and *viceversa* when production shrinks.

[7] Nonetheless, Nourzad and Almaghrbi (1995) mention that the most well known studies of Okun's law for the United States show an average value of 2.57. González Anaya (1999) shows that fluctuations in the products of the Latin American economies have a lesser effect on the quantitative variables (unemployent and employment) but a stronger effect on real wages. Specifically, he finds that Okun's coefficients for wages in Latin America are larger than 1.0, whereas in the United Sates, it is 0.5.

[8] In Mexico, INEGI (which is the main official office for gathering statistical data) considers as discouraged workers, all those individuals who are available on a non-active basis, as they were looking for jobs in the past but ceased to do so on the idea that they had no chance no find a job, but nevertheless they are prepared to engage again in a job immediately.

[9] Hernández Licona (1998) shows this evidence for the case of Mexico.

- *Labor productivity moves pro-cyclically.* There are some mechanisms through which productivity has a pro-cyclical behavior: i) employment shows a lag in responding to product changes; ii) the increase in the labor force; iii) changes in the composition of the industrial production toward more productive activities during periods of product expansion.

Okun's coefficient assumes that those three effects change *pari passu* with the unemployment rate, and that their combined effect are captured by the coefficient. Barreto (1993) shows that under certain conditions there are two main advantages when applying the inverse regression in the traditional models. These are the following: 1) it allows for better calculations, from the statistical point of view of the influence of unemployment on production; 2) it allows the calculation of more plausible values for Okun's law. (Chavarín, 2001).

Following Barreto (1993) and Chavarín (2001), we estimated the relationships for Mexico using the inverse regression with two approaches. First, we took Gross Domestic Product and unemployment as stationary variables at level, considering an adjustment relationship through time between them. Second, we considered that production can be a non-stationary variable at level, whereas unemployment is indeed stationary. This implies taking as a starting point a disequilibrated equation, which is solved through a dynamic model to equilibrate the equation, together with some specifications with theoretical and econometric extensions. (Chavarín, 2001).

We obtained different results from the estimation of Okun's law with a dynamic model, even though the value of the coefficient still was different from the one estimated for the United States. With such results, one can conclude that estimations based on regressions ran in the traditional way, overestimate the value of the Law. Thus, it is necessary to explore the estimations with the help of an inverse regression. In fact, if one wants to calculate the opportunity cost of unemployment, measured in terms of Gross Domestic Product, one has to use the inverse regression. In other words, the dependent variable must be the product, whereas unemployment becomes an explanatory variable.[10]

Such results show the image of the general situation of the country as a whole (at an aggregate level), but they do not show the structure of the results. Therefore, it is important to disaggregate those effects for various sectors and levels (rural/urban, regional and state), in order to have a better insight of the composition of the product-unemployment relationship.

2.2. The Structure of Economic Growth and Unemployment.

2.2.1. The Role of Agriculture in Economic Growth.

Agriculture is normally defined as the producer of commercial goods sold in international markets. In this context, agriculture is considered an important contributor for a country's economic development. (Johnston and Mellor, 1984; Mellor, 1995).[11]

[10] Chavarín (2001) realized such an estimation for México for the period 1987-2000, and found that the short-run multiplier which is the coefficient of the explanatory variable (unemployment) was equal to minus 0.024. Thus, the value of the coefficient (2.4) is very similar to the one estimated for the United States, and therefore, a one percent increase in the unemployment rate has a cost of 2.4 percent in the reduction of GDP.

[11] Main roles of agriculture in developing countries: i) Ecological: procuring natural resources. ii) Social: equity and stability. iii) Food sufficiency: satisfaction of human and strategic needs. iv) Economic: sustainable growth and employment. v) Cultural: cultural legacy. (FAO, 2000).

Mellor and Gavian (1999) found that high rates of growth in agriculture are usually due to technological innovations, which increase labor productivity and sometimes also increase profits (when they labor-saving). They realized a study in Egipt and found that the agricultural product elasticity with respect to the growth of total product (derived from the green revolution) is relatively small (less than 0.6).

The role of agriculture in economic development has always been a classical theme in economic development theory (Mellor, 1966, 1986). Specífically, is considered as the most important source of investment resources for countries that want to industrialize, and need funds for investing in emerging industrial activities. Thus, the generation of an agricultural surplus requires an increasing level of the productivity of resources in the sector. (Winters *et al* 1997). This can only be achieved with successful rural and agricultural development. (Hayami and Ruttan, 1985).

Another important aspect of the role of agriculture in economic development is its influence in the industrial growth models. De Janvry and Sadoulet (1989) show how agricultural growth can supress the industrial sector growth in a two-gap model, when agricultural exports are the main area of foreign trade. Also, Lewis' classical model of the dual economy, establishes that there exists a relationship between the low-cost labor surplus in agriculture and the level of wages in industry which works through the labor markets. (Lewis, 1955).[12]

Thus Jorgenson (1961) showed the possibility for transferring labor from agriculture to the industrial sector without pushing food prices up, and therefore without increasing the need for higher nominal wages in industry. Of course, this would require a technological change in agriculture so that labor productivity could increase in the sector.[13]

2.2.2. Agriculture and Sectorial Economic Growth

Ravallion and Datt (1996) showed that sectorial economic growth in India has an important general effect in reducing poverty, and that such an effect is stronger in the case of agricultural growth.[14]

---

[12] Lower wages in industry in turn allow for higher rates of industrial investment and growth.

[13] These two features of industrialization in developing economies (the labor surplus and the role of technical change in agriculture) are the most importnt ones in the dual-economy models developed by Fei and Ranis (1964) and Lele and Mellor (1981). Another important analysis by Kuznets (1964), while dealing with the role of agriculture in economic development identifies one of the most relevant problems of modern economic growth: how to exact a surplus of agricultural product to finance the needed capital formation in industry without tampering agricultural growth?

[14] In their study, Ravallion and Datt tried to measure the importace of intra-sectorial growth for the Indian poor, and also tried to identify the impact of rural-urban migration in all sectors. Their main findings include the following: i) Urban growth carried along some benefits for the urban poor in India but had no impact on rural poverty. Besides, changes in the urban-rural structure of population had no significant impact on poverty. However, the growth of the industrial sector did not reduced poverty in any sector. ii) The direct impact of growth (in any sector) on general poverty is limited by the participation of population in the respective sector. By decomposing national income growth by sectors defined by the type of product, the study found significant differences on their impact on poverty. Growth in the primary and tertiary sectors helped to reduce rural and urban poverty. As it was said above, industrial growth, on the contrary, did not have any impact at all on reducing poverty in India.

Torres (2002) realized a study similar to Ravallion and Datta's for México, and estimated the impact of sectorial growth on regional poverty, as well as the effects of migration on the urban/rural sectors. In that study, Torres found a significant effect of economic growth on reducing poverty in Mexico for the period 1984-2000. On the basis of a model with panel data, the author estimated regional poverty and per capita expenditures, finding an elasticity of total poverty with respect to urban growth of around –1.143, while for the rural growth the correspnoding value was –0.551. He also found evidence of *intra-sectorial* effects of growth.[15]

3. METHODOLOGY AND DATA

3.1. Estimation of the Unemployment Rate for Mexico.

Since the middle 80's, México has been subjected to a vigurous process of stabilization and structural adjustment; the old inflationary periods and the government budget deficits were controlled, and the Mexican government carried out some of the structural reforms suggested by the international organizations. As a result of that, there was a significant inflow of foreign investment and the economy seemed recovered from the 1986 recession, with the help of a strong response of the export sector to the liberalization of foreign trade. (Lustig, 1998).

However, by the end of the year 1994, the mexican economy experienced a severe financial crisis which in turn caused an economic crisis worse that the ones experiencied by the country in 1982 and 1986. Real GDP dropped 6.9 percent in 1995, whereas aggregate consumption decreased by 11.7 percent in that year. In fact, real income per capita went back up to the 1994 level only until the second quarter of 1997. Afterwards the economy recuperated and GDP grew around seven percent in the year 2000, but growth could not be sustained as GDP fell by 0.24 percent in 2001. Thus a question comes in order: what have been the impacts of those periods of expansion and recession on unemployment in México?

We will try to answer that question with the help of data from the National Employment Surveys for the period 1996-2001, to estimate what is called the 'rate of open unemployment' (ROU), at the national, regional and state levels. (OIT, 1959)[16]

At present, the rate of open unemployment in Mexico is calculated as follows:

$$ROU = (OU / EAP)* 100$$

[15] That is, rural and urban growth significantly reduce poverty within their own sector. But there are also inter-sectorial effects, as the data show that urban growth significantly reduces poverty in the rural sector. On the estimation of the effects of rural-urban migration, Torres' results were non-significant.

[16] The Rate of Open Unemployment is a proportion of the Economically Active Population (EAP) or labor force. The EAP refers to all people in working age who either had a job or did not have one but were looking for one at the time of the estimation. Those who had a job are known as 'occupied', while the second group are known as 'openly unemployed'. The proportion of the population in the working age who were neither 'occupied' nor looking for a job at the time of the estimation, are known as Economically Inactive Population.

where: OU = openly unemployed
EAP = economically active population

3.2. The National Employment Survey (NES)

The National Employment Survey is probabilistic and since 1995 is carried out annually in Mexico.[17] Originally, the NES offer information for the nation and state levels as well as for two groups of localities: greater and smaller than 100,000 inhabitants.[18] The Survey is stratified with the household being the selection unit and the individual is the observation unit. In our case, the Survey is disaggregated also at a regional level, following the regional devision proposed by INEGI, which is the institution that conducts the Survey.[19] For the validity of our estimations, the standard errors were calculated along with the calculation of the unemployment rates, as shown in the next paragraphs.

3.3. Estimation of the Unemployment Rates and the Standard Errors

Because of the need for the national surveys to be representative, one has to distinguish between the differences at the population level and the variations at the sample level. Some authors have stressed this need and have proposed some tools to calculate the relevant standard errors. (Kakwani, 1993; Ravallion, 1994). Also, some survey samples (such as the NES's) are not calculated randomly among the households of the country, but respond to some stratification and conglomeration. Thus, the need for the calculation of the standard errors.[20]

Table 1, includes the variability coefficients for the estimations at the state and regional levels.[21] From the data included in Table 1, one can see that for the total unemployment rate, the coefficient of variability (ee/μ) has a mean value of 0.0024 for the regional case, whereas it has a mean value of 0.0033 at the state level.

The estimated unemployment rates fon the nation as a whole are shown in Table 2, and in Figure 1. As it can be seen from the data shown in that table and that figure, there was a relative fall in unemployment in Mexico during the period under consideration (1996-2001).

---

[17] Eventhough the NES was carried out every two to three years in Mexico before 1995, we used the 1996-2001 annual series for our study because of disponibility of the data base.

[18] By the year 2000, the Survey allowed information for four groups of localities: greater than 100,000 inhabitants; between 15,000 and 99,999; between 2,500 and 14,999, and; less than 2,500 inhabitants.

[19] The way the states were agregated into regions for this study can be found in Appendix 1, Table A1.

[20] In order to calculate the unemployment rates at diferent levels of aggregation, we used the SVYRATIO command of the econometric package STATA, which allows the incorporation of the complex sample design into the calculation of the standard errors for the unemployment rates (at those different levels of agrgregation) folowing the methodology proposed by Howes and Lanjouw (1998).

[21] The estimations of the unemployment rates at the national and regional levels for both the rural and the urban areas are shown below. The regional estimates are included in Table A3 in Appendix 2.

Table 1.- Standard Errors of Estimation for the Unemployment rates for Mexico, 1996-2001

	Coefficient of Variability	
	Estimation State Level	**Estimation Regional Level**
Statistic	**ee/μ**	**ee/μ**
Total Unemployment		
Mean	0.0033	0.0024
Standard Deviation	0.0023	0.0014
Rank	0.0216	0.0064
Maximum	0.0221	0.0073
Minimum	0.0004	0.0009
Urban Unemployment		
Mean	0.0038	0.0033
Standard Deviation	0.0020	0.0028
Rank	0.0124	0.0119
Maximum	0.0133	0.0122
Minimum	0.0009	0.0003
Rural Unemployment		
Mean	0.0047	0.0029
Standard Deviation	0.0049	0.0015
Rank	0.0372	0.0372
Maximum	0.0372	0.0073
Minimum	0.0000	0.0010

Source: Calculated from the NES, 1996-2001.

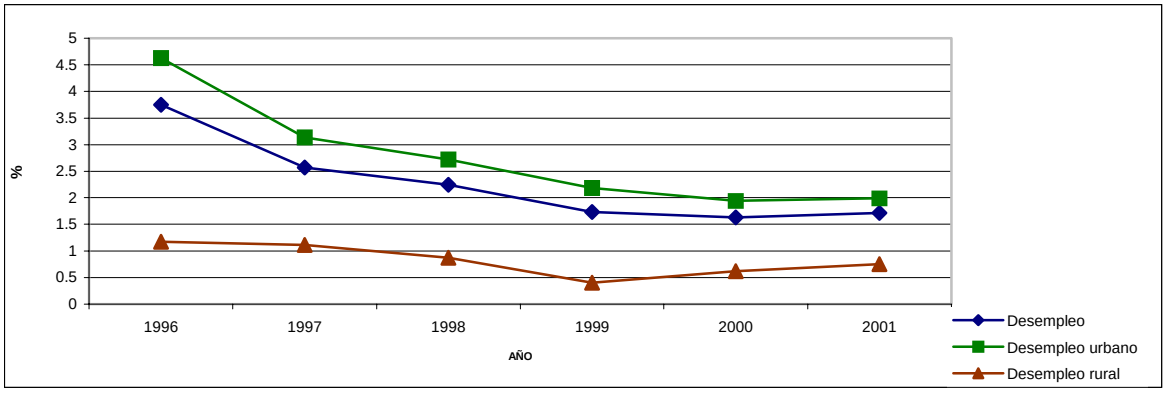
Total national unemployment fell around an accummulated 56.3 percent during 1996-2000, and it increased by about 4.5 percent by the end of 2001, at both the urban and rural areas. Rural unemployment diminished by 47.1 percent during the 1996-2000 period, but increased by 20.5 percent in 2001. Tabla 2 also shows the standard errors for the unemployment estimations, which are rather small, suggesting that the estimated unemployment measures are correct.

Table 2. Estimated Unemployment Rates at the National Level for México, 1996-2001[a]

Open Unemployment Rates	YEARS					
	1996	***1997***	***1998***	***1999***	***2000***	***2001***
Total	**0.0375**	**0.0257**	**0.0225**	**0.0173**	**0.0163**	**0.0171**
	(0.0011)	(0.0017)	(0.0010)	(0.0010)	(0.0005)	(0.0006)
Urban	**0.0463**	**0.0314**	**0.0272**	**0.0219**	**0.0194**	**0.0199**
	(0.0014)	(0.0019)	(0.0011)	(0.0012)	(0.0006)	(0.0007)
Rural	**0.0117**	**0.0111**	**0.0087**	**0.0040**	**0.0062**	**0.0075**
	(0.0014)	(0.0030)	(0.0012)	(0.0006)	(0.0008)	(0.0011)

[a] Standard errors are shown inside parentheses
Source: Calculated from NES, 1996-2001.

Figure 1. Total, Urban and Rural Unemployment Rates for Mexico, 1996-2001.



Source: Calculated from NES, 1996-2001.

At the regional level, the Central-Southern and Central regions showed the highest unemployment rates for the period, while the Southern and Southeastern regions had the lowest ones, on the average. (See Table 3). As it can be seen from the data shown in Table 3, rural unemployment was lower than the urban one in all (ten) mexican regions in 1996-2001. Also, the data shows, on the average, a generalized tendency to lower unemployment rates across the country for that period.

Table 4 shows the national labor force at the national and regional levels for both the rural and urban areas. As it can be seen from the data in that table, the EAP increased 9.5

percent for the period; the urban labor force increased 25.7 percent, while in the rual areas, the labor force increased by only 1.9 percent during the period.

Table 3. Open Regional Unemployment Rates for México, 1996-2001[a]

Regions	*Unemployment Rates*		
	Total	**Rural**	**Urban**
All Ten Regions	0.0216	0.0113	0.0255
Northeast	0.0263	0.0144	0.0279
Northwest	0.0282	0.0114	0.0328
Central-South	0.0289	0.0101	0.0338
South	0.0119	0.0045	0.0202
Southeast	0.0140	0.0058	0.0160
West	0.0169	0.0043	0.0209
Central-North	0.0180	0.0078	0.0228
East	0.0201	0.0090	0.0269
North	0.0186	0.0077	0.0231
Central	0.0415	0.0351	0.0415

[a] Average unemployment rates
Source: Calculated from NES, 1996-2001.

Table 4. National, Urban, Rural and Regional Labor Force for Mexico 1996-2001

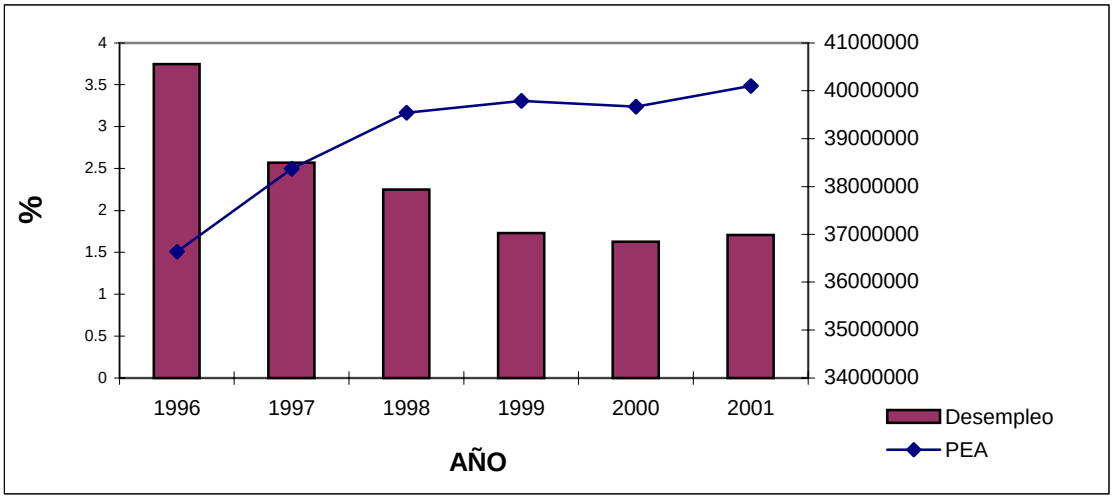
Levels	**YEARS**					
	1996	**1997**	**1998**	**1999**	**2000**	**2001**
Nacional	36635051	38370994	39541580	39786759	39663487	40097299
Urbano	27306662	27506376	29453678	29686552	30438938	34338617
Rural	9328389	10864618	10087902	10100207	9224549	9505796
Regional						
Noreste	3555870	3686309	3719687	3605348	3747114	3725154
Noroeste	2894595	2931077	3195876	3117459	3167197	3369142
Centro-Sur	6540972	6808930	7184979	7223701	7235477	7205884
Sur	3273037	3622574	3632550	3657519	3683301	3766721
Sureste	1148550	1078769	1285339	1327780	1329071	1425047
Occidente	4630690	5349006	4972463	4931591	4943563	5165071
Centro-Norte	3152015	3006195	3361421	3417383	3508020	3538162
Oriente	5493740	5707191	6072732	6064542	5934407	5811415
Norte	2163740	2209181	2264209	2398514	2285967	2271307

Centro	3781842	3971762	3852324	4042922	3829370	3819396

Source: Calculated from NES, 1996-2001.

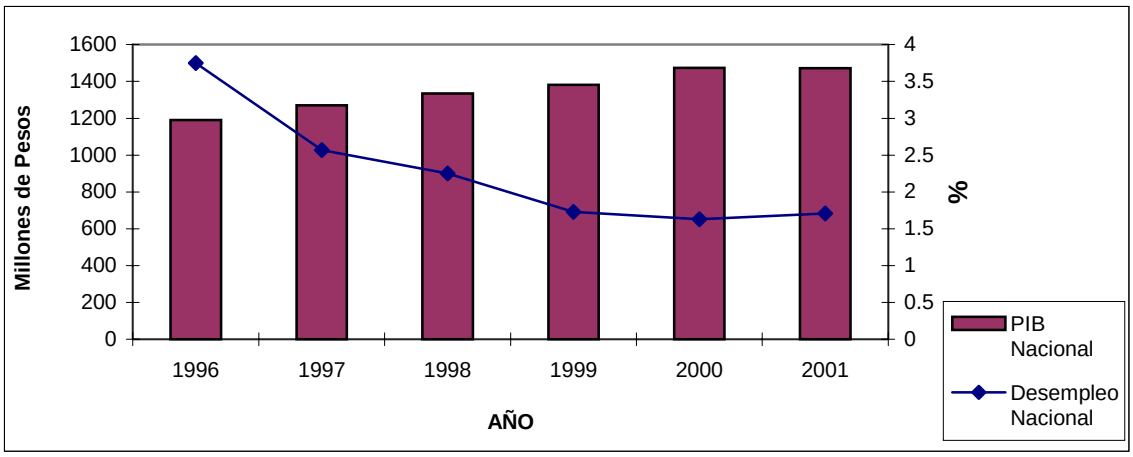
It is interesting to notice that most of the labor force in the country is urban and is located in the Central-Southern and Eastern regions. Also, that at the same time, while the unemployment rates were falling, the labor force was increasing, both at the national and regional levels. (Figure 2). This suggests that the economy was creating job opportunities both for those who had entered the labor force for the first time and for those who were already there, but were looking for a job at the time of the estimations. (See Figure 3).

Figure 2. National Unemployment and Labor Supply for México, 1996-2001.



Source: Calculated from NES, 1996-2001.

Figure 3. Unemployment and Gross Domestic Product for México, 1996-2001.



Source: Calculated from NES, 1996-2001.

Figure 3 shows that, as expected, during the period 1996-2000, while GDP was growing, unemployment was falling. However, in 2001, the reverse effect took place: GDP fell, while unemployment grew.[22]

3.4. The Econometric Strategy

The strategy followed in this study is to analize the covariate impacts on unemployment and GDP growth. Previous studies have found a significant negative relationship between total unemployment and economic growth. In this section, the relationship between the variations in unemployment and GDP is studied, gaining some degrees of freedom with respect to the national aggregate case.

Having a certain initial unemployment rate and level of product, the relationship between both of them is determined by how changes in unemployment and poroduct take place and also by how they covariate through time. It is expected to have different results for different regions, as the initial conditions and the working of the regional labor markets could differ from region to region. So long as such regional differences in the time patterns of unemployment are due to differences in the time patterns of grwoth for different economic activities, it would be appropriate to use the model (panel) proposed for this study. The panel model attempts at estimating the elasticities of unemployment with respect to economic (GDP) growth.

3.4.1. Estimating Unemployment and Sectorial Growth in Rural and Urban Areas

In this section we try to develop a complete structural model for the potential channels described previously and find some causality between the varibles in included. Following Ravallion and Datt (1996), we attempt at knowing the importance of the sectorial composition of growth of unemployment, by specifically controlling both population movements and cross effects among regions and/or areas.[23]

Thus, the average unemployment level for region i in year t, can be decomposed as follows:

$$(1) \qquad \mu = \eta^{u}_{it}\,\mu^{u}_{it} + \eta^{r}_{it}\,\mu^{r}_{it}$$

where η^{k} and μ^{k} show the proportion of population and the measure of unemployment, respectively for areas k = u, r, (urban and rural). Similarly, GDP can be written as follows:

[22] Nonetheless, as it can be seen from Figure A (Appendix 3), at the regional level, upon ocassion during the period 1996-2000, both GDP and unemployment fell down simultaneously in some regions, thereby suggesting that at the regional level unemployment changed mainly because of the working of the labor market and not neccesarily because of corresponding changes in production.

[23] Ravallion and Datt (1996) used time-series analysis to study the India case because they had access to more than 30 annual surveys conducted inthat country. Because of lack of information, we decided to use the panel techniques for the mexican case.

(2) $$\pi_{it} = \eta^{u}_{it}\, \pi^{u}_{it} + \eta^{r}_{it}\, \pi^{r}_{it}$$

where π^{k} is the average product for sector *k*.

Since $s^{\mu}_{k,it} = \eta_k\ \mu_k/\mu$ and $s^{\pi}_{k} = \eta_k\ \pi_k/\pi$, are the proportions of total unemployment and GDP of the sector for region *i* in year *t*, respectively, the rate of growth of unemployment can be decomposed by obtaining the total differentiation of equation (1) as follows:

(3) $$\text{dln}\ \mu_{it} = s^{\mu}_{uit}\, \text{dln}\ \mu_{uit} + s^{\mu}_{rit}\ \text{dln}\ \mu_{rit} + (s^{\mu}_{uit} - s^{\mu}_{rit}\ \eta_{uit}/\eta_{rit})\text{dln}\ \eta_{uit}$$

Equation (3) shows the average rate of change in unemployment which depends upon the change in the number of unemployed people within each sector. This is due to the weighted proportion of the rate of change in unemployment within each sector ($\mathbf{s^{\mu}_{k}}$ dln μ_k), plus the independent contribution of urbanization. The coefficient for dln η_u can be written also as $(\mu_u - \mu_r)\ \eta_u/\mu$, which indicates that urbanization will reduce unemployment when unemployment is larger in rural than in urban areas.

One could also differentiate equation (2) as follows:

(4) $$\text{dln}\ \boldsymbol{\pi_{it}} = s^{\pi}_{uit}\, \text{dln}\ \boldsymbol{\pi}_{uit} + s^{\pi}_{rit}\ \text{dln}\ \boldsymbol{\pi}_{rit} + (s^{\pi}_{uit} - s^{\pi}_{rit}\ \eta_{uit}/\eta_{rit})\ \text{dln}\ \eta_{uit}$$

thus decomposing the average rate of growth of GDP as well.

Ravallion and Datt's equation for poverty can be applied for unemployment by using the following regression equation:

(5) $$\Delta\ln\mu_t = \beta_u\ s^{\pi}_{uit-1}\Delta\ln\pi_{uit} + \beta_r\ s^{\pi}_{rit-1}\ \Delta\ln\pi_{rit} + \beta_\eta\ (s^{\pi}_{rit-1} - s^{\pi}_{uit-1}\ \eta_{rit-1}/\eta_{uit-1})\ \Delta\ln\ \eta_{rit} + \varepsilon_{it}$$

for all t = 2,…T, where β's are parameters to be estimated; Δ is the difference operator for discrete time. Coefficients β_u y β_r can be interpreted as the impact (weighted participation) of GDP growth in urban and rural areas, respecively, while β_η shows the population movements from rural to urban areas.

It is clear that there must exist other independent factors which influence the measurement of unemployment (including the errors in the measures), thus the inclusion of the probabilistic error term, ε.

Under the null hypothesis: $\beta_u = \beta_r = \beta_\eta = \beta$, euation (5) collapses to:

(6) $$\Delta\ln\mu_{it} = \beta\ \Delta\ln\pi_{it} + \varepsilon_{it}$$

Thus, under the null hypothesis, $\beta_u = \beta_r = \beta_{\eta,}$ the total economic growth rate is the most important one. However, as it was said before, the objective of this paper is to know wheather or not the economic growth in one sector or area influences the distribution of unemployment in other sectors. Thus, in order to be able to achieve that objetive, one could use equation (3) to decompose the average rate of economic growth as follows (without the time subscript for short):

(7) $$s^{\mu}_{u}\Delta\ln\mu_u = \beta_{u1}\ s^{\pi}_{u}\Delta\ln\pi_u + \beta_{u2}\ s^{\pi}_{r}\Delta\ln\pi_r + \beta_{u3}\ (s^{\pi}_{r} - s^{\pi}_{u}\ \eta_r/\eta_u)\ \Delta\ln\eta_r + \varepsilon_u$$

(8) $$s^{\mu}_{r}\Delta\ln\mu_r = \beta_{r1}\, s^{\pi}_{u}\Delta\ln\pi_u + \beta_{r2}\, s^{\pi}_{r}\Delta\ln\pi_r + \beta_{r3}\,(s^{\pi}_{r} - s^{\pi}_{u}\,\eta_r/\eta_u)\,\Delta\ln\eta_r + \varepsilon_r$$

(9) $$(s^{\mu}_{r} - s^{\mu}_{u}\,\eta_r/\eta_u)\,\Delta\ln\eta_r = \beta_{\eta 1}\, s^{\pi}_{u}\Delta\ln\pi_u + \beta_{\eta 2}\, s^{\pi}_{r}\Delta\ln\pi_r + \beta_{\eta 3}\,(s^{\pi}_{r} - s^{\pi}_{u}\,\eta_r/\eta_u)\,\Delta\ln\,\eta_r + \varepsilon_{\eta}$$

Where overall β_i is $\beta_i = \beta_{ui} + \beta_{ri} + \beta_{\eta i}$, $\boldsymbol{i} = 1, 2, 3$. Equation (5) is obtained by adding equations (7), (8) and (9). Equation (7) shows how the composition of economic growth and population changes affect urban unemployment, and equation (5) shows their corresponding effect in rural areas. Equation (9) shows the effect related to population changes, $\Delta\ln\mu$. Equations (7) and (8) are estimated. Equation (9) does not have to be estimated because its parameters can inferred from the estimates of equations (5), (7), and (8), by using the additive restriction $\beta_{\eta i} = \beta_i - \beta_{ri} - \beta_{ui}$, $\boldsymbol{i} = 1, 2, 3$.

Equations (5), (7),(8), and (9) can not be estimated corectly for Mexico as there is lack of information about GDP by area (urban, rural). Thus, the analysis of the effects of the composition of growth on employment can be done by economic activity. This is better and much easier than the urban-rural approach. Easier, because population changes are negligible among activities; better, because the analysis can be more precise in terms of estimating the effects of the economic composition of product growth.

Starting with the per capita GDP for the primary, secondary and tertiary sector components, $\boldsymbol{Y_{it} = Y_{1it} + Y_{2it} + Y_{3it}}$, and noticing that the rate of growth of Y_{it} can be approximated by the sum of the weighted sectors' rates of growth for region *i* in year *t*, then the equation for the effect of the composition of product growth on unemployment can be written as follows:

(10) $$\Delta\ln\mu_{it} = \beta_1\, s_{1it}\Delta\ln Y_{1it} + \beta_2\, s_{2it}\Delta\ln Y_{2it} + \beta_3\, s_{3it}\Delta\ln Y_{3it} + \varepsilon_{Yit}$$

where $s_{1it} = Y_{1it}/Yit$.

Equation (10) can be rewritten for its components as follows:

(11) $$s^{\mu}_{uit-1}\,\Delta\ln\mu_{uit} = \beta^{*}u_1\, s_{1it}\,\Delta\ln Y_{1it} + \beta^{*}u_2\, s_{2it}\,\Delta\ln Y_{2it} + \beta^{*}u_3\, s_{3it}\,\Delta\ln Y_{3it} + \varepsilon^{*}_{uit}$$

(12) $$s^{\mu}_{rit-1}\,\Delta\ln\mu_{rit} = \beta^{*}r_1\, s_{1it}\,\Delta\ln Y_{1it} + \beta^{*}r_2\, s_{2it}\,\Delta\ln Y_{2it} + \beta^{*}r_3\, s_{3it}\,\Delta\ln Y_{3it} + \varepsilon^{*}_{rit}$$

(13) $$(s^{\mu}_{rit-1} - s^{\mu}_{uit-1}\,\eta_{rit-1}/\eta_{uit-1})\Delta\ln\eta_{rit} = \beta^{*}_{\eta 1}\, s_{1it}\,\Delta\ln Y_{1it} + \beta^{*}_{\eta 2}\, s_{2it}\,\Delta\ln Y_{2it} + \beta^{*}_{\eta 3}\, s_{3it}\,\Delta\ln Y_{3it} + \varepsilon^{*}_{\eta it}$$

This separated scheme allows the testing of the differential effects of economic growth of different sectors both on urban and rural unemployment and on rural-urban migration. As before, equations (11) through (13), are estimated under the condition that $\beta^{*}_{\eta i} = \beta^{*}_{i} - \beta^{*}_{ri} - \beta^{*}_{ui}$, $i = 1, 2, 3$, in order to infer the parameters for equation (10).

In regressions for total unemployment (equations (5) and (10)), elastitices are estimated by multiplying the regression coefficients by the relevant product proportions (share of GDP for each sector). For the desomposition of the rates of change on average unemployment (as in equations (10) and (11)), the elasticiy of unemployment in sector *k* (*u, r*) for growth in sector j, can be estimated by multiplying the coefficient from the

regression for *j*, by the GDP share of that sector, relative to the share of sector *k* on toal unemployment.[24]

4. EMPIRICAL EVIDENCE OF THE EFFECT OF GROWTH ON REGIONAL UNEMPLOYMENT IN MEXICO, 1996-2001

The results from the estimations of regressions ran with the panel data for the ten mexican regions are shown in Table 5.[25] Table 6 includes the estimated mid-point elasticities, whereas Tabla 7 sjows the elasticities for unemployment estimated by region. Such results suggests that the composition of economic growth by activity plays a very important role in reducing unemployment in Mexico, notewithstanding that only the growth of the secondary sector affects unemployment in a significant manner.[26] The results also suggest that rural unemployment is most affected by growth in the primary sector, and that only the secondary sector growth reduces urban unemployment.

Table 5. Impact of the Composition of Growth by Sector of Economic Activity on Unemployment in Mexico, by Regions in 1996-2001.

	Total Unemployment	Urban Unemployment	Rural Unemployment
Growth of Primary Sector	-6.285906	-3.0522	-7.762307*
T	(-0.82)	(-0.49)	(-2.19)
	[-0.622]	[-0.337]	[-7.321]
Growth of Secondary Sector	-8.067314**	-7.174189**	-0.8417971
T	(-1.77)	(-1.94)	(-0.4)
	[-2.057]	[-2.043]	[-2.046]
Growth of Tertiary Sector	2.533128	1.500721	1.943555
T	(0.75)	(0.55)	(1.25)

[24] The economic sectors considered for the decomposition of growth are: i) Primary, which includes agriculture, livestock, forestry, fisheries and mining. ii) Secondary, including manufacturing, construction, electriciy, gas and water supplies. iii) Tertiary, which includes commerce, hotels, restaurants, transportation, communications, financing, insurance, realty, commercial services, and personal services.

[25] We also estimated rates of unemployment at the state level (see Table A4 in Appendix 4). The so estimated coefficients are smaller (in absolute terms) than the ones estimated at the regional level with the panel data. Moreover, some of the coefficients at the state level have sign contrary to the ones estimated at the reaional level.

[26] We also estimated the Alternative Rate of Open Unemployment, both total and by sector (urban-rural), thereby estimating equations (11), (12), and (13). Those results show that none of the sectors' growth causes the reduction of unemployment in the three sectors considered. We arrived at similar results when estimating the Partial Unemployment Rates for Maarket and Occupation Reasons.

	[1.690]	[1.118]	[12.362]

Note: T-statistics are included within parentheses (see Table A5 in Appendix 5 for details); mid-point elasticities are included within brackets. At the mid-points, the share of the primary sector in total GDP is 0.099; the share of the secondary sector is 0.255, while the share of the tertiary sector is 0.646. The share of urban unemployment is 0.895 whereas the share of rural unemployment is 0.105.
* Coefficientes statistically significant at the 5 % level.
** Coefficientes statistically significant at the 10 % level.
Source: Calculated from NES, 1996-2001

Table 5 shows an estimated elasticity (using ordinary MLS) for total unemployment with respect to growth in the secondary sector of –2.06.[27] This means that a growth of one percent in the product of the secondary sector is associated with a fall of two percent in the total unemployment rate. In urban areas, the elasticity of unemployment with respect to growth in the secondary sector was –2.04. For the rural areas, an elasticity of unemployment with respect to growth in the primary sector was –7.32.

Table 6. GDP Shares and Regional Unemployment for México, 1996-2001

Region	**Sectors Shares in GDP**			**Urban and Rural Shares in Total Unemployment**	
	Primary	**Secondary**	**Tertiary**	**Urban**	**Rural**
Northeast	0.046	0.336	0.638	0.931	0.069
Northwest	0.120	0.223	0.680	0.845	0.155
Central-South	0.050	0.340	0.620	0.920	0.080
South	0.181	0.185	0.646	0.814	0.186
Southeast	0.178	0.113	0.723	0.917	0.083
West	0.119	0.244	0.657	0.944	0.056
Central-North	0.074	0.320	0.619	0.861	0.139
East	0.093	0.305	0.614	0.851	0.149
North	0.125	0.249	0.640	0.873	0.127
Central	0.002	0.235	0.834	0.995	0.005

Source: Calculated from NES, 1996-2001

From the data shown in Table 7 one can see that the elasticities for total unemployment with respect to growth in the secondary sector are larger in absolute terms for regions where the shares of GDP of the secondary sector are also larger (Northeastern, Central-South and Central-North regions). Also, those same regions show the largest elasticities of urban unemployment with respect to growth in the secondary sector.

[27] A Wald test with Ho: elasticity = -1 for urban growth could not be rejected, while a similar test for rural unemployment had to be rejected.

The data in Table 7 also show that the elasticities for rural unemployment with respect to growth in the primary sector are larger in regions where the shares of the primary sector in total GDP are larger (or where the shares of rural unemployment are smaller). Such is the case for the Southeastern and Western regions. (See Table 7).

Table 7. Regional Elasticities of Unemployment With Respect to Economic Growth.

	Change in Total Unemployment	**Components of Change in Total Unemployment**	
Region		**Urbano**	**Rural**
Primary Sector Growth			
Northeast	-0.757	-0.435	-6.030
Central-South	-0.317	-0.167	-4.894
South	-1.138	-0.679	-7.540
Southeast	-1.118	-0.592	-16.700
West	-0.747	-0.384	-16.576
Central-North	-0.465	-0.262	-4.126
East	-0.586	-0.334	-4.850
North	-0.787	-0.437	-7.678
Central	-0.014	-0.007	-3.106
Secondary Sector Growth			
Northeast	-1.801	-1.896	-1.213
Central-South	-2.743	-2.651	-3.579
South	-1.490	-1.629	-0.834
Southeast	-0.912	-0.884	-1.150
West	-1.967	-1.853	-3.687
Central-North	-2.581	-2.666	-1.935
East	-2.457	-2.568	-1.719
North	-2.008	-2.045	-1.656
Central	-1.898	-1.697	-36.540
Tertiary Sector Growth			
Northeast	1.722	1.208	8.529
Central-South	1.570	1.011	15.063
South	1.636	1.191	6.735
Southeast	1.832	1.183	16.995
West	1.665	1.045	22.944
Central-Nortth	1.567	1.079	8.641
East	1.556	1.083	8.003
North	1.621	1.100	9.830

Central	2.112	1.258	298.966

Source: Calculated from NES, 1996-2001

We applied Wald test under the null hypothesis that the secondary sector growth has the same effect on total unemployment as do the growth of the primary and tertiary sectors and it was rejected for all cases (Table A5 in Appendix 5). We also found that none of the economic sectors' growth had any significant effect on rural-urban population changes (equation 9).

5. CONCLUDING REMARKS

Empirical evidence shows that economic growth has a negative effect on the open rate of unemployment and that the sector composition of economic growth is very important for reducing unemployment in Mexico. On the basis of panel data for 1996-2001, we estimated regional unemployment and per capita GDP for the period, and found an elasticity of total unemployment with respect to growth in the secondary sector of –2.06, meaning that a one percent increase in the product of the secondary sector is associated to a fall of two percent in hte rate of grwth of total unemployment. We also found that for the urban areas, the elasticity of urban unemployment with respect to growth in the secondary sector was –2.04, whereas for rural areas we found that the elasticity of rural unemployment with respect to growth in the primary sector was –7.32. We found no significant effects of sectorial growth on rural-urban migration among the ten mexican regions.

Regionally, we found that the elasticities of total (and also urban) unemployment with respect to growth in the secondary sector are larger in absolute terms for regions where the secondary sector's shares of GDP are larger. That is the case for the Northeastern, Central-South and Central-North regions. Also, we found that the elasticities for rural unemployment with respect to growth in the primary sector are larger in regions where the shares of the primary sector in total GDP are larger, or where the shares of rural unemployment are smaller. Such is the case for the Southeastern and Western regions.[28]

[28] One of the limitations of this study, which follows a general equilibrium approach, is that it does not look into the causes of economic growth; that is, if growth comes out from labor or from capital intensive activities, which clearly would have a differential impact on employment. Another limitation is that it did not estimate the elasticity of product growth with respect to wages, and therefore does not look upon the flexibility of the labor markets. Yet another limitation is that it does not offer any conclusions about the economic effects of interregional migration.

REFERENCES

Barreto, Humberto, and Frank Howland (1993). *"The Two Okun's Law Relationships Between Output and Unemployment"*. http://www.wabash.edu/ depart/economic /econmat/okun/index.html

Chavarín Rodríguez, Rubén (2001). "El costo del desempleo medido en producto: una revisión empírica de la Ley de Okun para México". *El Trimestre Económico*, v. 68(2). N. 270, Abr-Jun. 2001. pp. 209-231.

Datt, Gaurav, & Martín Ravallion (1997). "Why have some Indian states done better than others at reducing rural poverty?" *Económica,* Vol.64.

Dornbusch, Rudiger & Stanley Fischer (1984). *Macroeconomics*. New York: McGraw-Hill Book Company. ISBN 0-07-017770-8

Fei John C. H. & Gustav Ranis (1961), "A Theory of Economic Development". *The American Economic Review*, Volume 51, Issue 4 (Sep., 1961), 533-565.

Fei John C. H. & Gustav Ranis (1964). "Capital-Labor Ratios in Theory and History: Reply". *The American Economic Review*, Volume 54, Issue 6 (Dec., 1964), 1063-1069.

Gallup, J. Luke & Steven Radelet & Andrew Warner (1999). *Economic Growth and the Income of the Poor.* CAER II. Discussion Paper No. 36, Harvard Institute for International Development.

Garavito, Cecilia (2002). *La ley de Okun en el Perú: 1970-2000.* Documento de trabajo 212.

Harris, John R. & Michael Todaro (1970). "Migration, Unemployment and Development: A Two Sector Analysis". *American Economic Review* 60 (1).

Hashida, Emiko & Jeffrey M: Perloff (1996). *Duration of Agricultural Employment*. Working Paper No.779. Department of Agricultural and Resource Economics Division of Agriculture and Natural Resources, University of California at Berkeley.

Hayami Yujiro & V. W. Ruttan (1970). "Factor Prices and Technical Chance in agricultural Development: The United States and Japan, 1880-1960". *The American Economic Review*, Volume 78, Issue 5 (Sep.-Oct.., 1970).

Hayami Yujiro & V. W. Ruttan (1970). "Agricultural Productivity Differences Among Countries". *The American Economic Review*, Volume 60, Issue 5 (Dec.1970), 895-911.

Hernández Licona, Gonzalo (1998). *The Effects of Household Poverty on Participation: Total Labor Supply and Unemployment in Mexico*. Instituto Tecnológico Autónomo de México (ITAM).

Howes, Stephen, y Jean Olson Lanjouw (1997). *Making Poverty Comparisons Taking into Account Survey Design: How and Why?* Living Standards Measurement Study Working Paper No. 129. World Bank.

ILO (International Labour Organization) (1996). *Latin America: (1996*). Editorial. Labour Outlook.

INEGI (2002). *Guía de conceptos, uso e interpretación de la Estadística sobre la Fuerza Laboral en México.* Aguascalientes, Ags.: INEGI

Johnston, F. and J. W. Mellor (1961). "The Role of Agriculture in Economic Development". *American Economic Review*, Vol. 51, No 4.

Jorgenson, Dale W. (1961). "The Development of a Dual Economy". *The Economic Journal"*, Volume 71.

Lustig, Nora (1998). *México: The Remaking of an Economy*. Second Edition, The Brookings Institution.

Mellor, John W. (2000). *Agricultural Growth, Rural Employment, and Poverty Reduction: Non-tradables, Public Expenditure, and Balanced Growth*. Prepared for the World Bank Rural Week 2000, March 28-21, 2000.

Mellor John W. (2000). *More Equitable Growth: The Relation Between Growth in Agriculture and Poverty Reduction*. CAER II. Discussion Paper No. 70, Harvard Institute for International Development.

Mellor J. (2000). *Proyecto de los roles de la Agricultura.* FAO, 2000.

Mellor, John W. & Sarah Gavian and Abt Associates. (1999). *Determinants of Employment Growth in Egypt: the Dominant Role of Agriculture and the Rural Small-scale Sector*. December, 1999. Impact Assessement Report No. 7

Nourzad, Farrokh, & Yacer Almaghrbi (1995). "Okun's Law and the Fulfillment of Wage and Price Expectations". *Journal of Post Keynesian Economics*, núm. 2.

Oficina Internacional del Trabajo (OIT). *Empleo y progreso económico*. Ginebra. Imprenta Corbaz, Montreux (Suiza).

Oficina Internacional del Trabajo (OIT) (1971). *El empleo como objetivo del desarrollo económico: informe de una reunión de expertos*. Ginebra. Imprenta ATAR (Suiza).

Okun, Arthur (1962). "Producto nacional bruto potencial: su medición y su significado". *Lecturas de macroeconomía.* (1982), CECSA. pp. 419-429.

Oliveira, Orlandina de (1976). *Migración y absorción de mano de obra en la Ciudad de México: 1930-1970.* México, D. F.: Centro de Estudios Sociológicos. El Colegio de México.

Ravallion, M. & Gaurat Datt (1996). "How important to India's poor is the sectorial composition of economic growth?". *The World Bank Economic Review.* Vol. 10. No 1.pp 1-25.

Southworth, Herman M. & Bruce F. Johnston (1971). *Desarrollo agrícola y crecimiento económico*. México-Argentina. Unión Tipográfica Editorial Hispano-Americana y Centro Regional de Ayuda Técnica, Agencia para el Desarrollo Internacional (A.I.D), Departamento de Estado del Gobierno de los Estados Unidos de América.

Timmer C. P. (991). "Agricultural employment and poverty alleviation in Asia". In C.P. Timmer, ed. *Agriculture and the State: Growth, Employment, and Poverty in Developing Countries.* Ithaca: Cornell University Press. Pp. 123-55.

Todaro, Michael (1969). "A Model of Labor Migration and Urban Unemployment in Less Developed countries". *American Economic Review* 59: 138-48.

Torres, Mario (2002). *Crecimiento económico y pobreza*. Mimeo, Universidad de las Américas-Puebla.

Williamson, Oliver E. (1995). "What Washington Means by Policy Reform". In Stephen Haggar, ed., *The International Political Economy and the Developing Countries*. Elgar Reference Collection Library of International Political Economy, 7: 514-28. Aldershot, U.K.:Elgar. Distributed in the United States by Ashgate, Brookfield, Vermont.

Winters, Paul & Alain de Janvry, Elisabeth Sadoulet, Kostas Stamoulis (1997). *The Role of Agriculture in Economic Development: Visible and Invisible Surplus Transfers.* Working Paper No. 814. Department of Agricultural and Resource Economics Division of Agriculture and Natural Resources, University of California at Berkeley.

Wooldridge, M. Jeffrey (1999). *Introductory Econometrics: A Modern Approach*. South-Western College Publishing

World Bank (1995). *Workers in an Integrating World*. World Development Report 1995, World Development Indicators.

APPENDIX 1. THE REGIONS OF MÉXICO

Table A1.- Regionalization by INEGI

Region	State Capital	Circunscripción
1 Northeast	Monterrey, N.L	Nuevo León, Coahuila and Tamaulipas
2 Northwest	Hermosillo, Son.	Sonora, Baja California, B. C. Sur and Sinaloa
3 Central-South	Toluca, Edo. De Méx.	México, Guerreo and Morelos
4 South	Oaxaca, Oax.	Oaxaca, Chiapas, and Tabasco
5 Southeast	Mérida, Yucatán.	Yucatán, Campeche and Quintana Roo
6 West	Guadalajara, Jal.	Jalisco, Colima, Michoacán and Nayarit
7 Central-North	San Luis Potosí, S.L.P	S.L.P, Aguascalientes, Guanajuato and Querétaro
8 East	Puebla, Pue.	Puebla, Hidalgo, Tlaxcala and Veracruz
9 North	Durango, Dgo.	Durango, Chihuahua and Zacatecas
10 Central	México, D.F.	Distrito Federal

Source: Calculated from NES, 1996-2001

APPENDIX 2. ESTIMATIONS OF REGIONAL UNEMPLOYMENT FOR MÉXICO, 1996-2001.

Table A2. Regional Estimates of Total, Urban and Rural Unemployment for México, 1996-2001.

Region		***Year***	***Total Unemployment***	***ee***	***Urban Unemployment***	***ee***	***Rural Unemployment***	***ee***
Northeast	1	1996	**0.0284**	0.0024	**0.0309**	0.0030	**0.0196**	0.0029
	1	1997	**0.0244**	0.0027	**0.0248**	0.0070	**0.0234**	0.0026
	1	1998	**0.0204**	0.0019	**0.0224**	0.0033	**0.0130**	0.0022
	1	1999	**0.0148**	0.0012	**0.0172**	0.0023	**0.0069**	0.0014
	1	2000	**0.0168**	0.0015	**0.0182**	0.0025	**0.0105**	0.0017
	1	2001	**0.0148**	0.0013	**0.0159**	0.0012	**0.0100**	0.0047
Central-South	2	1996	**0.0510**	0.0032	**0.0602**	0.0032	**0.0170**	0.0039
	2	1997	**0.0322**	0.0051	**0.0366**	0.0052	**0.0179**	0.0064
	2	1998	**0.0291**	0.0025	**0.0333**	0.0067	**0.0145**	0.0023
	2	1999	**0.0232**	0.0031	**0.0291**	0.0003	**0.0004**	0.0037
	2	2000	**0.0192**	0.0015	**0.0215**	0.0022	**0.0085**	0.0018
	2	2001	**0.0186**	0.0016	**0.0221**	0.0019	**0.0021**	0.0014
South	3	1996	**0.0154**	0.0014	**0.0272**	0.0013	**0.0054**	0.0023
	3	1997	**0.0100**	0.0032	**0.0182**	0.0031	**0.0027**	0.0052
	3	1998	**0.0137**	0.0035	**0.0247**	0.0014	**0.0043**	0.0050
	3	1999	**0.0099**	0.0013	**0.0174**	0.0015	**0.0029**	0.0020
	3	2000	**0.0107**	0.0020	**0.0158**	0.0030	**0.0059**	0.0023

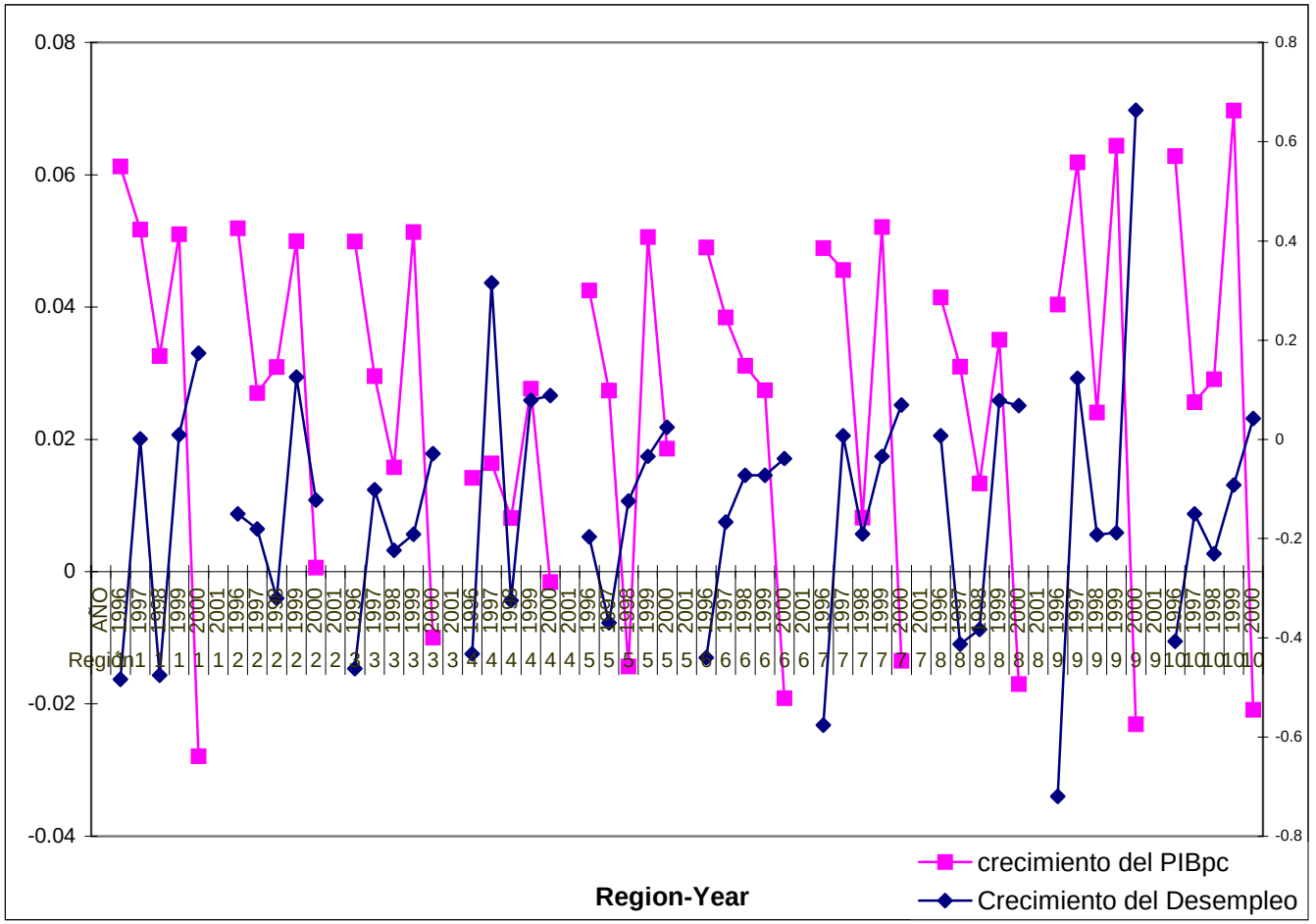
	3	2001	**0.0117**	0.0018	**0.0179**	0.0028	**0.0055**	0.0017
Southeast	4	1996	**0.0218**	0.0020	**0.0261**	0.0021	**0.0057**	0.0026
	4	1997	**0.0179**	0.0029	**0.0195**	0.0009	**0.0082**	0.0033
	4	1998	**0.0123**	0.0012	**0.0148**	0.0013	**0.0036**	0.0015
	4	1999	**0.0109**	0.0018	**0.0116**	0.0054	**0.0082**	0.0018
	4	2000	**0.0105**	0.0011	**0.0121**	0.0018	**0.0040**	0.0012
	4	2001	**0.0108**	0.0010	**0.0121**	0.0012	**0.0053**	0.0017
West	5	1996	**0.0280**	0.0017	**0.0344**	0.0023	**0.0083**	0.0019
	5	1997	**0.0180**	0.0025	**0.0239**	0.0023	**0.0033**	0.0023
	5	1998	**0.0153**	0.0011	**0.0191**	0.0013	**0.0021**	0.0011
	5	1999	**0.0142**	0.0020	**0.0171**	0.0020	**0.0047**	0.0025
	5	2000	**0.0132**	0.0012	**0.0159**	0.0010	**0.0028**	0.0014
	5	2001	**0.0127**	0.0011	**0.0148**	0.0013	**0.0048**	0.0015
Central-North	6	1996	**0.0305**	0.0023	**0.0390**	0.0052	**0.0125**	0.0022
	6	1997	**0.0172**	0.0028	**0.0242**	0.0055	**0.0065**	0.0030
	6	1998	**0.0173**	0.0017	**0.0208**	0.0035	**0.0085**	0.0019
	6	1999	**0.0143**	0.0017	**0.0174**	0.0020	**0.0066**	0.0022
	6	2000	**0.0138**	0.0018	**0.0170**	0.0023	**0.0064**	0.0023
	6	2001	**0.0148**	0.0013	**0.0185**	0.0016	**0.0061**	0.0018

Oriente	8	1996	**0.0291**	0.0043	**0.0403**	0.0025	**0.0108**	0.0059
	8	1997	**0.0293**	0.0068	**0.0376**	0.0120	**0.0168**	0.0072
	8	1998	**0.0194**	0.0028	**0.0252**	0.0033	**0.0096**	0.0036
	8	1999	**0.0132**	0.0018	**0.0204**	0.0008	**0.0025**	0.0026
	8	2000	**0.0143**	0.0013	**0.0199**	0.0011	**0.0046**	0.0017
	8	2001	**0.0153**	0.0018	**0.0182**	0.0016	**0.0100**	0.0041
Norte	9	1996	**0.0311**	0.0026	**0.0386**	0.0040	**0.0127**	0.0036
	9	1997	**0.0151**		**0.0214**	0.0109	**0.0024**	
	9	1998	**0.0171**	0.0014	**0.0208**	0.0030	**0.0085**	0.0019
	9	1999	**0.0141**	0.0017	**0.0173**	0.0015	**0.0062**	0.0021
	9	2000	**0.0117**	0.0010	**0.0129**	0.0022	**0.0083**	0.0012
	9	2001	**0.0227**	0.0016	**0.0275**	0.0013	**0.0078**	0.0050
Centro	10	1996	**0.0704**	0.0040	**0.0702**	0.0122	**0.0839**	0.0040
	10	1997	**0.0468**	0.0050	**0.0471**		**0.0260**	0.0050
	10	1998	**0.0403**	0.0034	**0.0403**	0.0081	**0.0349**	0.0034
	10	1999	**0.0320**	0.0073	**0.0320**	0.0010	**0.0215**	0.0073
	10	2000	**0.0291**	0.0025	**0.0292**	0.0019	**0.0248**	0.0025
	10	2001	**0.0304**	0.0031	**0.0304**	0.0032	**0.0194**	0.0043

Source: Calculated from NES, 1996-2001

APPENDIX 3

Figure 4. Regional Rates of Growth of Gross Domestic Product and Unemployment for Mexico, 1996-2001



Source: Calculated from NES, 1996-2001

APPENDIX 4. STATE ESTIMATES FOR THE IMPACT OF THE SECTORIAL COMPOSITION OF ECONOMIC GROWTH ON UNEMPLOYMENT

Table A4. Estimates of Changes in Unemployment as a Function of the Sectorial Composition of Economic Growth for 32 Mexican States in 1996-2001.

Variable or Parameter	Change in Total Unemployment	Components of Change in Total Unemployment		Population Change βn
		Urban	Rural	
Primary Sector Growth β_1	4.774	2.497	2.681**	-0.424
	(1.47)	(0.96)	(1.89)	(-1.17)
Secondary Sector Growth β_2	1.073	-0.683	-0.103	-0.478
	(0.33)	(-0.26)	(10.07)	(-1.3)
Tertiary Sector Growth β_3	-6.573*	-4.22**	-0.544	-0.116
	(-2.2)	(-1.76)	(-0.4)	(-0.35)
R^2	0.176	0.169	0.0765	0.1166
Functional Form (RESET) F(3, 149)	0.55	0.88	6.56	2.38
	[0.6509]	[0.4505]	[0.0004]	[0.072]
Wald $\beta_1=\beta_2=\beta_3$	2.67	1.58	1.97	0.19
F(2, 152)	[0.0728]	[0.2088]	[0.1434]	[0.8234]
Heteroscedasticity	12.93704	21.72134	43.76894	29.55236
Chi-sq(25)	[0.9773]	[0.6518]	[0.0115]	[0.2415]

Note: T-values inside parentheses; p-values inside brackets.
* Coefficients statistically significant at the 5% level
** Coefficientes statistically significant at the 10% level
Source: Calculated from NES, 1996-2001

APPENDIX 5. REGIONAL ESTIMATES FOR THE IMPACT OF THE SECTORIAL COMPOSITION OF GROWTH ON UNEMPLOYMENT

Table A5. Estimates of Changes in Unemployment as a Function of the Sectorial Composition of Economic Growth for 10 Mexican Regions in 1996-2001.

Variable or Parameter	Change in Total Unemployment	Components of Change in Total Unemployment		Population C
		Urban	Rural	
Primary Sector Growth β_1	-6.286	-3.052	-7.762	0.55
	(-0.82)	(-0.49)	(-2.19)*	(0.49
Secondary Sector Growth β_2	-8.067	-7.174	-0.841	-0.81
	(-1.77)**	(-1.94)**	(-0.4)	(-1.20
Tertiary Sector Growth β_3	2.533	1.5	1.943	0.32
	(0.75)	(0.55)	(1.25)	(0.65
R^2	0.522	0.537	0.248	0.27
Functional Form F(3, 149)	2.62	2.86	4.26	2.43
	[0.0645]	[0.0492]	[0.0108]	[0.08
Wald $\beta_1=\beta_2=\beta_3$	1.16	1.32	2.9	1.33
	[0.3239]	[0.2773]	[0.0664]	[0.274
Heterocedasticidad Chi-sq(25)	26.16224	28.38335	42.48411	15.898
	[.399]	[0.2905]	[0.0159]	[0.917

Note: T-values inside parentheses; p-values inside brackets.
* Coefficients statistically significant at the 5% level
** Coefficientes statistically significant at the 10% level
Source: Calculated from NES, 1996-2001