Measuring a Territorial Labor Market Development Index

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Abstract

There is a widespread debate on the importance of the quality of labor, which is the requirement for wages to cover basic needs and provide people with a decent way of life and fostering development at the same time. This paper proposes to measure a labor market development index, using variables that can usually be found in labor surveys and can be applied for regional and country comparisons with easiness of aggregation through geometric means. We consider three principal pillars that make of labor one of the main mechanics for development: equality, productivity, and welfare.

Keywords: development, labor market, welfare, equality, productivity

JEL: D30, D60, J01, J21, J48

1. INTRODUCTION

The quality of labor is one of the main mechanisms through which individuals, and households, can not only improve their chances to leave poverty, or prevent themselves from falling into it, but can also make them achieve better consumption levels of basic goods. Thus, it is a central factor of well-being for households and individuals. Some of these issues have been widely reflected in the discussion of what the International Labour Organization (ILO) has called decent work, and this has sparked a series of studies all around the world that try to capture such a concept.

The ILO's (1999) definition of decent work comprises four dimensions: creating jobs; guaranteeing rights at work; extending social protection; and promoting social dialogue. Since it is important to progress the decent work agenda, measurement is needed to monitor weak areas where public policies can be strengthened. However, some concepts may be difficult to measure as they involve rights, representation, and similar variables where qualitative assessments are involved. Despite this, the ILO has already started different projects for country profiles, including some databases. Other academic institutions, like the Oxford Poverty & Human Development Initiative (OPHI) (2013), have identified quality of labor as one of the missing components of poverty, as it is related to the probability of leaving poverty and to giving people a sense of respect and of having a fulfilling life, and they call for more data and indicators that can be compared at the international level.

Other indexes have been constructed in order to measure some related aspects but not the same central focus. For example Osberg and Sharpe (2002, 2005) build an index of well-being for the US and OECD countries that includes wages, job security, wage inequality and the average of education, using a method similar to the Human Development Index (HDI). San, Hung and Huang (2006) use manufacturing data and build a quality of labor index by sector for Taiwan that includes workers' productivity, security, health, training, labor conflicts, and the type of labor model to account for 25 different components. These authors weight the components of the index using sectorial importance for aggregation. Schwerdt and Turunen (2007) decompose total productivity using labor surveys to predict wages and hours worked, for both men and women, and find education and experience to be the main changing forces of the observed labor quality. Aggarwal (2004) aggregates a labor quality index for the Indian states, decomposing manufacturing production and the share of labor, and finds wide differences among regions, but slow changes over time. Mostly, the development of those labor quality index involves the use of more specialized data and decomposition of factors that can be used to track over time how such factors can change and affect productivity levels, but that can make comparisons of regions and countries more difficult since data for all the components is not available for all areas.

Another stream of the literature also points to the importance of labor development as a mechanism for development. Ljungqvist (1993) departs from the contributions of both Arthur Lewis and Theodore Schultz, and considers the importance of human capital for development for a framework he builds to understand what happens in less-developed countries. This author suggests that a less-developed country is characterized by the

following criteria: a high ratio of unskilled workers, a lower stock of physical capital, a smaller gross national product, higher rates of returns on education, and larger wage differentials between skilled and unskilled labor. A perpetuation of underdevelopment is related here to the inability to improve labor conditions and the quality of labor.

From a territorial point of view, the proposal of Ljungqvist can be adapted to identify and monitor those factors related to labor and development. Whether between nations or between states within a country, development can take place to the extent that productivity increases, and this issue is completely related to how the labor market can be improved or remains stagnated and underdeveloped. Unlike the previous set of indexes that decompose productivity, with more complex data and methods, the proposal here can be easily integrated in an index though specific factors, as the used data comes from employment surveys that are available for all countries to some extent, and using the geometric mean aggregation of factors.

The objective of this paper is to build a territorial measure of development of the labor market by adapting the frameworks of Ljunqvist (1993) and of Osberg and Sharpe (2005). In doing so, we will use labor surveys and a more flexible method for calculating and aggregating the components of the index, using geometric mean of dimension sub-indexes The utility of this index arise from the fact that our proposal can be easily replicated in other countries or regions, since the availability of labor surveys has become common, and

the set of variables is common in those surveys. In this paper we apply the method to Mexico, developing the index at the state level, and compare it along time.

The index does not aim to overlap over other indicators such as the Human Development Index. It rather goes to the mechanics of labor as determinant of development, and pointing to what factors are lagging in specific areas, so local government can implement actions to improve in different aspect and at the same time have an incidence on total welfare and competitiveness of the region. The advantage in its implementation is the availability of data and easiness of aggregation and interpretation.

The paper is structured as follows: in the next section we outline the conceptual bases for the index of labor market development, comparing it with other bases of other indexes and presenting why we choose three pillars to build our index. We then present the aggregation of the index, with a detailed description of the construction and method in the annex, finally some conclusions are drawn.

2. CONCEPTUAL FRAMEWORK

The creation of jobs, and their quality, may be different among countries but also within countries. As recognized by the World Bank (2013a) through its World Development Report 2013, jobs are central instruments for development, they argue that jobs not only contribute to the well known effect on well-being of households and individuals, but also they contribute to more broad objectives such increasing productivity, reducing poverty, and social cohesion, setting these three pillars as the base for which countries can focus on improving the quality of jobs and contributing to development at the same time.

The literature has traditionally separated the analysis of quality of jobs and development. The stream of the literature focusing on quality of labor has relied largely on the decomposition of factors for productivity, following earlier work by Jorgensen et al. (1987) and Sattinger (1980). Such decomposition mainly relates to the manufacturing industry, and using data for stocks of capital, showing low correlation with other indicators such as the HDI (i.e. Aggarwal, 2004). In addition to the need for special data for decomposing productivity for a sector, the weights can be set in different forms, and, as Lacuesta et al. (2011) show, the changes in the composition of the labor force, and new variables, make it more difficult to analyze and compare across time.

Other, as Osberg and Sharpe (2005), build a general index for wellbeing including labor aspects among others. These authors propose the idea that a good well-being index should include consumption, accumulation of productive resources, income distribution, and

economic security. They argue that with such factors, individuals can better organize their ideas on social and economic outcomes, thus leading to better evaluations of political and economic outcomes that closely resemble their preferences, and therefore keeping indexes simple is also a must for reaching individuals. They include 17 factors and weight them in similar parts, including consumption per capita, public spending on debt, and other concepts such as poverty and different stocks (capital, human capital, nature, R&D), among others.

In another strand of the literature, Ljungqvist (1993) reconciles the concept of development through the labor market. This author presents a dynamic model with underinvestment in human capital in countries with lower levels of development, resulting in a relatively small proportion of skilled workers. The cause of this appears to be that access to such education is relatively more expensive in underdeveloped countries. The consequences are a small stock of capital, a low gross national product and a high rate of returns on human capital, which cause a large differential in wages according to educational level. Even though these are conditions in a theoretical model, they can be aggregated into an index for labor market underdevelopment.

Here, we propose a labor market development index based on the idea that labor is a center piece for development, and operating through three pillars that affect the quality of labor and make regions more prone for a higher development: equality, productivity, and welfare. The three areas selected for our index cover the essential and basic elements for a labor

market to develop capacities and opportunities: productivity for improving innovation and linking education to efficiency; equality for better basis for opportunities; and welfare for proving at least for the basic physical and material well-being of workers and their households. Table 1 presents the factors used by the mentioned indexes.

Insert Table 1

We mostly base our proposal on the Ljungqvist (1993) characterization of the underdeveloped labor market, but we adapt it to the availability of common data for comparison of regions, so that is easy for replication with the usual labor surveys available. Also such areas are to some extent similar to the three pillars set by the World Bank (2013a) for making jobs a factor of development. Next, we explain the three pillars, and the annex details the integration with examples.

(a) Equality

Since the work of Kuznets, who hypothesizes that there is a relationship between inequality and development, inequality has become an issue that deserves attention for improving the functioning of a market with implications for development and economic growth. In this sense, it is very important to find tools that allow a better income distribution to be generated. On the other hand, in the report of the Economic Commission for Latin America (ECLAC, 2010), education is established as the decisive factor in halting the

intergenerational reproduction of poverty and inequality. This happens since education improves the potential of households for increasing productivity. Eventually this will create faster, greater social and occupational upward mobility for those who graduate from the education system. Therefore, a more equal labor market will follow changes in the distribution of wages between groups, and the composition of the supply of labor, being composed of the following two subcomponents for relative prices and relative supply.

(i) Skilled workers to unskilled workers ratio:

As reported by Topel (1997) most industrialized countries experienced a faster schooling upgrading, provided they expanded their supply of education and then younger cohorts entered the labor market with higher education than previous generations. Then, the proportions of educated workers may narrowing the differentials in shares of workers is a way to reduce future inequalities in the labor market and policies can focus on such task. Underdeveloped countries are characterized by a high ratio of unskilled workers in the labor force, and this sub-index show the spatial distribution of skills and such inequality in terms of abilities. Then, regions with lower differential ratios here may point to higher development.

(ii) Real hourly wages ratio by educational level:

One of the indicators of inequality is the wage gap between skilled and less skilled workers for different areas. Here we measure the dispersion of wages between different skills among the different areas and it is a weighted share of wages by the skilled group compared to the less skilled group, i.e, the fraction of earning made by groups. It is politically and

ethically desirable to reduce inequality, this sub-index could hint the trend towards wage inequality along time so there would possible to suggest addressing policies in this regard.

(b) Productivity

Productivity can be defined as the marginal product of an additional unit of labor or capital. Given the cost involved in accumulating capital and hiring staff (wages, investment, depreciation, etc.), it is important to make an efficient allocation of resources. The aim of this pillar is to measure the productivity of labor, and we propose the percentage of employees in innovative sectors, and the returns to education or human capital.

(i) Returns to human capital:

As it is well known, there is a strong positive relationship between wages and education level (Mincer, 1974). In an economy with a low supply of skilled workers, the wage premium for an additional year of education is relatively high. Empirical evidence confirms these theories (Psacharopoulos & Patrinos, 2004). Again, we must reverse the direction of the results when we standardize the index, so that a higher value of this sub index represents a greater level of development.

(ii) Percentage of employed in innovative sectors:

There is extensive literature on the effects of technological innovation on economic growth. Solow (1957) explains that technical change counteracts the diminishing returns on the

accumulation of capital stock; in this sense, in the long run all the growth in output per worker is generated by technological progress.[1] On the other hand, Romer (1986) presents a model of long-run growth where knowledge is added to the set of inputs in production, resulting in an endogenous technological change model. Therefore, growth rates can increase over time. Aghion and Howitt (2007) develop a hybrid model between the neoclassical and the Schumpeterian models, in which the capital accumulation takes place but productivity growth arises endogenously; therefore its contribution to growth is carried out jointly. These models demonstrate that innovation and technological progress are essential to economic growth given the diminishing marginal returns of capital accumulation and the slow process of labor force growth. We propose that the percentage of employed in innovative sectors is the best indicator to measure the efforts to generate technological development with labor.

(c)Welfare

We also analyze the quality of working conditions that exist in each state. Having good quality working conditions implies that workers have access to social security—so welfare is guaranteed in terms of health and access to pensions in the future— and that such income will allow them to meet their basic needs. In addition, Schwerdt and Turunen (2007) argue that a higher labor quality leads to greater productivity, increasing total income. Rodriguez-Oreggia and Silva (2009) demonstrate this through the construction of a working conditions

[1] In his empirical study for the US case (1909-1949), Solow (1957) concludes that 81.5% of the growth in gross output per person hour is due to technical change.

index at state level for Mexico, where they find a positive correlation between working conditions and GDP per capita.

(i) Percentage of people employed in the formal sector (with social security benefits for the job):

We propose using the degree of formality as a measure of development in terms of working conditions. Since the informal sector inhibits the returns to education and its growth can lead to greater exclusion from health care and pensions for much of the population, along with a lower aggregate productivity (Levy, 2007), the lack of opportunities and incentives for access to the formal sector is a characteristic of an underdeveloped labor market. Developing countries tend to present high rates of informality. Leaving a high share of workers out of social security benefits such as health access and pensions (World Bank, 2013).

(ii) Percentage of households above the labor poverty line:

This component allows us to know whether the labor income of each household is enough so that each one of its members can meet their basic needs to ensure minimum welfare. The main goal is to measure the chances of getting a dignified work in the Mexican labor market in each region.

3. INDEX AGGREGATION AND RESULTS

To calculate the index we transform the elements mentioned above into quantifiable indexes, aggregating them using geometric means as in the HDI methodology. The data

used is the National Labor and Occupational Survey, or in Spanish Encuesta Nacional de Ocupación y Empleo (ENOE), carried out by the Instituto Nacional de Estadística y Geografía e Informática (INEGI). This is a quarterly survey that includes all sociodemographic characteristics of the household members, as well as several labor characteristics. It has representation at the national and state level. Since it is a quarterly survey it allows for replication of the index in a continuous form. For each state we calculate sub-indexes standardizing between 0 and 1. The detailed explanation for the aggregation method is in the Annexes, while Table 2 presents the comparison of subcomponents in each panel.

Insert Table 2 (indexes with subcomponents)

The states with the highest values in terms of well-being are Nuevo Leon, Baja California Sur, and Baja California, and the lowest values are Chiapas, Zacatecas, Oaxaca, and Puebla. The states with the highest values in equality are Distrito Federal (DF) or Mexico City, and Baja California Sur and Sonora, and the lowest values are Chiapas, Oaxaca, and Guerrero. In terms of productivity the highest values are Chihuahua, Baja California, and Tamaulipas, and the lowest values are for Quintana Roo, Chiapas, and Oaxaca.

The next table presents the results of the index for the first quarter of 2005 where an index value of 1 is the best achievement and 0 the worst in terms of development of the labor market. As we can see here, the states with higher rates are Chihuahua, Baja California,

Nuevo León, Coahuila de Zaragoza, and Tamaulipas, which represent more developed labor markets.

Insert Table 3

According to the table, Chihuahua's labor market seems to be the most developed in the country considering the pillars of equality, productivity, and welfare, as aggregated in the index. Likewise, we see Chiapas, Oaxaca, and Zacatecas as the least-developed cases with the worst labor conditions. This does not mean that these states are the worst in each of the subcomponents.

Likewise in the table, we can see the index for the third quarter of 2012 (the last available survey at the time of doing the analysis), and we appreciate that the situation does not change too much. These changes in the ranking may be mainly because of the big effects of the last economic crisis in the states that have a greater connection with foreign trade. That is why we see that states like Chihuahua and Baja California, which border the US, start at the top of the list and end in 3rd or 4th place, which are the sub-indexes of productivity such as employees in innovative sectors; the formal employees are the ones that are skewing the index values of these states down. This is because, as a result of the economic crisis, firms might reduce their staff, causing this effect in the index. We can see the same situation at the bottom of the list. The cases of Michoacan and Guerrero are two of

the most remarkable ones. The sub-index of the percentage of employees in innovative sectors is the one lowering the index value for these states that are at the bottom of the list.

If we disaggregate, the last states in the ranking are affected mostly by the productivity component. In general, that is the item that has the most effect, but for the least-developed states it is critical, and Nayarit is the worst affected in this respect. However, Chiapas is shown as the least-developed state, and this is mainly due to its low percentage of employees in innovative sectors, high informality rate, and low rate of skilled employees to unskilled ones. The same scenario is presented by Zacatecas and other underdeveloped states. Even the most developed states have low values in the sub index related to formality and also in the percentage of employees in innovative sectors. Then there is stagnation over time and no change in the states' development, as seen in the graphs presented in the Appendix.

Mapping the first and last index, Maps 1 and 2 show the spatial distribution of the development of labor.

Insert Maps 1 and 2

In the maps, the index is divided into three categories: high, medium, and low. Besides one state moving to the high category, and two moving from low to medium, the picture is very similar in both years. This points to a characteristic of the Mexican spatial development:

stagnation. Other studies (Rodriguez-Oreggia, 2005) have focused on the convergence of growth in Mexico, finding that education is the most important factor for development; thus, such differences in human capital play one of the main roles in the persistence of disparities. The index built here seems to go in the same direction.

(a) Relation with other indicators

Our index can be related to other indicators. Here we measure the correlation between the Labor Market Development Index (LMDI) and the Human Development Index published by the UNDP. In the graph that follows we can see how the LMDI correlates the HDI for 2008, last year of such index for Mexico. For this exercise we use an average of the four quarters of each year and then we calculate the correlation.

Insert Figure 1

We can see that the correlation is above 0.9, suggesting that the Labor Market Development Index is a good predictor for the Human Development Index. This calculation also corroborates the idea that development in the labor market is to a great extent correlated with the workers' development and their level of human development, even though they measure different issues, and the LMDI can only be used as predictor for the HDI in periods where the information for HDI is not available.

In Figure 2 we can appreciate the correlation between this index and the states' growth of GDP per capita as an aggregated measure of productivity. A quality of jobs can improve productivity and growth, even though, here we can only correlate actual indicators for both the LMDI and economic growth, but the ideal correlation for actual growth is with past labor market development. As noted, the correlation is low.

Insert Figure 2

One of the main factors for a better quality of labor is the quality of education. Measures for quality of education have been through standardized tests ENLACE, we can relate the present indicators for the labor index and the one for quality of education. Since 2006, ENLACE is applied every year to primary school and here it is the combined test for Spanish and Math for all grades at the state level in 2009.

As we can see, there is a negative but very low correlation between these two measures. This is remarkable for the analysis in this section, considering that in global tests in recent years Mexico has been ranked last, which means that there is a poor quality of elementary education, and, as in the last analysis, joined with the stagnancy in development it is not surprising that there is a poor correlation between grades and development.

Insert Figure 3

As a conclusion for this section, we can see that the LMDI and measures of human development such as HDI are very correlated, which means that our index is a good predictor for the development of the individuals' quality of life, provided the HDI is calculated every few years. However, there is a low correlation with aggregated productivity measures and quality of education. Given the high rates of informal labor, this seems plausible. There is also a limited capacity for relating quality of jobs and productivity, perhaps due to the low quality of education, although more research needs to be carried out into such links, and this cannot be done in this paper.

4. CONCLUSIONS

In this paper we have proposed the construction of a labor market development index comprising three areas of well-being that workers can have in the labor market: equality, productivity, and welfare. This index relies on information that is common across labor surveys, and using the geometric means methodology for aggregation allows for simple construction and possible comparison of territorial unities, be they regions or countries. In the example for this paper we construct the index for the Mexican states, using labor surveys representative at that level and for several years, then we compare it with other development and economic indicators. The three selected areas represent the opportunities, capacities and benefits that workers can have in labor markets and in a general form set the contribution for development.

Each of the areas is composed of two subfactors. Equality is composed of the aggregation of the ratio of skilled to unskilled workers, and of the ratio of wages for different educational levels. The area of productivity comprises the returns to human capital in inverse form, and the employees in the most innovative sectors. The area of welfare aggregates the share of workers with social security benefits for the job, or those formal workers, and also the share of households that are not in labor poverty. Within each pillar, we aggregate the two subcomponents, and then, once standardized, we aggregate and standardize using the geometric means methodology.

In this paper we applied the proposed methodology to the Mexican states with existing labor surveys. States with better labor market development conditions are those in the north and center, while those in the south experience worse development conditions. The economic crisis affected some states that have more links with the US economy, but in general there seems to be stagnation for the period under analysis in labor development conditions within Mexico.

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APPENDIX

1. CONSTRUCTING THE LABOR MARKET DEVELOPMENT INDEX

The labor market development index, here applied to the Mexican states, results from the aggregation through geometric means of three sub-indexes outlined in the conceptual section: 1) equality, 2) productivity and 3) welfare. Its calculation is shown below; we illustrate the results for the national case for the first quarter of 2005.

The geometric mean of the components, is as follows:

$$LMDI = (Equality)^{\frac{1}{3}} * (Productivity)^{\frac{1}{3}} * (Welfare)^{\frac{1}{3}}$$

$$Equality = (EREL)^{\frac{1}{2}} * (SREL)^{\frac{1}{2}}$$

$$Productivity = (RHC)^{\frac{1}{2}} * (PEIN)^{\frac{1}{2}}$$

$$Welfare = (PHOLP)^{\frac{1}{2}} * (PF)^{\frac{1}{2}}$$

Where all acronyms for sub-indexes are explained next.

(a) Equality

(i) Employed ratio by educational level sub-index (EREL)

$$EREL = \frac{Number\ of\ skilled\ workers}{Number\ of\ unskilled\ workers}$$

Skilled workers are those with more than nine years of education. Similarly, unskilled workers are considered to be those with nine or fewer years of schooling, i.e. occupied without instruction or some degree of primary or secondary education.

Unskilled workers			Skilled workers					
Without instruction	Primary	Secondary	High school	Professional	Total	Skilled workers	Unskilled workers	$EREL$
3,414,945	14,969,544	11,151,299	7,723,228	4,685,619	41,944,635	12,408,847	29,535,788	0.4201

$$EREL = \frac{OV_{EREL} - MINV_{EREL}}{MAXV_{EREL} - MINV_{EREL}}$$

where

OV_{EREL}: Observed value of the employed ratio by educational level

$MINV_{EREL}$: Minimum value of the employed ratio by educational level

$MAXV_{EREL}$: Maximum value of the employed ratio by educational level

The maximum value used for the calculation of this component is an approximation of the maximum value observed in the analyzed period. The minimum is 0, which is equivalent to the absence of skilled workers.

(ii) Wage ratio by educational level sub-index (SREL)

$$SREL = \frac{\ln (RHWSW)}{\ln (RHWUW)}$$

where

$\ln (RHWSW)$: The real hourly wage logarithm for skilled workers. It is the weighted average of the logarithm means of the wages of employees who have attended high school or completed professional studies.

$$\ln(RHWSW) = \frac{(N° \, Employees \, H.S.) * (E[Ln(RHW \, H.S.)]) + (N° \, Employees \, Prof.) * (E[Ln(RHW \, Prof.)])}{[(N° \, Employees \, H.S.) + (N° \, Employees \, Prof.)]}$$

$\ln (RHWUW)$: The real hourly wage logarithm for unskilled workers. It results from the weighted average of the logarithm means of the wages of employees who are uneducated or who have some level of primary or secondary education.

$$\ln(RHWUW) = \frac{(N° \, Empl.{}^{W}/_{O} \, Inst.) * (E[Ln(RHW \, {}^{W}/_{O} \, Inst.)]) + (N° \, Emp.Prim.) * (E[Ln(RHW \, Prim.)]) + (N° \, Emp.Sec.) * (E[Ln(RHW \, Sec.)])}{[(N° \, Empl.{}^{W}/_{O} \, Inst.) + (N° \, Emp.Prim.) + (N° \, Emp.Sec.)]}$$

Example:

Unskilled workers						Skilled workers						
Without Instruction		Primary		Secondary		High School		Professional				
Employees	E[Ln(RHW)]	Employees	E[Ln(RHW)]	Employees	E[Ln(RHW)]	Employees	E[Ln(RHW)]	Employees	E[Ln(RHW)]	RHWUW	RHWSW	SREL
2,564,809	2.47	11,724,233	2.83	8,875,637	3.02	6,150,396	3.35	3,644,782	3.944	2.86	3.57	1.247

In order to remove the bias caused by outliers, two cleaning stages were performed for each database. The first one consisted of eliminating those observations that did not report the real hourly wage and those exceeding 400 pesos per hour.[2] The purpose of this is to reduce the high data dispersion caused by some outliers. For the second stage we calculate the natural logarithm of real hourly wages in order to normalize their distribution.[3] Subsequently, we eliminate those observations that present values above or below three standard deviations from the mean for each level of education in each state and period.

Having cleaned the bases, we calculate the average of the natural logarithm of the real hourly wage for each state according to education levels.

$$SREL = 1 - \frac{OV_{SREL} - MINV_{SREL}}{MAXV_{SREL} - MINV_{SREL}}$$

where,

OV_{SREL}: Observed value of the wage ratio by educational level

$MINV_{SREL}$: Minimum value of the wage ratio by educational level

$MAXV_{SREL}$: Maximum value of the wage ratio by educational level

Maximum value was taken as 2. For the minimum value we use 1—since it is expected that employees who completed higher education have a remuneration at least as good as that of employees with less education (Ljungqvist, 1993).

[2] The number of observations that had a RHW greater than 400 pesos per hour represents approximately 0.1% of each sample.

[3] The variable of real hourly wages has a log-normal distribution with mean μ_{ijk} and variance $\sigma^2{}_{ijk}$. Where i ≡ educational level, j ≡ state, and k ≡ Period.

(b) Productivity

(i) Returns on human capital sub-index (RHC)

The calculation of returns to education is conducted from the Mincerian equation:

$$Ln(W_i) = \alpha + \beta_1 Educ_i + \beta_2 Exp_i + \beta_3 Exp^2{}_i + \beta_4 Hom_i + \beta_5 Patron_i + \beta_6 CtaProp_i + \beta_7 OcupSAE2._i + \beta_8 OcupSAE3_i + \beta_{10} Urb_i + \varepsilon_i$$

According to the standard theory of the returns to education, the level of education (Educ) is a key variable for the study of the returns to education (Mincer, 1974). The other components of human capital—labor experience (Exp) and labor experience squared (Exp^2)—and the set of dummy variables relating to sector and occupations—occupied employer (Patron), occupied by self (CtaProp), industry sector (OcupSAE2), services sector (OcupSAE3), male (Hom), and occupied in urban area (Urb)— were used as control variables.[4]

Example:

Returns to human capital	8.1417%

$$RHC = 1 - \frac{OV_{RHC} - MINV_{RHC}}{MAXV_{RHC} - MINV_{RHC}}$$

[4] The sample is restricted to workers aged from 18 to 65 years.

where

OV_{RCH}: Observed value of the returns to human capital

$MINV_{RCH}$: Minimum value of the returns to human capital

$MAXV_{RCH}$: Maximumvalue of the returns to human capital

The minimum value of the return to human capital is 0, which means that an extra year of schooling does not increases wages. The maximum value we use is 20.1, corresponding to Ivory Coast in 1986 (Psacharopoulos & Patrinos, 2004); this result indicates that it is expected that an additional year of schooling increases wages by 20.1%.

(ii) Percentage of employed in innovative sectors sub-index (PEINS)

$$PEIN = \frac{Number\ of\ employed\ in\ innovative\ sectors}{Number\ of\ employed\ people}$$

According to the Thomson Reuters report (2011), innovative sectors for North America are:

1. Aerospace and transportation equipment manufacturing
2. Chemical sector
3. Manufacture of computer software

4. Electrical products
5. Manufacture of electric generation equipment and electrical appliances and accessories
6. Manufacture of machinery
7. Basic metal industries
8. Oil sector
9. Industrial manufacturing
10. Manufacture of metal products
11. Manufacture of computer, communication, and other measurement equipment, electronic components and accessories

Sector	Employed
Aerospace and transportation equipment manufacturing	467,425
Chemical Sector	298,926
Manufacture of computer software	62,441
Manufacture of electric generation equipment and electrical appliances and accessories	229,377
Basic metal industries	193,760
Manufacture of machinery	61,332
Oil sector	68,209

Industrial manufacturing	666,592
Manufacture of metal products	479,805
Manufacture of computer, communication, and other measurement equipment, electronic components and accessories	207,835
Employed in innovative sectors	**2,735,702**
Total employed	**40,316,083**
Percentage of employed in innovative sectors	**6.79%**

$$PEIS = \frac{OV_{PEIS} - MINV_{PEIS}}{MAXV_{PEIS} - MINV_{PEIS}}$$

where

OV_{PEIS}: Observed value of the percentage of employed in innovative sectors

$MINV_{PEIS}$: Minimum value of the percentage of employed in innovative sectors

$MAXV_{PEIS}$: Maximum value of the percentage of employed in innovative sectors

The figure of 19.2749 took the maximum value resulting from an approximation to the maximum value observed in the analyzed period. The minimum value is 0.

(c) Welfare

(i) Percentage of households over the labor poverty line sub-index (PHOLP)

$$PHOLP = \frac{(Number\ of\ households) - (Number\ of\ households\ in\ labor\ poverty)}{Number\ of\ households}$$

To identify people in labor poverty the minimum welfare line for urban and rural areas calculated by the National Council for Evaluation of Social Development Policy (CONEVAL, 2013) based on a price index was used. This represents the minimum average labor income required by each household member to cover a food basket. In this sense we identify the labor income of each household member who belongs to the labor force (anyone who does not comply with this condition is assigned a value of 0 in the labor income variable). We then calculate the average labor income per household member. We take households in working poverty as those whose total labor income is below the poverty line. The result for each household member is the same as for the whole household, allowing us to know the percentage of households in labor poverty.

Example:

Households below the labor poverty line	33.14%
Households over the labor poverty line	66.86%

$$PHOLPS = \frac{OV_{PHOLP} - MINV_{PHOLP}}{MAXV_{PHOLP} - MINV_{PHOLP}}$$

where

OV_{PHOLP}: Observed value of the percentage of households over the labor poverty line

$MINV_{PHOLP}$: Minimum value of the percentage of households over the labor poverty line

$MAXV_{PHOLP}$: Maximum value of the percentage of households over the labor poverty line

The maximum and minimum values are 100 and 0 respectively.

(ii) Percentage of formality sub-index (PFS)

$$PF = \frac{Employed\ in\ the\ formal\ sector}{Employed\ people}$$

We take as a formal worker anyone in a job who has to social security in the job.

$$PFS = \frac{OV_{PF} - MINV_{PF}}{MAXV_{PF} - MINV_{PF}}$$

where

OV_{PF}: Observed value of the percentage of formality

$MINV_{PF}$: Minimum value of the percentage of formality

$MAXV_{PF}$: Maximum value of the percentage of formality

The maximum and minimum values are 100 and 0 respectively.

2. CORRELATION BETWEEN SUB-INDEXES:

The correlation between sub-indexes is presented in the next table. The share of formal workers, (with social security benefits for the jobs) is more correlated with some indicators than other sub-indexes. However, it does point to coverage of social benefits and then it is an important component of the total index.

		Productivity		Equality		Welfare	
		PEIN	RHC	EREL	SREL	PHOLP	PF
Productivity	PEIN	1					
	RHC	-0.154	1				
Equality	EREL	0.353	-0.273	1			
	SREL	0.369	0.372	0.528	1		
Welfare	PHOLP	0.443	0.044	0.759	0.782	1	
	PF	0.710	-0.277	0.690	0.574	0.845	1

Figure 1. Correlation of the Labor Market Development Index (LMDI) and the Human Development Index (HDI)

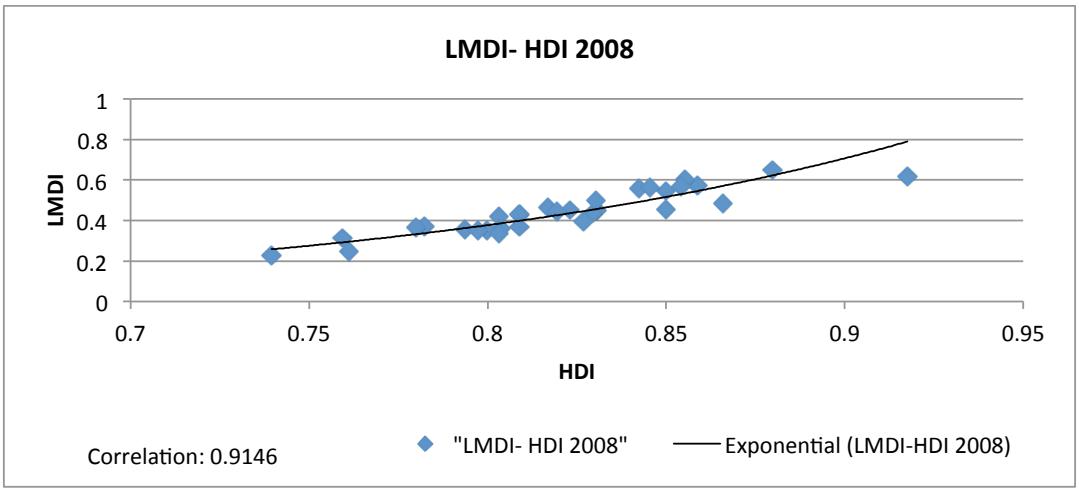


Figure 2. Correlation of economic growth and the Labor Market Development Index (LMDI)

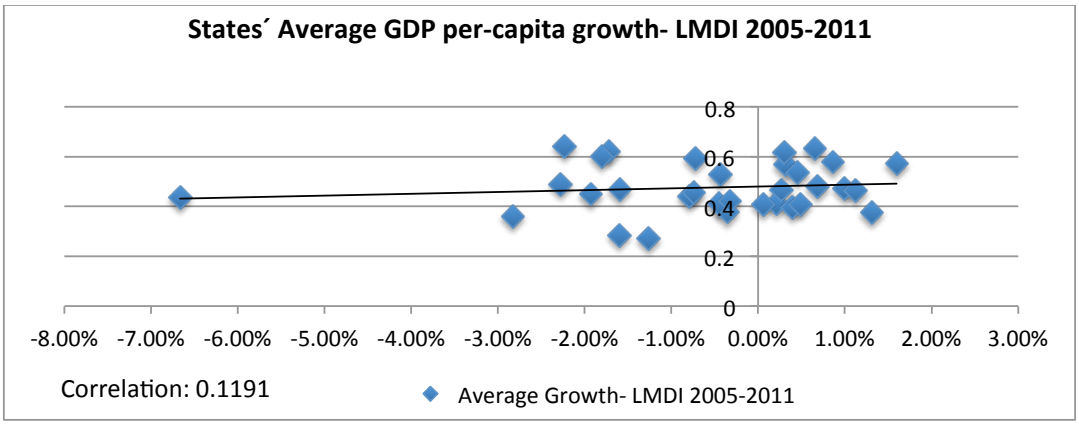
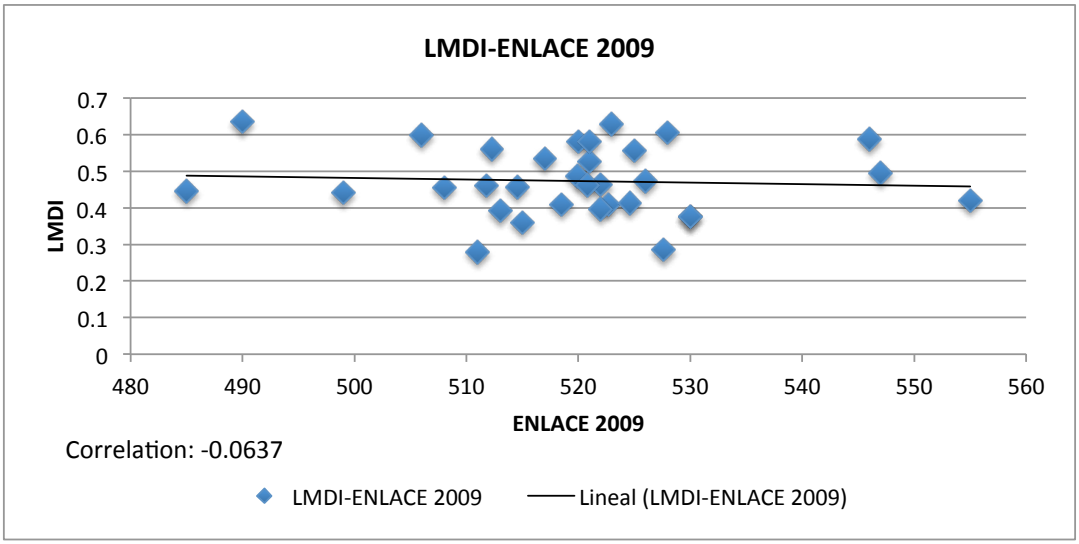
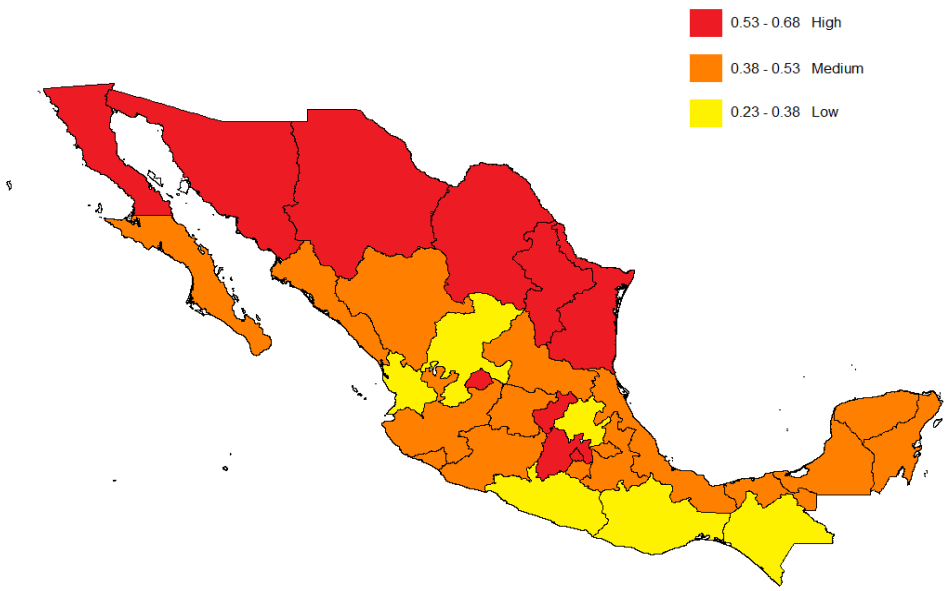


Figure 3. Correlation of ENLACE standardized test and the Labor Market Development Index



Map 1. Labor Market Development Index 2005



Map 2. Labor Market Development Index 2012

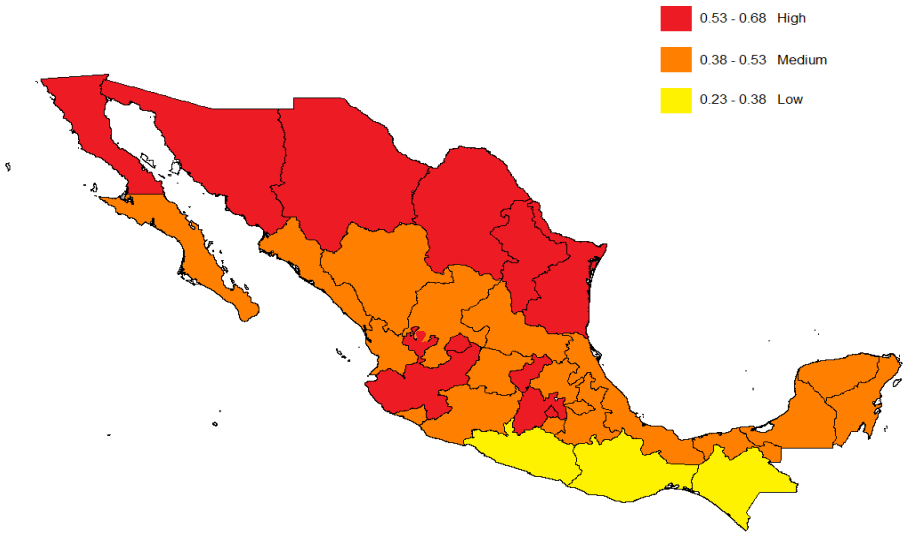


Table 1. Components for different indexes

Ljungqvist (Labor Market Underdevelopment)

- High rate of unskilled workers in the labor force
- Small stock of capital
- Low gross national product
- Large differential in wages according to educational level

Osberg & Sharpe (Index of Economic Well-Being)

- Consumption flows
  - Real total consumption (NCU per capita)
  - Real current government spending on goods and services excluding debt service (NCU per capita) + Adjustments for changes in working time, life expectancy and household economies of scale
- Stocks of wealth
  - Real capital stock (including housing) (NCU per capita)
  - Real R&D stock (NCU per capita)
  - Real stock of human capital (NCU per capita)
  - Real stock of natural resources (NCU per capita)
  - Real net foreign debt (NCU per capita)
  - Real social cost of environmental degradation (CO_2 emissions) (NCU per capita)
- Equality
  - Poverty intensity (Sen–Shorrocks–Thon Index)
  - Income inequality (Gini coefficient)
- Security
  - Risk from unemployment
  - Risk to financial security from illness
  - Risk from single parenthood poverty
  - Risk from poverty in old age

LMDI (Labor Market Development Index)

- Equality
  - Ratio of skilled workers to unskilled workers
  - Ratio of real hourly wages by level of education
- Productivity
  - Returns to human capital
  - Percentage of employed in innovative sectors
- Welfare
  - Percentage of households above the labor poverty line
  - Percentage of formality

Table 2. Labor Market Development Index subcomponents

A. Equality subindex									
Employed by education level (EREL)					Wage ratio by education level (SREL)				
Position	1st quarter 2005	Index	3rd quarter 2012	Index	Position	1st quarter 2005	Index	3rd quarter 2012	Index
1	DF	0.7326	DF	0.9673	1	Baja California	0.8364	Sonora	0.8758
2	Baja California Sur	0.4640	Baja California Sur	0.7021	2	Mexico	0.8278	Tamaulipas	0.8659
3	Sonora	0.4571	Quintana Roo	0.5862	3	Baja California Sur	0.8225	Mexico	0.8587
4	Nuevo Leon	0.4375	Sinaloa	0.5719	4	Morelos	0.8210	Nuevo Leon	0.8566
5	Coahuila	0.4271	Tamaulipas	0.5418	5	Sinaloa	0.8187	Jalisco	0.8551
6	Aguascalientes	0.4210	Tabasco	0.5400	6	Chihuahua	0.8128	Sinaloa	0.8544
7	Colima	0.4146	Aguascalientes	0.5376	7	Tamaulipas	0.8104	Baja California	0.8541
8	Tamaulipas	0.4086	Sonora	0.5362	8	Nuevo Leon	0.8068	Colima	0.8525
9	Mexico	0.4056	Mexico	0.5334	9	Colima	0.7978	Morelos	0.8488
10	Morelos	0.3947	Baja California	0.5272	10	Sonora	0.7964	Queretaro	0.8487
11	Quintana Roo	0.3885	Morelos	0.5222	11	Nayarit	0.7953	Nayarit	0.8430
12	Sinaloa	0.3842	Chihuahua	0.5106	12	Jalisco	0.7948	Baja California Sur	0.8421
13	Baja California	0.3825	Nuevo Leon	0.5026	13	Quintana Roo	0.7944	Chihuahua	0.8390
14	Chihuahua	0.3700	Nayarit	0.4901	14	Guanajuato	0.7898	Tlaxcala	0.8366
15	Queretaro	0.3694	Coahuila	0.4865	15	Queretaro	0.7889	Quintana Roo	0.8362
16	Tabasco	0.3664	Colima	0.4792	16	Tlaxcala	0.7848	Guanajuato	0.8337
17	Campeche	0.3603	Campeche	0.4654	17	DF	0.7802	Veracruz	0.8276
18	Nayarit	0.3380	Jalisco	0.4481	18	Aguascalientes	0.7633	Tabasco	0.8259
19	Jalisco	0.3337	Queretaro	0.4416	19	Coahuila	0.7584	Coahuila	0.8256
20	Durango	0.3234	Tlaxcala	0.4162	20	Hidalgo	0.7554	Aguascalientes	0.8144
21	Yucatan	0.3093	Veracruz	0.4124	21	Michoacan	0.7416	DF	0.8006
22	Tlaxcala	0.3083	Yucatan	0.4014	22	Zacatecas	0.7410	Zacatecas	0.7951
23	Veracruz	0.2965	San Luis Potosi	0.4003	23	Guerrero	0.7371	Guerrero	0.7857
24	Guerrero	0.2780	Puebla	0.3637	24	Durango	0.7303	Michoacan	0.7831
25	Michoacan	0.2775	Durango	0.3498	25	Veracruz	0.7150	Durango	0.7819
26	San Luis Potosi	0.2734	Hidalgo	0.3358	26	Tabasco	0.7009	Puebla	0.7803
27	Hidalgo	0.2566	Guanajuato	0.3318	27	Puebla	0.6838	San Luis Potosi	0.7364
28	Puebla	0.2525	Michoacan	0.3307	28	Campeche	0.6618	Hidalgo	0.7348
29	Guanajuato	0.2419	Zacatecas	0.3116	29	San Luis Potosi	0.6288	Yucatan	0.7211
30	Zacatecas	0.2314	Guerrero	0.3028	30	Yucatan	0.6263	Campeche	0.7125
31	Chiapas	0.1994	Chiapas	0.3011	31	Oaxaca	0.5528	Oaxaca	0.7073

32	Oaxaca	0.1949	Oaxaca	0.2898	32	Chiapas	0.3759	Chiapas	0.5211

B. Productivity subindex									
% Employed innovative sectors (PEIN)					Returns to human capital (RHCS)				
Position	1st quarter 2005	Index	3rd quarter 2012	Index	Position	1st quarter 2005	Index	3rd quarter 2012	Index
1	Chihuahua	0.9999	Coahuila	0.8619	1	Zacatecas	0.6700	DF	0.5596
2	Baja California	0.7856	Chihuahua	0.7805	2	Nuevo Leon	0.6628	Yucatan	0.5901
3	Coahuila	0.7025	Nuevo Leon	0.6488	3	Puebla	0.6601	Baja California Sur	0.5940
4	Nuevo Leon	0.6548	Baja California	0.5924	4	Oaxaca	0.6574	Aguascalientes	0.5948
5	Tamaulipas	0.6221	Queretaro	0.5877	5	DF	0.6556	Chiapas	0.6119
6	Queretaro	0.5004	Tamaulipas	0.5227	6	Quintana Roo	0.6522	Tabasco	0.6120
7	Mexico	0.4464	Aguascalientes	0.4954	7	Tlaxcala	0.6496	Hidalgo	0.6126
8	Aguascalientes	0.3996	Sonora	0.4608	8	Jalisco	0.6487	Quintana Roo	0.6160
9	DF	0.3947	San Luis Potosi	0.3906	9	Michoacan	0.6339	Nuevo Leon	0.6209
10	Sonora	0.3753	Durango	0.3559	10	Tamaulipas	0.6281	San Luis Potosi	0.6226
11	San Luis Potosi	0.3563	Jalisco	0.3538	11	Morelos	0.6195	Campeche	0.6229
12	Jalisco	0.3246	Mexico	0.3498	12	Coahuila	0.6182	Zacatecas	0.6325
13	Durango	0.2900	Guanajuato	0.2714	13	Guanajuato	0.6175	Sonora	0.6373
14	Michoacan	0.2809	Tabasco	0.2591	14	San Luis Potosi	0.6118	Coahuila	0.6374
15	Tlaxcala	0.2781	DF	0.2533	15	Colima	0.6116	Chihuahua	0.6431
16	Puebla	0.2316	Tlaxcala	0.2461	16	Nayarit	0.6100	Durango	0.6442
17	Tabasco	0.2201	Morelos	0.2283	17	Mexico	0.6070	Michoacan	0.6544
18	Guerrero	0.2101	Puebla	0.2159	18	Aguascalientes	0.5984	Puebla	0.6643
19	Guanajuato	0.2016	Veracruz	0.2143	19	Campeche	0.5923	Queretaro	0.6647
20	Morelos	0.1954	Hidalgo	0.1994	20	Sonora	0.5855	Oaxaca	0.6695
21	Veracruz	0.1923	Zacatecas	0.1780	21	Yucatan	0.5798	Veracruz	0.6726
22	Yucatan	0.1911	Campeche	0.1630	22	Sinaloa	0.5773	Morelos	0.6740
23	Campeche	0.1756	Michoacan	0.1512	23	Queretaro	0.5680	Tamaulipas	0.6743
24	Sinaloa	0.1629	Colima	0.1365	24	Hidalgo	0.5657	Sinaloa	0.6777
25	Zacatecas	0.1568	Yucatan	0.1289	25	Baja California Sur	0.5624	Guanajuato	0.6801
26	Hidalgo	0.1543	Sinaloa	0.1262	26	Chiapas	0.5571	Nayarit	0.6833
27	Colima	0.1464	Oaxaca	0.1137	27	Durango	0.5393	Baja California	0.6840
28	Baja California Sur	0.1261	Chiapas	0.1104	28	Tabasco	0.5352	Colima	0.6885
29	Chiapas	0.1109	Guerrero	0.0875	29	Guerrero	0.5291	Mexico	0.6951
30	Quintana Roo	0.0820	Quintana Roo	0.0818	30	Chihuahua	0.5253	Jalisco	0.7006

31	Nayarit	0.0770	Nayarit	0.0801	31	Veracruz	0.5122	Guerrero	0.7116
32	Oaxaca	0.0737	Baja California Sur	0.0710	32	Baja California	0.4950	Tlaxcala	0.7191

C. Welfare subindex									
% Household not in labor poverty (PHOLPS)					% Formal jobs (PFS)				
Position	1st quarter 2005	Index	3rd quarter 2012	Index	Position	1st quarter 2005	Index	3rd quarter 2012	Index
1	Nuevo Leon	0.8317	Baja California Sur	0.7958	1	Nuevo Leon	0.5728	Chihuahua	0.5387
2	Baja California Sur	0.8266	Quintana Roo	0.7513	2	Coahuila	0.5548	Nuevo Leon	0.5380
3	Quintana Roo	0.8094	Colima	0.7468	3	Chihuahua	0.5517	Coahuila	0.5102
4	Baja California	0.7989	Baja California	0.7211	4	Baja California	0.5201	Baja California Sur	0.5056
5	DF	0.7763	Jalisco	0.7117	5	Baja California Sur	0.4942	Sonora	0.4858
6	Colima	0.7689	Nuevo Leon	0.7116	6	Aguascalientes	0.4932	Baja California	0.4606
7	Sinaloa	0.7627	Coahuila	0.7108	7	Tamaulipas	0.4709	DF	0.4534
8	Sonora	0.7470	DF	0.7071	8	Sonora	0.4581	Aguascalientes	0.4533
9	Coahuila	0.7420	Sonora	0.7015	9	DF	0.4562	Tamaulipas	0.4498
10	Mexico	0.7302	Mexico	0.6779	10	Quintana Roo	0.4298	Quintana Roo	0.4397
11	Chihuahua	0.7237	Sinaloa	0.6775	11	Queretaro	0.4283	Queretaro	0.4192
12	Jalisco	0.7173	Campeche	0.6588	12	Durango	0.3929	Sinaloa	0.3815
13	Aguascalientes	0.7132	Queretaro	0.6495	13	Colima	0.3894	Durango	0.3756
14	Tamaulipas	0.7051	Chihuahua	0.6272	14	Sinaloa	0.3762	Jalisco	0.3722
15	Queretaro	0.7021	Tabasco	0.6243	15	Jalisco	0.3681	Mexico	0.3716
16	Nayarit	0.6684	Michoacan	0.6219	16	Mexico	0.3664	Colima	0.3544
17	Guanajuato	0.6630	Nayarit	0.6201	17	Guanajuato	0.3399	San Luis Potosi	0.3423
18	Campeche	0.6440	Tamaulipas	0.6165	18	Yucatan	0.3373	Tabasco	0.3160
19	Morelos	0.6432	Aguascalientes	0.6160	19	San Luis Potosi	0.3295	Guanajuato	0.3132
20	Michoacan	0.6279	Yucatan	0.6104	20	Campeche	0.3274	Campeche	0.3121
21	Tabasco	0.6246	Guanajuato	0.6090	21	Tabasco	0.3073	Yucatan	0.2965
22	Durango	0.6112	Morelos	0.5647	22	Nayarit	0.2858	Morelos	0.2877
23	Hidalgo	0.5896	Durango	0.5613	23	Veracruz	0.2838	Nayarit	0.2814
24	Yucatan	0.5888	Veracruz	0.5535	24	Morelos	0.2677	Zacatecas	0.2674
25	Tlaxcala	0.5857	Hidalgo	0.5423	25	Zacatecas	0.2668	Veracruz	0.2511
26	San Luis Potosi	0.5827	Puebla	0.5270	26	Tlaxcala	0.2418	Michoacan	0.2267
27	Veracruz	0.5702	San Luis Potosi	0.5060	27	Puebla	0.2192	Tlaxcala	0.2219

28	Puebla	0.5599	Tlaxcala	0.4958	28	Michoacan	0.2147	Hidalgo	0.2218
29	Guerrero	0.5383	Zacatecas	0.4907	29	Guerrero	0.1963	Puebla	0.2188
30	Zacatecas	0.5010	Oaxaca	0.4515	30	Hidalgo	0.1960	Chiapas	0.1693
31	Oaxaca	0.4702	Guerrero	0.4033	31	Chiapas	0.1535	Guerrero	0.1650
32	Chiapas	0.3889	Chiapas	0.3863	32	Oaxaca	0.1503	Oaxaca	0.1642

Table 3. Comparison of the Mexican states Labor Market Development Index

2005-2012

Position	1st quarter 2005	Index	3rd quarter 2012	Index
1	Chihuahua	0.6503	Coahuila de Zaragoza	0.6565
2	Baja California	0.6383	Chihuahua	0.6460
3	Nuevo Leon	0.6287	Nuevo Leon	0.6363
4	Coahuila de Zaragoza	0.6028	Baja California	0.6267
5	Tamaulipas	0.5890	Sonora	0.6007
6	DF	0.5889	Tamaulipas	0.5983
7	Sonora	0.5472	Queretaro Arteaga	0.5845
8	Mexico	0.5437	Aguascalientes	0.5747
9	Queretaro Arteaga	0.5435	DF	0.5724
10	Aguascalientes	0.5430	Mexico	0.5512
11	Jalisco	0.4953	Jalisco	0.5413
12	Baja California Sur	0.4825	Tabasco	0.4906
13	Durango	0.4629	Durango	0.4863
14	Sinaloa	0.4604	San Luis Potosi	0.4812
15	Colima	0.4584	Morelos	0.4722
16	Morelos	0.4397	Sinaloa	0.4701
17	San Luis Potosi	0.4309	Colima	0.4654
18	Tlaxcala	0.4308	Baja California Sur	0.4644
19	Guanajuato	0.4246	Guanajuato	0.4621
20	Tabasco	0.4222	Quintana Roo	0.4486
21	Michoacán de Ocampo	0.4160	Campeche	0.4366
22	Quintana Roo	0.4159	Veracruz	0.4357
23	Campeche	0.4149	Tlaxcala	0.4350
24	Veracruz	0.3976	Puebla	0.4092
25	Yucatan	0.3922	Yucatan	0.3982
26	Puebla	0.3814	Nayarit	0.3975
27	Guerrero	0.3774	Zacatecas	0.3925
28	Nayarit	0.3733	Hidalgo	0.3920
29	Hidalgo	0.3609	Michoacan de Ocampo	0.3917
30	Zacatecas	0.3556	Oaxaca	0.3240
31	Oaxaca	0.2687	Guerrero	0.3154
32	Chiapas	0.2539	Chiapas	0.2975