Why is Chiapas Poor?

Faculty Research Working Paper Series

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December 2016

RWP16-049

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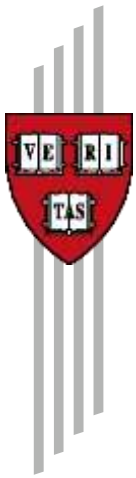
WHY IS CHIAPAS POOR?

Dan Levy, Ricardo Hausmann, Miguel Angel Santos, Luis Espinoza, and Miguel Flores

CID Working Paper No. 300
Revised March 2016



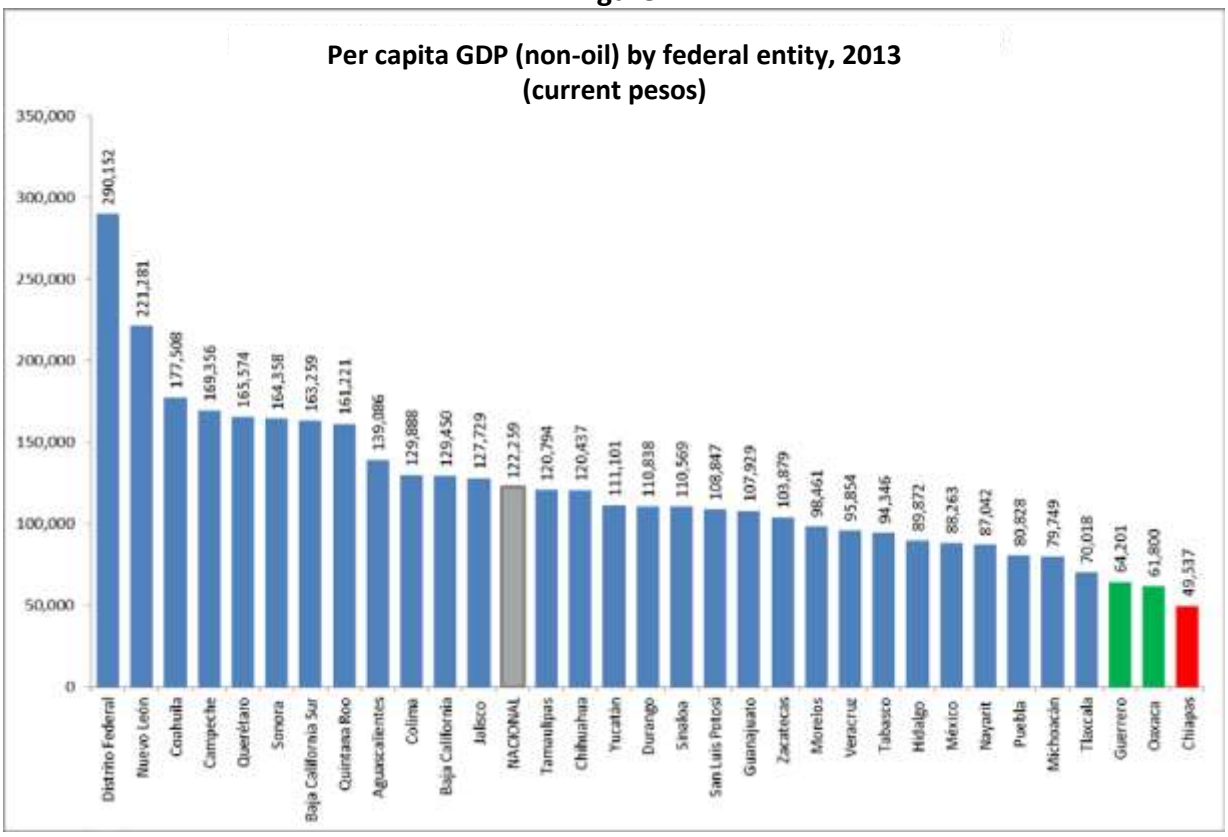
Working Papers

Center for International Development at Harvard University

1. Introduction

No matter which way you look at it, Chiapas is the most backward of any state in Mexico. Its per capita income is the lowest of the 32 federal entities, at barely 40% of the national median (Figure 1). Its growth rate for the decade 2003-2013 was also the lowest (0.2%),[1] causing the income gap separating Chiapas from the national average to increase from 53% to 60%. That is to say that today the average income for a worker in Mexico is two and a half times greater than the average in Chiapas. The two next poorest states, Oaxaca and Guerrero, are 25% and 30% above Chiapas.[2] According to the Instituto Nacional de Estadística y Geografía de México (INEGI, National Institute of Statistics and Geography), Chiapas is also the state with the highest poverty rate (74.7%) as well as extreme poverty (46.7%).[3]

Figure 1



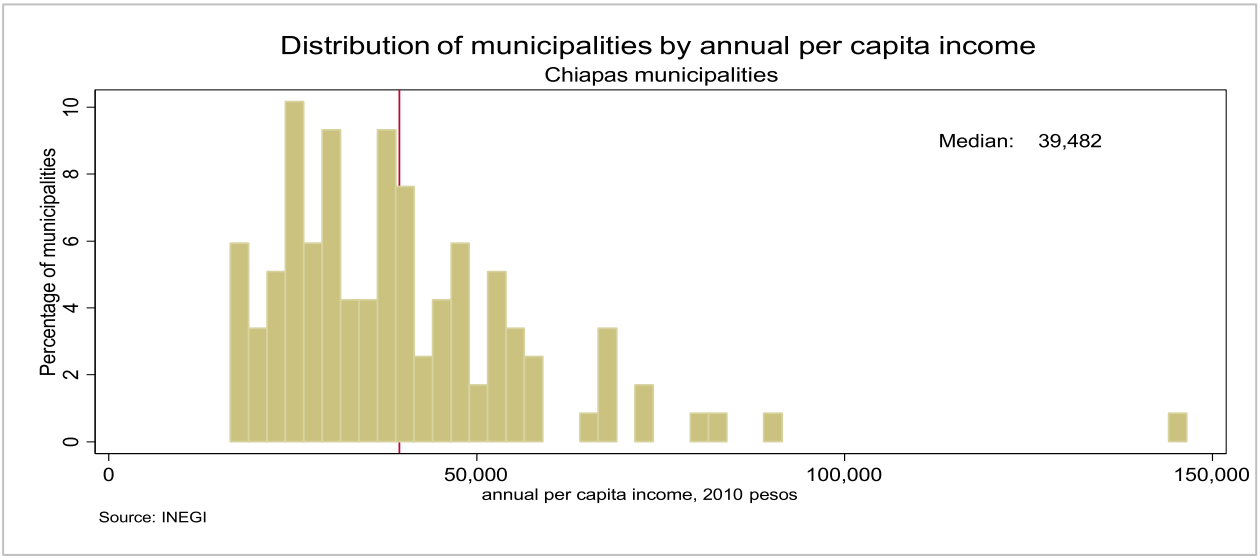
Source: INEGI (GDP) and CONAPO (Population)

[1] This is the non-oil gross domestic product growth rate reported by INEGI, considered to be more representative of the productive spectrum. In any case, the overall rate of growth in Chiapas (-0.2%) was also the lowest amongst all Mexican entities for the decade.
[2] Refers to non-oil GDP; in general terms, Guerrero and Oaxaca are 19% and 16% above Chiapas.
[3] Growth figures refer to the decade 2003-2013, poverty figures are those published by INEGI for 2012.

These major differences in income levels among Mexican federal entities are reproduced as in a fractal within Chiapas. In fact, while the wealthiest entity (Mexico City) is wealthier than the poorest (Chiapas) by a factor of six, the difference within Chiapas between the wealthiest municipality (Tuxtla Gutiérrez) and the poorest (Aldama and Mitontic) is by a factor greater than eight.[4]

As there are different "Mexicos" within Mexico,[5] in Chiapas there are also different sorts of Chiapas (Figure 2). Income per capita in Tuxtla Gutiérrez, to the right of the distribution, is five standard deviations above the state average. Next comes a series of intermediate cities, San Cristóbal de las Casas, Comitán de Domínguez, Tapachula, and Reforma, between two and a half to four standard deviations above the average. The remaining municipalities of Chiapas follow (122 in all), clustered to the far left of the distribution. In addition, both the statistics available at the town level and our visits to various municipalities in Chiapas seem to indicate that significant differences also exist within these municipalities.

Figure 2



Source: 2010 Population Census (INEGI)

From this vantage point, questions as to why Chiapas is poor, or what explains its significant backwardness compared to other areas of Mexico, become much more complex.
Why do some regions in Chiapas have high income levels, while other regions remain stagnant, fully dependent on federal transfers and deprived from the benefits of modern life?

[4] Comparisons of Chiapas municipalities are made based on the data from the 10% sample of the 2010 Population Census, which is representative at the state level.
[5] This is a reference to the report, *A tale of two Mexicos: Growth and prosperity in a two-speed economy*, McKinsey Global Institute (2014).

2. Our study within the context of the literature

Chiapas is a state that has attracted a great deal of attention from academia, in particular from the beginning of 1994. Since then, the library catalog at Harvard University has seen the publication of 2,079 books, 38 movies, 30 graduate theses, and 28 articles in specialized journals. The vast majority of these publications deal with the indigenous aspect of Chiapas, the history of its Mayan origins, and the referendum that determined its incorporation into the Mexican federation in 1824, in addition to the numerous civil wars, revolutions, and counterrevolutions that have occurred. None of them are concerned with the factors linked to poverty in Chiapas, let alone with the understanding of intra-regional income differences within the entity.

A vast amount of literature does exist that looks at the origins and factors associated with the phenomenon of rural poverty in Mexico. Most of these studies have focused on the impact of various types of assets on rural poverty. Since Chiapas is not only the poorest state, but also the state with the second highest rural population in Mexico, these studies have major implications for Chiapas even though they were not specifically focused on the state. Some common conclusions can be drawn from this host of studies.

First of all, the wage structure of rural households depends largely on the initial endowment of factors. The factors with the greatest impact on poverty are education, availability of irrigated land, and remittances from emigrants (de Janvry and Sadoulet, 1996, 1997; World Bank, 2005). Being a member of an indigenous ethnic group, while associated with lower daily wages, is not statistically significant when controlling for other asset classes.

Second, the evidence shows that there is a very significant degree of complementarity between different types of assets. On the one hand, a strong correlation is reported between assets holdings that is observed solely in the poorest homes (de Janvry and Sadoulet, 2000). On the other, computerized model simulations of general equilibrium indicate that the redistribution of assets towards families that lack all other assets may result not only in a general loss of well-being, but also in the gradual dissipation of the assets in the receiving families (de Janvry and Sadoulet, 1996). Taken together, the evidence points to a poverty trap, i.e., a minimum endowment of various factors is needed in order to make productive use of the whole.

Third, and in keeping with the above, most of the factors used in these studies (working-age adults, education, relatives sending remittances, capital goods, institutions, share capital) have increasing returns to scale. In other words, redistribution policies have a greater impact on well-being when they are carried out progressively (assets are redistributed to families that already have a supply of those assets). The literature also concurs that the only factor that does not offer increasing returns to scale is land. Author opinions are split between those who report diseconomies of scale that justify land redistribution policies (de Janvry and Sadoulet 1996), and those who find no link between the value added per hectare and the size of the production lot (World Bank, 2005; Cazuffi, Pereira-López and Soloaga, 2014).

Taken together, this series of specific studies would seem to conclude that the problem lies on the supply of factors. From there, we can infer that in order for many Mexican households located in rural areas to stop being poor, they must be rich. We would like to suggest a different way of seeing things, one that does not necessarily contradict the evidence shown so far, but that sees it as more of a symptom than a cause.

Chiapas is not poor because the asset endowment of its inhabitants is low; it is poor because the productivity of those assets is very low. According to this viewpoint, accumulation of assets is endogenous to the productivity of assets. The incentives to invest time and money in education, to gain work experience, to sacrifice consumption today to build a base of capital; all these are endogenous to the productivity that can be obtained by combining these factors. If one extra year of schooling has low returns, the motivation to invest in additional education is reduced. If the type of economic activity that predominates in Chiapas makes experience irrelevant, no one is going to want to gain years of experience in Chiapas. And so on.

From this perspective, Chiapas is poor because it has too many people in nonproductive zones, where modern means of production have never existed. Therefore, their productivity is low, and consequently, their desire to accumulate assets that do not produce significant returns is also low. In this context, the effects observed in these studies in terms of the benefits of schooling, experience, capital, or even joining the formal economy, can hardly be indicators of something that is absent in Chiapas: economic complexity.

3. Economic complexity in Chiapas

A product's economic complexity index is an indicator of the degree of sophistication and specialization of knowledge required to develop it (Hausmann and Hidalgo, 2009). According to this definition, the most complex products are those that are competitively[6] exported by very few countries, which in turn have very full export baskets.

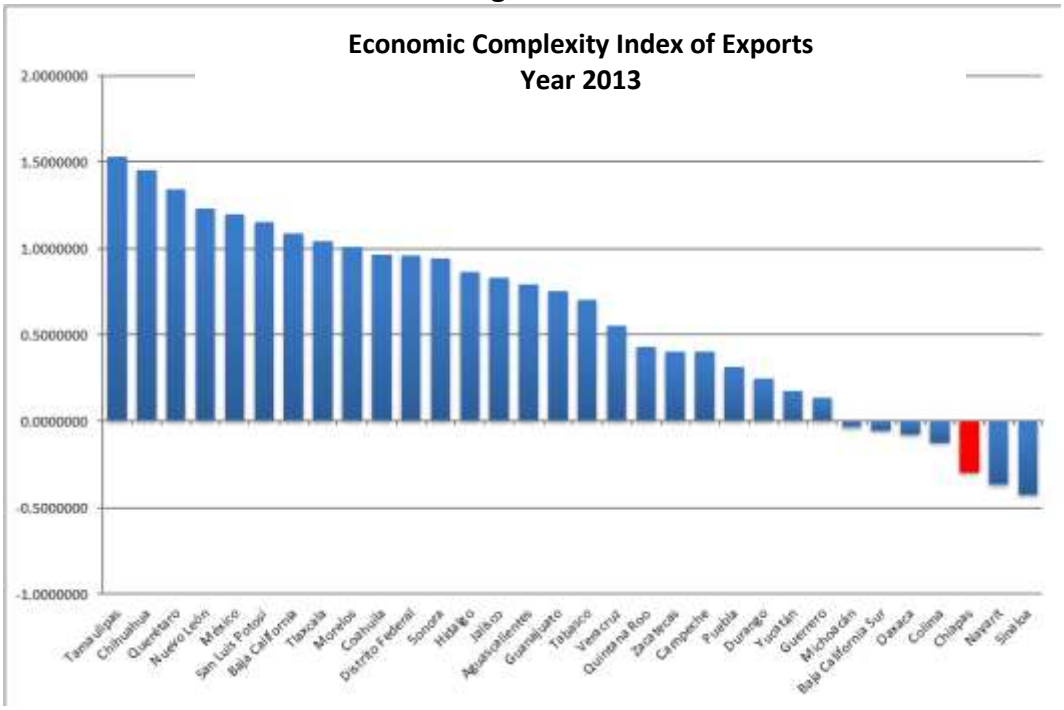
Economic complexity attempts to capture the productive capacities of a place, by observing the products it is capable of making competitively. If a country is able to make many products (high diversity) which few countries on average are able to make (low ubiquity), we assume it has a broad range of productive capacities. If a country is able to make few things (low diversity) that many countries are able to make (high ubiquity), we can expect it to have few productive

[6] The definition of the ability to export a product competitively comes from Balassa (1965). More details appear in the Technical Appendix.

capacities. Successive combinations of diversity and ubiquity lead to a product's Economic Complexity Index (ECI), and to the weighted average (for exports) of ECIs for a region's products—its average economic complexity. (See Technical Appendix for more details.) Measurements of intensity are not used to construct the ECI. Instead, we use the degree of diversity and ubiquity of the products that the region is able to make. It is a measure of the variety of the productive ecosystem. Economic complexity is important, not only because it is closely related to per capita income, but because the differences between the income that each country should have according to its complexity and the income it actually has are very useful when predicting future growth (Hausmann et al., 2014).

If we measure the economic complexity of Chiapas based on its exports, it is the third least complex state in Mexico (Figure 3). This means that Chiapas has a productive ecosystem with very little diversity and scant knowledge, that is barely adequate to export a small set of primary goods (coffee, bananas, rubber) which many other regions are capable of making.

Figure 3



Source: Center for International Development, Atlas Mexicano de Complejidad Económica

Measuring economic complexity based on the comparative advantages in exports has some flaws. Firstly, when looking at subnational areas, taking into account only those products that the region is capable of exporting competitively could be placing the bar too high. In the case of Chiapas, for example, some basic products barely surpass this threshold. Since the goal is to detect productive capacities, there may be some things that Chiapas can make and sell outside its territory (to the rest of Mexico), that would go unnoticed if we focus only on exports. In addition, using only international trade statistics would lead us to overlook the whole service sector (Crespi, Fernández-Arias, and Stein, 2014).

To fill both gaps, we have estimated an ECI with the use of relative employment intensities, based on data from the Mexican Social Security Institute (Spanish initials, IMSS).[7] Next, each individual in the 10% sample from the Population Census was assigned an ECI calculated with the IMSS data for his or her municipality. Then we calculated the average for Chiapas, weighted for the number of individuals in each municipality in the sample.

To compensate for any omissions resulting from the low level of formal employment in rural areas of Mexico, we made an alternate calculation using data from the 2010 Population Census. Regardless of which method is chosen to estimate economic complexity in Chiapas, exports (-0.30), IMSS (-0.52), or the Population Census (-0.34), Chiapas is among the three Mexican states of least economic complexity.

In this context, and according to our hypothesis, the incentives to save, get an education, join the formal economy, gain experience, and other factors that have been used to explain rural poverty in Mexico, are very low. Rather than being factors linked to poverty in Chiapas, these conditions would become a symptom of the scant variety in the region's productive ecosystem, and of the low level of knowledge that has been acquired.

4. Data

Table 1 shows the essential features of the variables for Chiapas and the rest of Mexico, both by individual and by municipality. Individual data were taken from the 10% sample of the 2010 Population Census. Here we find all the usual suspects from previous studies on the determinants of rural poverty in Mexico: income, years of schooling, gender, living in a rural setting, speaking only an indigenous language, years of experience, and working in the public or private sector.

We have also constructed a set of variables on the municipal level based on various sources of information. In particular, we focused on two separate variables for a similar reason. First of all, we are interested in the economic complexity index of the municipality where the individual lives. As stated earlier, this is an indicator of the degree of modernity and knowledge, and of the existence of complementary productive capacities that determine the returns to individual factors. Secondly, we are interested in how many opportunities the individual has to connect with other places of greater economic complexity and to take part in exchanges that actually make him part of a commercial network where he can use his individual capabilities.

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[7] As in the case of exports, we define sectors where comparative advantages exist when the proportion of employment in the sector as a percentage of employment in Chiapas is greater than the employment percentage for that sector in the rest of Mexico. The difference is that the complexity graph based on exports was compiled in relation to the proportions of global export baskets, while the complexity graph is based on the IMSS and uses employment intensities in relation to the rest of Mexico (which is why the median is at zero).

Therefore we have estimated the distance from each municipality (in kilometers and hours) to cities (areas with over one hundred thousand inhabitants, where there are presumably more diverse and complementary productive capacities), airports, ports, customs offices, and to the US border. These statistics represent the distance between the capital of each municipality and the destination point, as shown on *Google Maps Directions API.*[8] When you input two coordinates, *Google Maps* finds the shortest distance for reaching the specific destination from the indicated starting point, providing an estimate of the distance and time for the trip (in kilometers and hours). The length of the trip is the number of meters covered, while the time comes from *Google Maps* estimates based on road conditions, speed limits, and average traffic conditions.

Table 1
Descriptive Statistics

	Descripción	Resto de Mexico		Chiapas	
		Promedio	Desviación	Promedio	Desviación
Nivel: Individual	Escolaridad	8.64	4.57	6.73	4.85
	Mujer	0.30	0.46	0.21	0.41
	Localidad Rural	0.33	0.47	0.52	0.50
	Hablante de lengua indigena	0.12	0.32	0.36	0.48
	Log del ingreso	8.18	0.84	7.54	1.04
	Experiencia	22.22	15.35	22.87	16.09
	Trabaja en el sector formal	0.25	0.43	0.09	0.29
	Empleado Publico	0.08	0.27	0.06	0.23
Nivel: Municipal	Distancia en km a la localidad mas cercana con 100k hab. o mas	56.81	62.57	64.09	51.85
	Distancia en km al aeropuerto mas cercano	100.87	76.13	97.99	47.86
	Distancia en km al puerto mas cercano	291.45	168.54	225.26	91.32
	Distancia en km a la aduana fronteriza mas cercana	782.60	312.46	346.23	154.24
	Distancia en hr a la localidad mas cercana con 100k hab. o mas	0.91	0.92	1.10	0.80
	Distancia en hrs al aeropuerto mas cercano	1.42	0.99	1.59	0.74
	Distancia en hrs al puerto mas cercano	3.52	1.95	3.16	1.28
	Distancia en hrs a la aduana fronteriza mas cercana	8.85	3.41	4.47	1.94
	Log poblacion total	4.71	0.79	4.62	0.50
	% Poblacion indigena	9.68	20.70	31.57	35.10
	% Poblacion rural	36.05	45.84	60.13	28.03
	Escolaridad promedio	7.58	1.87	5.34	1.35
	% Poblacion residiendo en comunidades rurales	0.36	0.33	0.61	0.28
	Distancia (ponderada) a USA	27.98	2.13	30.44	0.43
	Complejidad Economica (datos del IMSS)	0.60	0.92	-0.52	1.08
	Complejidad Economica (datos del Censo de Poblacion)	0.84	1.14	-0.34	1.15

The set of statistics referring to individual variables is fairly descriptive of the differences between Chiapas and the rest of Mexico. On average, incomes in the rest of Mexico

[8] https://developers.google.com/maps/documentation/directions

are 63% higher than in Chiapas.[9] Chiapas has fewer years of schooling (6.7 versus 8.6), and women's participation in the labor force is 30% lower (barely 21%, compared to 30%). Chiapas also has a lower percentage of employees in the formal sector (64.4% fewer) and fewer public employees (26.8% fewer).

The set of municipal statistics provides a description that has been overlooked in the literature in terms of connectedness, externalities, and economic complexity. Generally speaking, although the average municipality in Chiapas is located 12.1% farther from a city (over 100,000 inhabitants) in kilometers than the other municipalities in Mexico, the time it takes to get there is 21.3% longer. The inhabitants of Chiapas also tend to live in municipalities with indigenous population figures three times higher than in the rest of Mexico, and population percentages in rural areas that are much greater (60.1% versus 36.1%). The differences in economic complexity, whether estimated based on IMSS data or the Population Census, are quite marked. Not only is the ECI significantly different in both cases (-0.52 versus 0.60 in the case of the IMSS, -0.34 versus 0.84 using the 2010 Population Census), the dispersion towards the interior of Chiapas also tends to be similar to the dispersion in the rest of Mexico.

5. Factors associated with the income difference between Chiapas and the rest of Mexico

The sections above document a considerable gap between the average incomes in Chiapas and in the rest of Mexico. This section explores the factors associated with this gap. We should point out that the analysis in this section is descriptive; it reveals the factors associated with incomes and with differences in incomes between Chiapas and in the rest of Mexico, but they cannot be interpreted as having a causal effect.

We will begin with the results of regressions where the dependent variable is the logarithm of income and the independent variables are the main factors potentially associated with income that are available in the census database we used.[10] At first we limited our sample to data in Chiapas.

[9] This figure is reached by subtracting the two income logarithms, a misleading approximation given the size of the difference. More accurately speaking, the average income of workers in Chiapas is 47.3% that of the rest of Mexico (or, in the rest of Mexico, the average income is 89.7% higher than in Chiapas).

[10] We did not include the distance variables reported in the previous section because they are not available for towns, only for capitals of the municipality where the person lives. This does not capture the full variation which exists in practice. Presumably, part of this disconnected effect is included in the rural variable, which does register variations between individuals who live in the same municipality, but a different town.

Table 2 shows the results of these regressions.[11] Column (1) presents the simplest Mincerian wage regression and suggests that, other factors being constant, one year of education in Chiapas is associated with 11.8% higher income, and that women earn 14.9% less than men with the same level of education and experience. Once we include whether the person speaks only an indigenous language and lives in a rural area, the additional income associated with one year of education drops slightly (to 9.4%), and the factors associated to being monolingual (indigenous) woman who lives in a rural area are highly correlated with lower incomes. Specifically, other factors remaining constant, women earn 22% less than men who speak only an indigenous language earn 41% less than men who speak Spanish, and those who live in a rural setting earn 25% less than those who live in urban areas.

The obvious question is whether, once we control statistically for an individual's education level, the average years of schooling for the municipality are correlated with higher incomes for the people who live there. This is theoretically possible if there are positive externalities derived from living in a municipality with high levels of education. The results in columns (3) and (4) suggest that a municipality's average level of education is positively associated with an individual's income, but the link is not statistically significant. The municipality's average level of education is not significantly linked to the individual's income (column 3), nor with the income associated with one additional year of education for the individual (column 4).

[11] It is important to note that since we are using the census database, the number of items is quite large both for Chiapas (127,933) and for the rest of Mexico (2,621,274), which means that the vast majority of coefficients are statistically significant.

Table 2 - Factors Associated with Incomes in Chiapas

VARIABLES	(1) Log (income)	(2) Log (income)	(3) Log (income)	(4) Log (income)
Schooling	0.118***	0.094***	0.086***	0.066***
	(0.000)	(0.000)	(0.000)	(0.000)
Experience	0.030***	0.024***	0.023***	0.023***
	(0.000)	(0.000)	(0.000)	(0.000)
Experience^2	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Woman	-0.149**	-0.216***	-0.259***	-0.261***
	(0.018)	(0.000)	(0.000)	(0.000)
Indigenous Language		-0.412***	-0.177***	-0.178***
		(0.000)	(0.000)	(0.000)
Rural Area		-0.250***	-0.274***	-0.275***
		(0.000)	(0.000)	(0.000)
Municipal Variables				
Mun. Average Schooling			0.026	0.010
			(0.379)	(0.744)
Mun. Average Experience			0.565**	0.575**
			(0.017)	(0.015)
Mun. Average Experience^2			-0.014***	-0.014***
			(0.007)	(0.006)
Mun. Percentage Women			0.005	0.005
			(0.341)	(0.383)
Mun. Percentage Indigenous Language			-0.004***	-0.005***
			(0.000)	(0.000)
Mun. Rural Percentage			0.003*	0.003*
			(0.064)	(0.053)
Schooling* Mun. Schooling				0.003*
				(0.061)
Constant	6.380***	6.939***	0.943	0.949
	(0.000)	(0.000)	(0.734)	(0.729)
Items	127,933	127,933	127,933	127,933

Source: Sample of 10% of Population Census, 2010.
Standard errors reported in parentheses.
*/**/***: Statistically significant to 10%/5%/1%.

Below we present the results of regressions where the dependent variable is once again the income log, but this time we are looking at the contrast between Chiapas and the rest of Mexico. The independent variables are the main factors potentially associated with the income differences we observe between Chiapas and the rest of the country.

The first column in Table 3 shows, as did the previous section, that the average income of workers in Chiapas is 47% lower than worker income in the rest of Mexico.[12] We can see that this difference drops by 25% once we control statistically for the same factors that appeared in column (1) of the above table (education, experience, and gender), and by 40% once we also control for language and type of setting. The specification in column (3) suggests that, once we control statistically for education, experience, gender, type of setting, and indigenous language, the average worker income in Chiapas is 31% lower than the income of all other Mexican workers.

The regression in column (4) examines whether the returns associated with the factors in column (3) are different for Chiapas than for the rest of Mexico. In general, these returns do not seem different. While the coefficients of interactions between Chiapas and education, and between Chiapas and experience, seem to be statistically significant, they are very small in magnitude.

Although from an analytic viewpoint it is tempting to gradually add variables and interpret the coefficients as a sign of the incremental contribution of each factor to the explanation of differences between Chiapas and the rest of Mexico, this method is not suitable because the coefficients vary greatly depending on the sequence in which the variables are introduced.

To be able to understand which factors are associated with the gap, we used a statistical technique known as the "Blinder Oaxaca Decomposition" (Blinder, 1973; Oaxaca 1973). The technique is widely used to decompose differences in mean outcomes between two groups. One of the most common uses of this technique was the analysis of wage differences between men and women, or between ethnic groups. It has also been used to analyze differences in health indicators between the poor and the nonpoor (O'Donnell et al., 2008). In this case, we used the Oaxaca-Blinder decomposition to analyze the income gap between Chiapas and the rest of Mexico.

[12] Given that the dependent variable of the regression is expressed in logarithms, this corresponds to [exp(-0.64)-1]=-0.47 or -47%. This is another way of saying that the average income of workers in the rest of Mexico is 89% greater than the average income of workers in Chiapas.

Table 3 – Factors Associated with Income Differences: Chiapas vs. the Rest of Mexico

VARIABLES	(1) Log (income)	(2) Log (income)	(3) Log (income)	(4) Log (income)	(5) Log (income)
Chiapas	-0.640***	-0.473***	-0.373***	-0.317***	-0.284***
	(0.076)	(0.051)	(0.034)	(0.064)	(0.025)
Schooling		0.100***	0.088***	0.087***	0.082***
		(0.002)	(0.001)	(0.001)	(0.001)
Experience		0.032***	0.030***	0.030***	0.028***
		(0.000)	(0.000)	(0.000)	(0.000)
$Experience^2$		-0.000***	-0.000***	-0.000***	-0.000***
		(0.000)	(0.000)	(0.000)	(0.000)
Woman		-0.268***	-0.289***	-0.292***	-0.299***
		(0.008)	(0.007)	(0.007)	(0.006)
Indigenous Language			-0.329***	-0.318***	-0.213***
			(0.016)	(0.017)	(0.015)
Rural Area			-0.218***	-0.216***	-0.091***
			(0.009)	(0.009)	(0.008)
Chiapas*Schooling				0.007**	
				(0.004)	
Chiapas*Experience				-0.006***	
				(0.001)	
$Chiapas*Experience^2$				0.000***	
				(0.000)	
Chiapas* Woman				0.076	
				(0.050)	
Chiapas* Indigenous Language				-0.094	
				(0.061)	
Chiapas* Rural Area				-0.034	
				(0.052)	
Economic Complexity Index (eci_censo)					0.131***
					(0.006)
Constant	8.181***	7.007***	7.257***	7.256***	7.169***
	(0.013)	(0.016)	(0.011)	(0.012)	(0.012)
Items	2,749,207	2,749,207	2,749,207	2,749,207	2,749,207
R^2	0.024	0.283	0.314	0.315	0.334

Source: Sample of 10% of Population Census, 2010.
Standard errors reported in parentheses.
*/**/***: Statistically significant to 10%/5%/1%.

The decompositions we present below are based on statistical regressions where the dependent variable is income and the independent variables are factors that may explain the wage differences between Chiapas and the rest of Mexico. It is important to stress that this is a descriptive analysis that reveals the factors associated with these differences, and not necessarily the factors that cause them. Their usefulness lies in understanding what portion of the wage gap is linked to differences in features among inhabitants of Chiapas and those in the rest of Mexico, and what portion is linked to differences in the "returns" associated with these features.

Intuitively, the Blinder-Oaxaca decomposition attempts to explain what would happen statistically if we gave Chiapas inhabitants the same average features (same average levels of education, experience, percentage of women, percentage of people speaking only a native language, and percentage of people who live in rural areas) as the inhabitants of the rest of Mexico, and if we gave them the same returns on income associated with these features.

Table 4 displays the results of the decomposition for the same specification used in column (3) of the table above, expressed in two separate ways: original (columns 1 and 2), and by percentage. The first section shows the main decomposition of the wage gap in three components: features, coefficients (which represent the returns on income associated with these features), and the interactions between features and coefficients. The features lines represent what would happen to workers in Chiapas if we gave them the same features that workers in the rest of Mexico have. The coefficients line represents what would happen to them if we gave them the same returns associated with these features, and the interactions line represents what would happen if we gave the workers in Chiapas the same features and the same returns associated with these features.[13] The second section presents the results of decomposing these three components into their corresponding subcomponents for each of the features associated with workers' incomes.

The results of this decomposition (Table 4) suggest that the workers in the rest of Mexico have average wages that are 89% higher than the wages of Chiapas workers (column 3), and that nearly 41% of this gap can be explained by the differences in average features between these two groups.[14] That leaves a large percentage of the wage gap between Chiapas and the rest of Mexico unexplained, and suggests there are factors at play that go beyond the differences in individual features.

We also see in Table 4 that the main features associated with a narrowing of the gap are education (20%), indigenous language (10%), and rural area (5%).

[13] In the case of column 1, these 3 components add up to 0.64 (which represents the difference in income logarithms), while in the case of column (3), the product of these components is 1.89 (which represents the fact that, as we explained before, the average income of workers in the rest of Mexico is 89% higher than the average income for Chiapas workers).
[14] This equals 0.368/0.897=0.41, or 41%.

We can also observe that assigning to the Chiapas workers the returns on income associated with these features for other workers in Mexico is not associated with a major reduction in the wage gap between these two groups.[15]

Economic Complexity

Since the results of the Blinder-Oaxaca Decomposition suggest that much of the wage gap between Chiapas and the rest of Mexico cannot be explained by differences in education, experience, gender, rural population, and indigenous language, the question remains: what other factor can explain this gap? In this paper we have put forward the hypothesis that the relatively low economic complexity of Chiapas is a major obstacle to its development. In fact, the results of column 5 in Table 3 suggest that one additional point[16] in the municipality's economic complexity index is associated with a 13% higher wage, controlling statistically for education, experience, gender, type of setting, and indigenous language. This number is higher than the return associated with the individual acquiring one extra year of education (8%). This section briefly explores this possibility.

We begin by acknowledging that the complexity variable has an endogenous component. Specifically, we can argue that if the economic complexity is low in Chiapas, the people have less incentive to improve and educate themselves, and vice-versa. While we cannot solve this problem statistically, we will use a statistical process to identify upper and lower ranges for the impact of each variable.

This process is divided into two stages. First, we make a regression between the economic complexity of the municipality where the individual lives and his education level. The residuals of the regression are interpreted as the exogenous component of complexity. Thus, we obtain a lower limit for the portion of wage differences between Chiapas and the rest of Mexico associated with economic complexity. The second process involves a similar regression using education as the independent variable, economic complexity as the regressor, and considering the residuals as the correlation of education with wages once the correlation with complexity has been removed. This second step identifies an upper limit for the portion of wage differences between Chiapas and the rest of Mexico associated with economic complexity.

[15] This can be deduced by noting that the number for the constant in the coefficients section (columns 1 and 3) is much greater than the other numbers in that section.

[16] As a reference point, the economic complexity index for Chiapas is 1.18 points lower than the index for the rest of Mexico.

Table 4 - Blinder-Oaxaca Decomposition
Chiapas vs. Rest of Mexico

	In original terms		In percentage terms	
	Decomposition Coefficient	Standard Error	Decomposition Coefficient	Standard Error
Difference in log(income)	0.640	0.003	1.897	0.006
Blinder-Oaxaca Decomposition				
Features	0.314	0.002	1.368	0.003
Coefficients	0.377	0.003	1.458	0.004
Interactions	-0.050	0.002	0.951	0.002
Features				
Schooling	0.180	0.002	1.198	0.002
Experience	0.002	0.000	1.002	0.000
Woman	-0.020	0.001	0.980	0.001
Indigenous Language	0.103	0.001	1.108	0.002
Rural Area	0.049	0.001	1.050	0.001
Coefficients				
Schooling	-0.048	0.004	0.953	0.004
Experience	0.072	0.006	1.075	0.007
Woman	-0.016	0.001	0.984	0.001
Indigenous Language	0.034	0.002	1.035	0.002
Rural Area	0.018	0.003	1.018	0.003
Constant	0.317	0.011	1.373	0.015
Interactions				
Schooling	-0.014	0.001	0.986	0.001
Experience	0.001	0.000	1.001	0.000
Woman	-0.007	0.001	0.993	0.001
Indigenous Language	-0.023	0.001	0.977	0.001
Rural Area	-0.007	0.001	0.993	0.001

Table 5 presents the results of the Blinder-Oaxaca Decomposition in four distinct specifications. The first specification is the original one from columns (3) and (4) of Table 4. The second is equal to the first but includes the economic complexity index as an independent variable. The third equals the first but instead of using economic complexity as an independent variable, we use the residuals of the first stage of the process described above (i.e., the economic complexity variation that is not correlated with education). The coefficient in this variable is a lower limit to the percentage of the wage gap associated with economic complexity (20%). Lastly, the fourth specification is the same as the second, but it uses the education component that is not correlated with complexity. In this specification, the coefficient of the economic complexity index represents an upper limit (41%) to the percentage of the wage gap associated with economic complexity.[17]

The results in Table 5 suggest that economic complexity is an important factor in explaining the wage gap between Chiapas and the rest of Mexico. The coefficient of the features rose from 1.37 (column 1) to 1.57 (column 2) once we introduced the economic complexity index into the Blinder-Oaxaca decomposition. Moreover, the economic complexity coefficient in the features section suggests that giving Chiapas the average economic complexity index that exists in the rest of Mexico would be associated with a 23% increase in wages in Chiapas. Columns (3) and (4) suggest that this figure could range from 20% to 41%.

[17] Because all the coefficients are statistically significant, we do not present the standard errors in order to keep the table at a manageable size.

Table 5 - Blinder-Oaxaca Decomposition with Economic Complexity

	Spec # 1	Spec # 2	Spec # 3	Spec # 4
Difference in log(income)	1.90	1.90	1.90	1.90
Blinder-Oaxaca Decomposition				
Features	1.37	1.57	1.57	1.57
Coefficients	1.46	1.34	1.34	1.34
Interactions	0.95	0.91	0.91	0.91
Features				
Schooling	1.20	1.19	1.22	1.04
Experience	1.00	1.00	1.00	1.00
Woman	0.98	0.98	0.98	0.98
Indigenous Language	1.11	1.05	1.05	1.05
Rural Area	1.05	1.04	1.04	1.04
Economic Complexity		1.23	1.20	1.41
Coefficients				
Schooling	0.95	0.94	0.92	1.00
Experience	1.08	1.06	1.06	1.06
Woman	0.98	0.99	0.99	0.99
Indigenous Language	1.04	1.00	1.00	1.00
Rural Area	1.02	1.05	1.05	1.05
Economic Complexity		1.02	1.05	1.02
Constant	1.37	1.26	1.25	1.18
Interactions				
Schooling	0.99	0.98	0.98	1.00
Experience	1.00	1.00	1.00	1.00
Woman	0.99	1.00	1.00	1.00
Indigenous Language	0.98	1.00	1.00	1.00
Rural Area	0.99	0.98	0.98	0.98
Economic Complexity		0.95	0.95	0.93

6. Conclusions

Chiapas is the poorest state in Mexico. Its per capita income is the lowest of the 32 federal entities and amounts to barely 40% of the national median income. This paper is an attempt to determine the factors associated with the wage gap between Chiapas and the rest of Mexico. While we found that many of the factors usually associated with low incomes (low education, experience, gender, rural area, and indigenous language) explain part of the gap, even considering them all together leaves nearly 60% of the gap unexplained. We have found that the low economic complexity of Chiapas relative to the rest of Mexico is a factor that could explain a good part of the remaining difference. The implication is that Chiapas is not poor solely because it has a low endowment of factors compared to the rest of Mexico, but because the diversity of its factors of production does not allow it to produce many, more complex, goods that they could sell outside the state.

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Technical Appendix

REVEALED COMPARATIVE ADVANTAGE (RCA)

Following the Balassa methodology (1964), let's say that country *c* has a Revealed Comparative Advantage (RCA) in product *i* in a given year, if the percentage that product represents in the country's export basket is greater than the percentage of that product as a proportion of world trade:

$$RCA_{c,i} = \frac{\frac{X_{c,i}}{\sum_{i} X_{c,i}}}{\frac{\sum_{c} X_{c,i}}{\sum_{c,i} X_{c,i}}}$$

ECONOMIC COMPLEXITY INDEX (ECI)

If we define $\boldsymbol{M_{cp}}$, as a matrix that is 1 if country $\boldsymbol{c}$ produces the product $\boldsymbol{p}$ with a revealed comparative advantage (RCA>1), and 0 in any other case. We can measure diversity and ubiquity by summing over the rows and columns of that matrix. Formally, we define:

$$DDDDDDDDDDDDDDDDDD = kk_{cc,0} = \sum_{cc} MM_{cccc}$$

$$UUUUDDUUUUDDDDDD = kk_{cc,0} = \text{\textdiamond} MM_{cccc}$$

$$cc$$

To generate a more accurate measure of the number of capabilities available in a country, or required by a product, we need to use the information contained in ubiquity to correct the information contained in diversity. For countries, this requires us to calculate the average ubiquity of the products that they export, the average diversity of the countries that export those products, and so forth. For products, this requires us to calculate the average diversity of the countries that make them, and the average ubiquity of the other products that these countries are able to make. This can be expressed by the recursion:

$$\text{[illegible]} = \frac{1}{\text{[illegible]}} \sum \text{[illegible]} \qquad (1)$$

$$\text{[illegible]} = \frac{1}{\text{[illegible]}} \text{[illegible]} \qquad (2)$$

We then insert (2) into (1) to obtain:

$$kk_{cc,NN} = \frac{1}{MM_{cc'cc} kk_{cc',NN-2}} \frac{1}{kk_{cc,0}} \sum_{cc'} MM_{cccc} kk_{cc',NN-2} \quad (3)$$

$$kk_{cc,NN} = \sum_{cc'} kk_{cc',NN-2} \frac{MM_{cccc} MM_{cc'cc}}{kk_{cc,0} kk_{cc,0}} \quad (4)$$

and rewrite this as:

$$kk_{cc,NN} = \sum_{cc'} MM_{cccc'} kk_{cc',NN-2} \quad (5)$$

where

$$MM_{cccc'} = \sum_{cc} \frac{MM_{cccc} MM_{cc'cc}}{kk_{cc,0} kk_{cc',0}} \quad (6)$$

We note (6) is satisfied when $kk_{cc,NN} = kk_{cc,NN-2} = 1$. This is the eigenvector of $MM_{cccc'}$ which is associated with the largest eigenvalue. Since this eigenvector is a vector of ones, it is not informative. We look, instead, for the eigenvector associated with the second largest eigenvalue. This is the eigenvector that captures the largest amount of variance in the system and is our measure of economic complexity. Therefore, we define the Economic Complexity Index (ECI) as:

$$EEEEEE \quad (7)$$

$$= DDDDeeDDeeDDDDeeDDeeDD\ aaDDeeeeDDaaaaee\ eeeeee$$

$$DDee\ DDDDeeUUeeaaee \qquad DDDDeeDDeeDDaaeeUUDD$$

$$mmáDD \quad eeDDaaeeaaDD \quad aaDD \quad MM_{cccc'}$$

$MM_{cccc'}$ is given by (6).