The Low-Productivity Trap

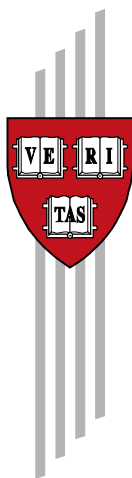## CHIAPAS GROWTH DIAGNOSTICS

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Abstract

Chiapas is the state with the lowest income per capita in Mexico and the state that grew the least during the last decade. Therefore, the income gap between Chiapas and the rest of Mexico has widened remarkably. This weak performance contrasts sharply with the relative macroeconomic and institutional stability that prevailed during the same period, and the massive amount of public resources that poured into the region since the Zapatista uprising in January 1994.

Chiapas' low income level is consistent with its inability to produce goods that can be sold beyond its borders. Its exports per capita are the lowest in Mexico, and are concentrated in a group of primary agricultural products traded in highly competitive markets with low margins.

What explains Chiapas' poor economic performance? To identify contributing factors, this document follows the Growth Diagnostics methodology developed by Hausmann, Rodrik and Velasco (2005), with some changes to adapt to the particularities of a sub-national context. Our goal is the same: to identify the main constraints to economic growth in Chiapas.

Our analysis indicates that the main constraints to economic growth in the state are not among the usual suspects. Low levels of education are to some extent related to the way Chiapas fell behind the rest of Mexico, but only explain a small part of the gap. Mountainous geography and weather are a challenge to building and preserving infrastructure in the region, but that doesn't seem to be the major obstacle to the development of productive capacities. There isn't evidence of failures in the credit markets. Low levels of private credit in Chiapas are related to the low productivity of the local economy rather than bottlenecks or insufficiencies in the supply of financing options.

Our conclusion is that Chiapas is in a (low) productivity trap. Its major problem is that its economy has very low complexity and mirrors its scant capacities. Modern production systems require a number of complementary inputs that are absent in Chiapas. In this context, productive diversity and private investment are low because returns to investment are also low. Given that demand derived from investment is low, supply of complementary inputs is inhibited, which leads to a coordination dilemma similar to the chicken and egg problem. Solving this problem requires government intervention. Some of the few cases of exports of manufactured goods in Chiapas are the result of successful federal interventions to coordinate provision of necessary production inputs with the demand for them. This has been used as the basis to justify the creation of Special Economic Zones.

In Chiapas, this situation is aggravated by three additional factors: (1) high federal transfers, (2) lack of public transport, and (3) low educational level.

Firstly, federal transfers have similar effects to those described in economic literature on Dutch Disease: they increase the relative price of tradable goods, which directs economic activity toward non-tradable sectors. Secondly, the absence of a public transport system directly reduces the benefits of working in the city for those who live in rural areas. That has established a dual urban-rural equilibrium with significant differences in salaries across a wide range of professions and occupations. Thirdly, though Chiapas has gradually closed the education gap with the rest of Mexico, there are still significant differences. In our view, the education gap is related to the fact that the decision to accumulate schooling years is partly endogenous to returns on education. Accordingly, the education gap in Chiapas reflects the difference in production methods prevalent in Chiapas as compared with the rest of the country. That is why we observe that although returns to education are higher in Chiapas, for each educational level, it is more profitable to emigrate (to another region with other complementary inputs that enable higher productivity and better salaries). Emigrants from Chiapas are not common, but earn a similar income to workers with their same education level at their new workplaces.

The policy implications for this diagnostic point to the need to use existing knowledge in Chiapas' more populated urban centers and the rest of Mexico to promote diversification towards more complex activities that build on existing capabilities in Chiapas. Creating a public transport system that links rural communities to the economy of the urban centers would open new employment opportunities to people living in those towns. This is a typical example of the chicken and the egg dynamic that prevails in Chiapas: there needs to be a minimum operational scale for the creation of an efficient public transport system, which in turn will not be possible until there is enough demand for transportation.

Our prescription suggests that we take the mountain to Muhammad, given that Muhammad hasn't traveled to the mountain. That is, to and solve the coordination problems through an intervention that brings job opportunities closer to where the workers are, because under current conditions, it's not profitable for workers to commute to where there are job opportunities. There are rural zones with low participation rates and high poverty in the vicinity of San Cristóbal de las Casas. There is considerable uncertainty around private economic activity in this area because the prevailing form of land property is communal, *territorios ejidales*. Our analysis points to potential of creating an Industrial Park around San Cristóbal to solve the lack of public goods problem (evidenced by legal insecurity, scarcity of adequate land, and social conflict) that has kept away private economic activity, and to attract companies to areas with inexpensive and relatively well educated labor. The experience in Chiapas of companies like Arnecom-Yazaki suggests that with short training periods, it is possible to integrate workers into relatively modern production systems.

This solution is a stepping stone on which Chiapas can enter a sustainable development dynamic, through successive improvements in productivity derived from the productive transformation and the progressive adoption of more modern production systems. In order to grow, Chiapas must start by learning to do things that are already produced in the rest of Mexico, and sell them beyond the boundaries of the state. From that point on, the economic fabric will come to life, as well as the knowledge related to more modern production systems, and gradually the export capacity could be developed, to eventually advance toward more complex activities. This process requires coordination between the main actors, government (both national and regional), the private sector, and universities, with the goal of proactively seeking out adjacent economic activities, as well as identifying and solving the respective bottlenecks in a dynamic way.

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1. Introduction

Chiapas is the state in Mexico that grew the least during the last decade. Although Mexico's per capita real GDP growth rate of 1.3% during 2003-2013 (1.8% for the non-oil economy) was low by Latin American standards (2.7% average during the period), Chiapas' growth rate was the lowest in all of Mexico (0.2% total and -0.2% non-oil). To gauge how big this lag is, note that by growing 1.8% per year, Mexico doubled its non-oil income per capita in 40 years. While it would take the other two poorest states in Mexico, Oaxaca and Guerrero, just 51 and 52 years to double their non-oil per capita GDP, it would take Chiapas 297 years.

Figure 1.1: Growth rate of GDP non-oil per capita (pesos 2008), 2003-2013
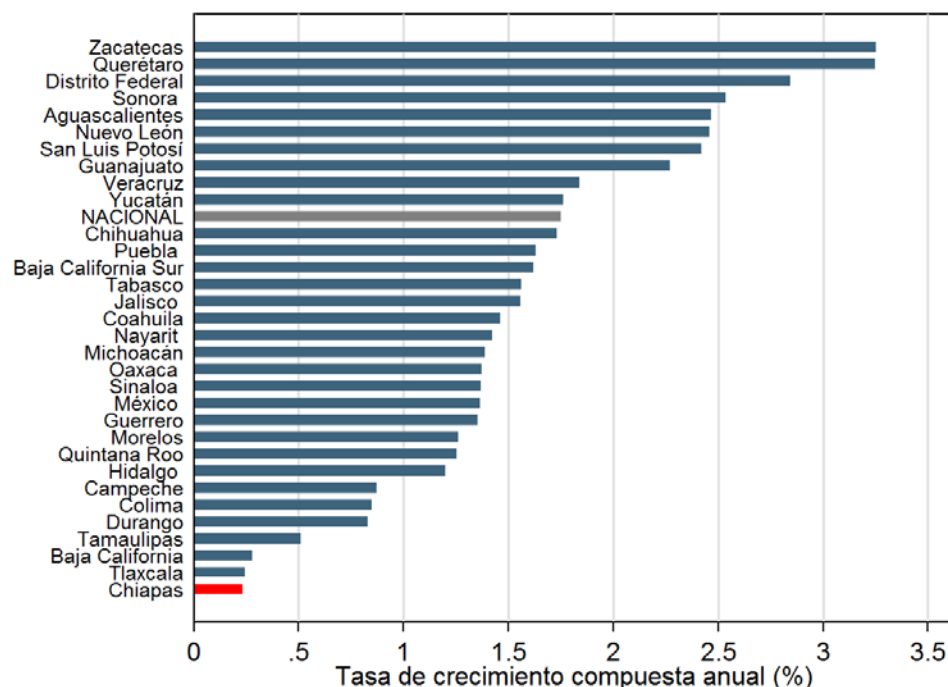
Source: INEGI (PIB) and CONAPO (population), authors' own calculations.

Chiapas became poorer relative to the rest of the country. Chiapas was already the poorest state in Mexico in 2003, and remained so in 2013. Due to its lower growth rate, the gap between Chiapas and the rest of the country widened throughout the decade. While non-oil GDP per capita in Chiapas was equivalent to 21% of Distrito Federal's and 46% of national average in 2003, 10 years later it represented just 16% and 40%, respectively.
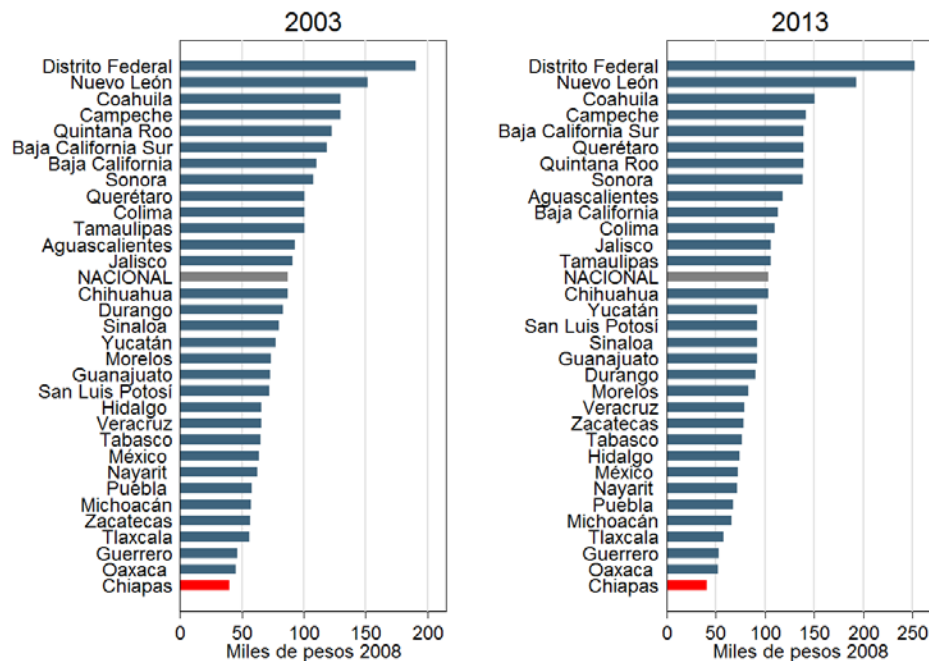
Figure 1.2: GDP non-oil per capita (pesos 2008), 2003 and 2013

Source: INEGI (PIB) and CONAPO (population), authors' own calculations.

Chiapas has the highest poverty rate in the country. When measured by income or by multidimensional criteria, Chiapas is the state with the highest poverty rate in Mexico[1]. Though the launch of social programs like *Progresa/Oportunidades* (known today as *Prospera)* has helped to mitigate the most extreme cases of poverty, as long as Chiapas' economy remains unable to accelerate growth consistently, Chiapas will continue to be the poorest state in Mexico and will continue to depend on such programs for subsistence.

Chiapas performed poorly in spite of favorable macroeconomic conditions. Mexico sustained strong macroeconomic performance in the last 15 years, keeping a low level of inflation (4%) and unemployment (5%) in spite of the financial crisis of 2008. Given that macroeconomic variables affect the whole country's business environment, they cannot explain the relatively low performance of Chiapas unless they impact Chiapas disproportionately. But this doesn't seem to be the case: inflation in Chiapas (using Tapachula as proxy) was broadly in line with national inflation, surpassing the latter by just 0.4 percentage points on average

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[1] In 2010, 78.5% of Chiapas population was multidimensional poor, while 78.1% was poor by income, in contrast with 46.1% and 51.3% in Mexico.

during the last 15 years[2]. More surprisingly, the unemployment rate in Chiapas stayed lower than the national rate (3% in 2014)[3].

Figure 1.3: Unemployment rate and inflation rate, 2014
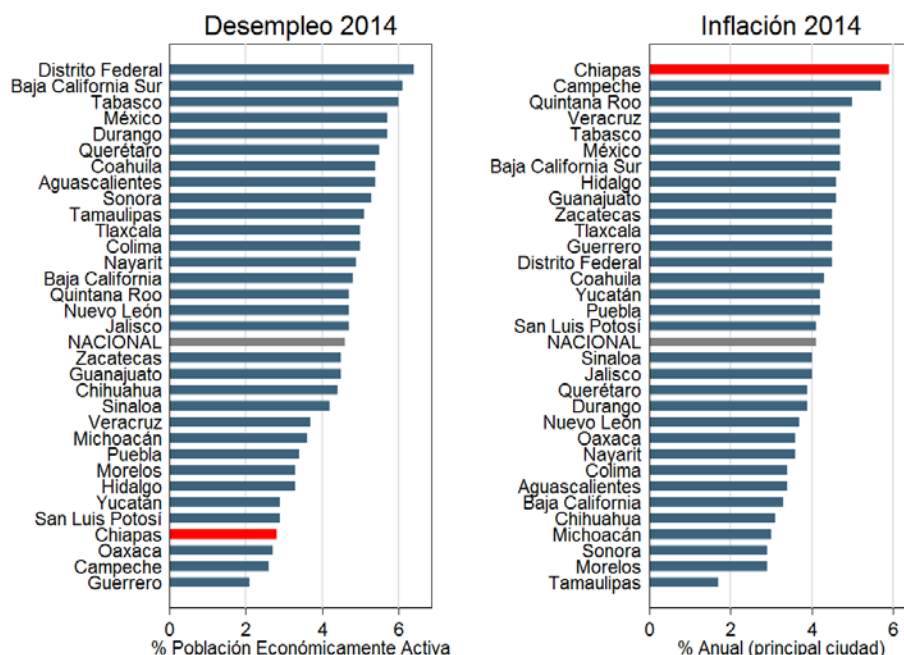
In sum, though Chiapas' economy is at full employment and does not face inflationary pressures significantly higher than the rest of Mexico, it remains in stagnation. This seems to suggest that the problem of growth in Chiapas is related to its rate of potential growth. In other words, the bottlenecks that impede growth are structural in nature, and are related to supply, not to a lack of aggregated demand.

All small and open economies need to export goods and services in order to acquire the goods that cannot be produced internally. By definition, a small economy cannot produce everything that its population demands, so it will have to purchase some of those goods abroad. To pay for them, it needs to produce external income (i.e. to export) to keep its balance of payments in equilibrium. This basic principle, which is evident at the country level, also applies to regional economies, and Chiapas is not exempted.

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[2] Last year was exceptional, with Chiapas surpassing national inflation rate by almost two percentage points.

[3] *Source*: INEGI.

Low exports per capita in Chiapas are consistent with its low level of income. Though there is no information about what Chiapas sells to the rest of the country, we can use goods export data as a first approximation of the state's productive capacities. As we can see, Chiapas is one of the states with lowest level of exports per capita, despite the presence of an extractive sector, which increases the value of exports in any region.

Figure 1.4: Value of exports per capita (US$), total and manufacture, 2013
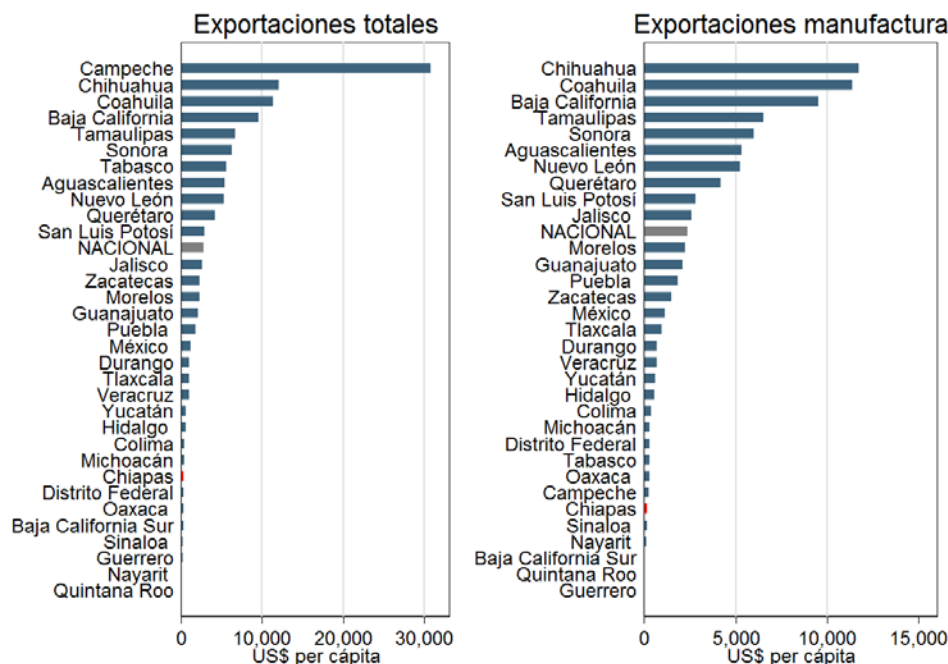
Source: INEGI (exports) and CONAPO (population).

This principle also rules in municipalities and localities in Chiapas. In some parts of the state, exports are financed through unilateral transfers from abroad (remittances from relatives, conditioned transfer programs), while in others, the ones closer to the main cities, people sell their work (temporary labor migration). Finally, there are zones, like Soconusco, able to export their production of coffee and bananas to other territories.

What explains Chiapas' low performance? The objective of this document is to find the main factors that inhibit Chiapas' economic growth. To look for the main restriction, the usual suspects will be screened one by one. But before that, we will review the existing economic diversity in Chiapas, a key subject relevant to any public policy discussion.

2. Not one but many Chiapas

Chiapas is a very diverse state. On one hand, it is Mexico's top producer in coffee and banana, the second in cocoa, the third in beef, and the fifth in corn[4]. Chiapas also generates 58% of hydroelectric power of all Mexico[5]. On the other hand, is among the least electrified[6], least educated, most poor and with highest illiteracy rate of all Mexican states. Chiapas diversity is multidimensional as well, because it's possible to identify dramatic internal differences in geography, urbanization, cultures, productive activities, and the corresponding incomes.

Chiapas diversity begins with its geography. The state is crossed by two mountain ranges from Southeast to Northwest (Sierra Madre and Los Altos shield) and two major rivers (Usumacinta and Grijalva), which divide Chiapas territory in seven physiographic regions very different in weather, quality of soil, economic activity and demography. Inside the physiographic regions there are 15 official socioeconomic regions[7], which contain the state's 122 municipalities.

Map 2.1: Topography and socioeconomic regionalization of Chiapas
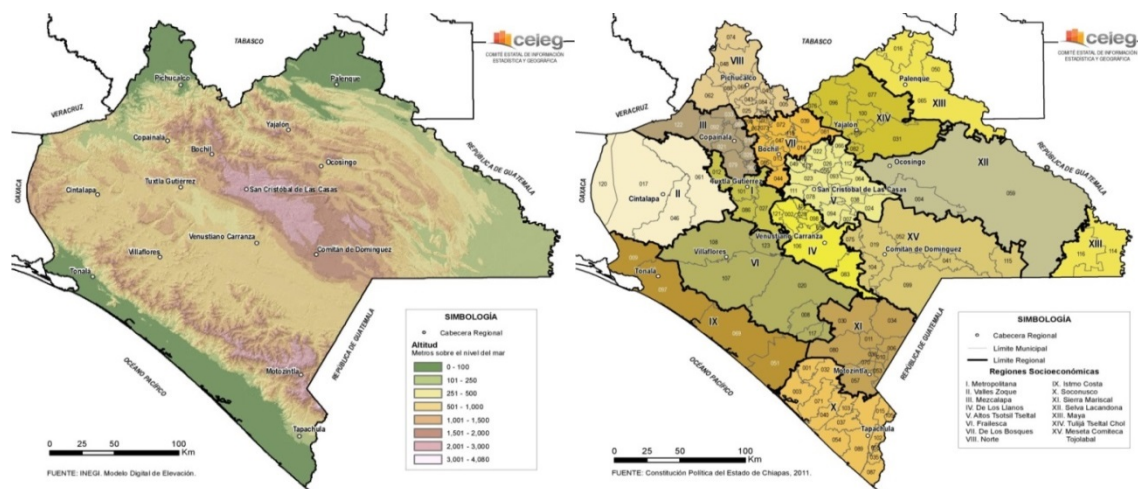
Source and elaboration: Comité Estatal de Información Estadística y Geográfica.

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[4] Chiapas production of coffee, banana, cocoa, beef, and corn beans represented 40%, 34%, 33%, 6%, and 7% of national total production (tons) in 2013, respectively. *Source:* SIAP – SAGARPA.

[5] Equivalent to 10% of national electric power generation. *Source:* Secretaría de Energía.

[6] In 1990, Chiapas was the state with the lowest rate of access to power, 66.9%. In 2010, Chiapas was the fourth state with the lowest rate, though then it was 96.3%. *Source:* INEGI.

[7] Chiapas came from 9 to 11 socioeconomic regions in 2011.

The population in Chiapas is also segmented between a rural majority and an urban minority. 51% of Chiapas' population, around 2.5 million people, lives in rural localities (defined by INEGI as those with less than 2,500 inhabitants). By contrast, the rural population in the rest of Mexico is 23%. This proportion aside, only 19% of Chiapas' population lives in localities with more than 100,000 inhabitants (versus 48% in Mexico): Tuxtla Gutiérrez, Tapachula and San Cristóbal de las Casas, the cities with higher density. While these three towns register the highest incomes per capita, the economic activities that sustain them are different.

Figure 2.1: Population distribution in rural and urban localities of more than 100,000 inhabitants
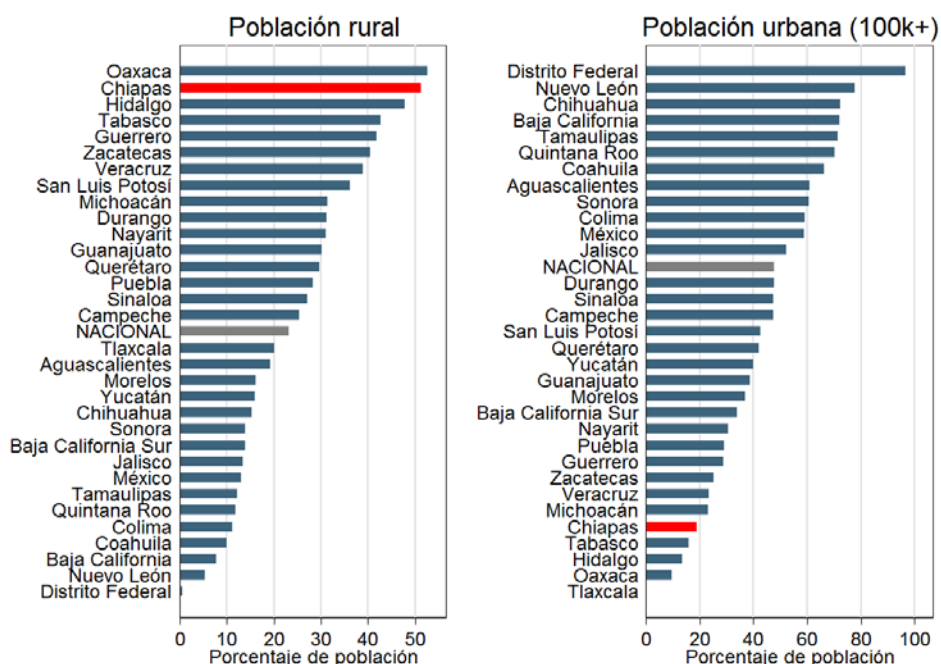
Source: Censo de Población y Vivienda 2010 (INEGI).

Ethnicity is also a dividing line in the state, not only because of cultural differences, but also differences in poverty. After Oaxaca (35%) and Yucatán (33%), Chiapas has the highest number of speakers of an indigenous language versus the total population (26%), most of them part of the Mayan language family[8]. The indigenous population is mainly concentrated in the northwestern zone of the state, in the Los Altos shield and the Lacandona jungle. Even though

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[8] The five indigenous languages most important in Chiapas are Tzeltal (spoken by 37% of indigenous speakers), Tzotzil (by 34%), Chol (by 16%), Tojolabal (by 5%) and Zoque (by 5%). All of them, except the last, belong to the Mayan family.

the most prosperous municipalities in Chiapas show poverty rates above 60%[9], the most elevated rates (above 90%) are in the municipalities with strongest indigenous presence[10]. This suggests that there is a Chiapas which is predominantly mestizo and an indigenous Chiapas which is poorer than the rest.

While most of the employment in Chiapas is concentrated in the primary sector, there are differences between the three most populated regions. Putting aside the extractive sector and utilities sector (activities with high added value per worker, which generate little employment)[11], around 55% of employed people in Mexico work in two sectors with high added value per worker (manufacturing and services) and only 14.2% work in the primary sector. In Chiapas, it's the opposite : 60% of occupied people work in low added value sectors[12]. When the analysis is replicated on the regional level, significant heterogeneity emerges. In the Metropolitan region (where Tuxtla Gutiérrez is), there are more urban activities like services, commerce and construction. The Soconusco region (Tapachula) is quite similar to the Metropolitan region in terms of the relative importance of services and commerce, but differs when it comes to the primary sector, which has an important role in Soconusco[13]. Despite hosting San Cristóbal de las Casas, the primary sector prevails in the Altos Tsotsil-Tseltal region, which focuses on self-consumption and retail within the region. In the rest of Chiapas, the main economic sector is the primary sector, mostly similar to the one of Los Altos. The common denominator in these regions is that the manufacturing sector represents no more than 8% of employment.

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[9] For instance, poverty rates in Tapachula and San Cristóbal de las Casas are 61% and 66% respectively. The only exception is Tuxtla Gutiérrez, where poverty rate is 43%.

[10] The municipalities Bejucal de Ocampo and Montecristo de Guerrero are the exception for this rule; both are among the poorest, without an important indigenous population.

[11] Utilities include generation, transmission and distribution of electric power, current water and gas on ducts for final customer.

[12] In order to calculate this, we used GDP series per sector and per state for 2010, published as part of the national accounts by INEGI, and the series on employment per sector and per state from the Population Census 2010. The former include in its calculations the gross added value generated by informal activities (around 25% of total GDP), while the second, which considers the whole working population, includes by definition informal workers. Notwithstanding, we chose to not use information from Economic Census 2009 because this source doesn't include the informal sector.

[13] The main primary exports (bananas, coffee, etc.) of the state come from the Soconusco region.

Figure 2.2: Distribution of employment by sector, selected regions in Chiapas 2010
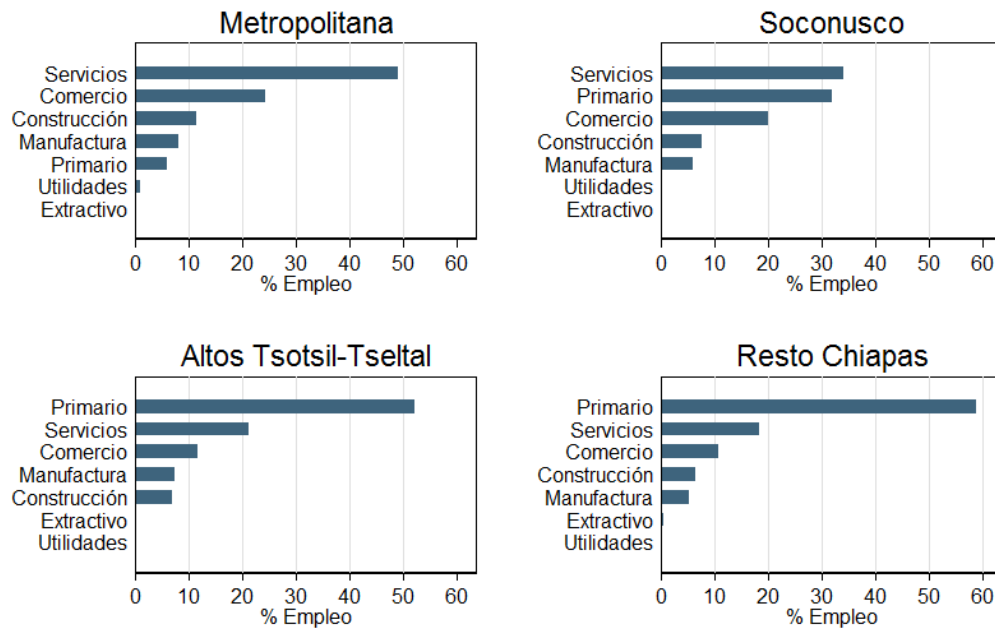
Source: Censo Poblacional 2010 (INEGI). Elaboration: our own.

Put together, these differences produce a very diverse map in terms of income per capita, where internal divergences are bigger than the ones between states. While the difference in per capita non-oil GDP between Distrito Federal and Chiapas is in the order of 6 to 1, the gap between per capita income of the richest municipality in Chiapas (Tuxtla Gutiérrez) and the poorest (Aldama) can be expressed in multiples of eight. Once again, the Tuxtla Gutiérrez municipality appears to be different than the rest, with a per capita income 60% higher than the second richest municipality (Reforma).

Figure 2.3: Distribution of municipalities according to annual per capita income, Chiapas 2010
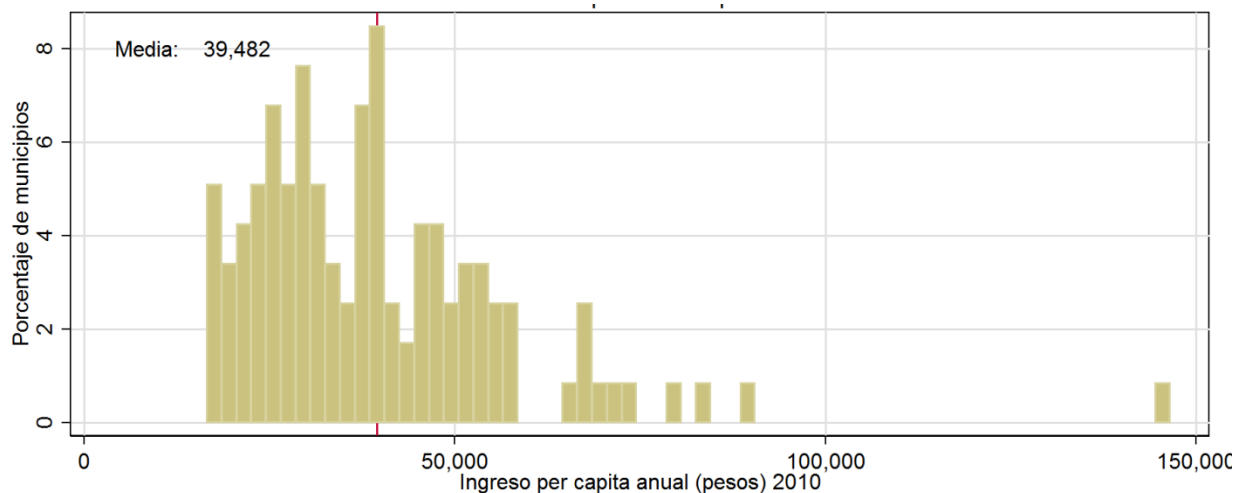
Source: Population Census 2010 (INEGI), authors' own calculations.

In summary, Chiapas is a considerably diverse state in several dimensions: geography, demography, economics and ethnicity. Therefore, is important to be aware of this heterogeneity when searching for bottlenecks to growth.

3. The usual suspects: access to credit

In this section, we inquire if the main reason behind Chiapas' low growth is credit scarcity. Our reading of the available evidence is that financial depth in the banking sector is low, but not because credit supply is deficient. According to our findings, low financial depth derives from the fact that economic agents are smaller, riskier and less productive than in the rest of the country.

3.1 Description of the financial sector

According to the law on credit institutions, there are two kinds of financial institutions in the Mexican banking system: private multiple banks (45) and public development banks (6)[14]. On December the 31st, 2013, there were 303 branches of multiple banking and 29 branches of development banking in Chiapas. Of 45 multiple banking entities which operate at the national level, seven banks concentrate 78% of branches in Chiapas[15]. On the development banks side, there two of the six that exist in Mexico are present: BANSEFI and Banjercito (27 and 2 branches, respectively). Given that development banks don't assign credit following the same criteria as private banks, we should evaluate their relative importance in the market.

Private participation in commercial credit has shrunk, while development banking has grown[16]. In December 2010, multiple banking represented around 97% of deposits, 80% of total credit and 72% of commercial credit[17]. However, while its relative share of deposits remained more or less constant between 2000 and 2011[18], its share of commercial credit declined in relative terms starting in 2005, and fell in absolute terms between July 2011 and April 2012. At the same time, the participation of development banks in commercial credit was multiplied by six during the second half of 2011, going from 26% to 72%. This trajectory differs

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[14] These are: (1) Banco Nacional de Comercio Exterior (Bancomext), (2) Banco Nacional de Obras y Servicios Públicos (Banobras), (3) Nacional Financiera (Nafin), (4) Banco Nacional del Ejército, Fuerza Aérea y Armada (Banjercito), (5) Banco del Ahorro Nacional y Servicios Financieros (BANSEFI) ["Mexico's social bank"] and (6) Sociedad Hipotecaria Federal (SHF). *Source*: Comisión Nacional Bancaria y de Valores.

[15] Banco Nacional de México (Banamex), Banco Azteca, Banco Mercantil del Norte (Banorte), BBVA Bancomer, HSBC México, Banco Santander, and Scotiabank Inverlat.

[16] Commercial credit includes "productive" credit (for the sectors of agriculture, livestock, industries and services), credit for financial sector (both private and public) and to public sector.

[17] Being the other two types the mortgage credit and the credit to consumption.

[18] There is no more recent data.

from the rest of the country, where multiple banks participation in commercial credit has stayed around 80% since 2008.

Starting 2004, almost all commercial credit from development banks in Chiapas financed the public sector[19]. In 2014, the development banks didn't give credit to the private productive sector in Chiapas, despite lending to the private sector at the national level (41%). In fact, 96% of loans went to finance the public sector and the remaining 4% to the financial system. This is why, in spite of representing less than a third of total commercial credit[20], the following analysis will focus exclusively on multiple banking[21]. The key question: is there a real scarcity of productive credit in Chiapas?

Figure 3.1: Participation of development banking in total commercial credit, 2014
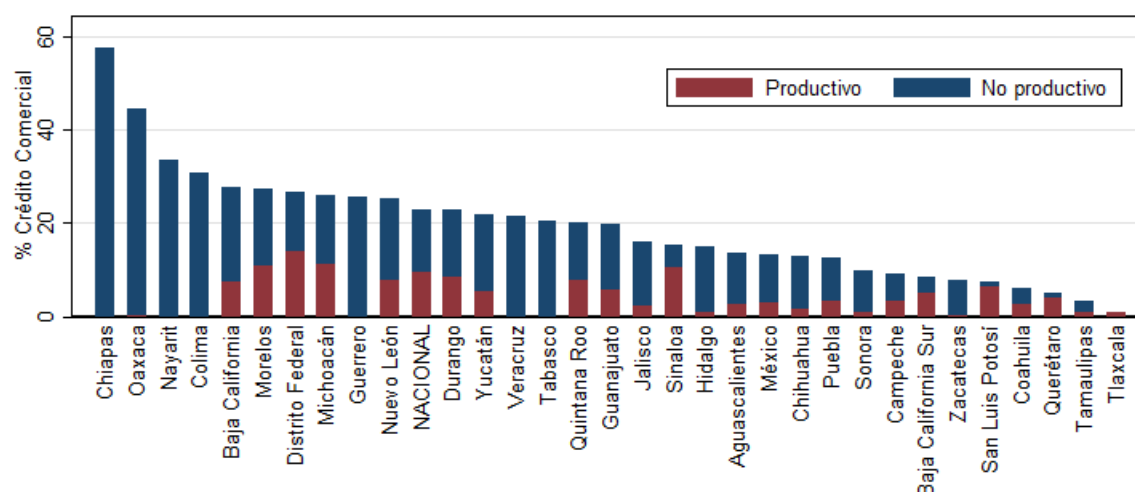
Note: the percentages were calculated considering only commercial credit given by multiple banks and development banks.
Source: Banco de México.

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[19] As "public sector" we must understand federal government, state government, municipal government, Distrito Federal government, companies and non-financial public entities.

[20] Following Banco de México's classification, commercial credit includes both credit known here as productive (for the sectors of agriculture, livestock, industries and services), and the non-productive (for the financial system and public sector).

[21] Figures shown from now on will not consider the popular financial sector, because the concerning data is only available in quarters of one year, and this sector represents less than 1% of total commercial credit in Mexico and in Chiapas. SOFOL and SOFOM will not be considered either, given that both represent only 4% and 6% of total commercial credit in Mexico and in Chiapas, respectively.

3.2 Is access to credit a problem in Chiapas?

The share of households and firms (or economic units, E.U. for short) which got external financing in Chiapas in 2008, as well those financed through banks is close to the national average. According to Economic Census 2009, around 30% of Chiapas' E.U.s didn't have financing in 2008, versus 28% on the national level[22]. However, this measurement includes the funds provided by partners or owners of the company, and is therefore more a capital investment than a credit. When we only consider external financing, Chiapas fell slightly under the national average, with 14%[23]. Similarly, 32% of E.U.s that secured external credit did so through banks, in line with the Mexican average[24], which equals to 5% of all E.U.s[25]. In sum, at least concerning E.U.s, credit access in Chiapas doesn't seem to be very different to the rest of Mexico.

Figure 3.2: Percentage of economic units that obtained credit, 2008
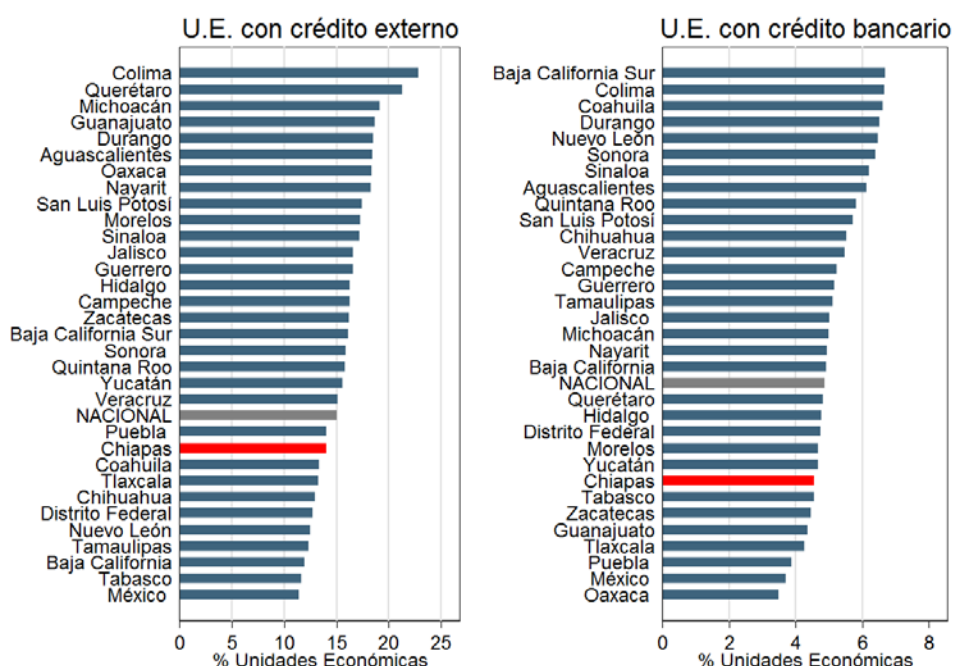
Source: Economic Census 2009 (source of financing), INEGI (GDP non-oil) and CONAPO (population).

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[22] As a reference, on the state level the proportion was between 21% (Chihuahua) and 37% (Campeche) of E.U.

[23] Proportion went from 11% in the state of Mexico to 23% in Colima.

[24] Proportion went from 19% in Oaxaca to 52% in Nuevo León.

[25] The rest was financed mainly through providers (16%), relatives (14%), popular saving banks (13%) and private lenders (12%).

However, productive commercial credit as percentage of GDP in Chiapas is the third lowest out of all Mexican states. Chiapas fell to 30th place out of 32 states in 2013 with just 2.1% of its non-oil GDP, twice the percentage of Guerrero and Oaxaca, and 80% under the national average.

Figure 3.3: Total productive credit and credit from multiple banking

(states, 2013)
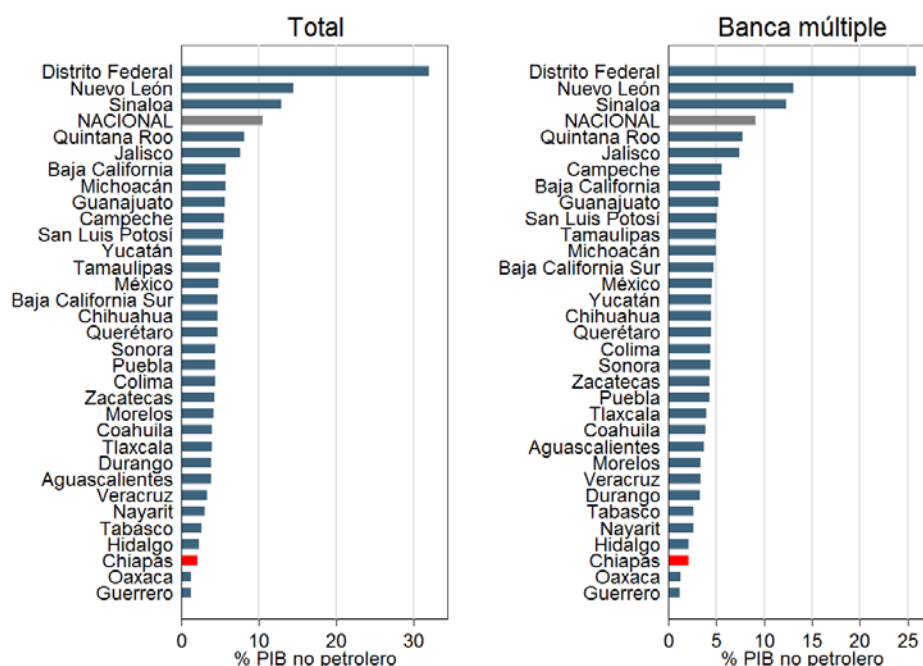
Note: Percentages calculated considering only commercial credit given by multiple and development banks.

Source: Banco de México (commercial credit), INEGI (GDP non-oil) and CONAPO (population).

The share of productive credit in overall credit extended by multiple banks is much lower in Chiapas (35%) than the national average (65%). Consumption and mortgage loans are generally considered more secure because they don't require extensive screening of candidates given that these loans finance hard assets that can be pledged (real estate, cars, etc). In 2010[26] Chiapas had the third highest share of consumption and mortgage credit in overall credit (43% versus 11% in Mexico). Coupled with the fact that 22% of commercial credit went to non-productive purposes, we find that Chiapas has one of the lowest productive credit rates in the

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[26] There is no statistical disaggregated information by states for more recent dates.

country, only higher than Coahuila's, Guerrero's, Tabasco's and Oaxaca's. This is consistent with higher credit risk in loans to the productive sector relative to other loan types in Chiapas.

Figure 3.4: Distribution of total credit between commercial credit, mortgage credit and housing credit, 2010
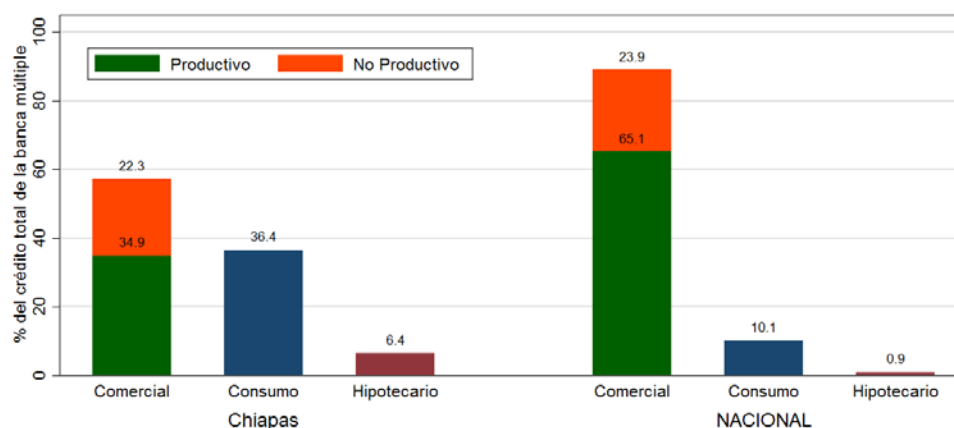
Source: Comisión Nacional Bancaria y de Valores (interest rates) and INEGI (inflation), authors' own calculations.

In sum, though the share of E.U.s with access to bank credit is close to the national average, productive banking credit in Chiapas was one of the lowest in Mexico (considering the state's size) in 2013. Banks extend a larger share of credit to consumption loans. Why isn't productive credit as prevalent in Chiapas? Is it a supply problem, or a demand problem? If credit scarcity was a supply problem (that is, if there were many attractive investment opportunities that cannot find financing) one would expect higher interest rates in Chiapas vis a vis the rest of Mexico.

3.3 Is credit more expensive in Chiapas?

The cost of credit from banks in Chiapas has remained closely in line with the rest of Mexico. Both in Chiapas and Mexico, real interest rates declined between 2009 and 2014. While real rates for micro and small companies were slightly higher in Chiapas (0.3 percentage points), real interest rates for medium-size and big companies were lower (-0.2% and -0.9%, respectively).

Figure 3.5: Real interest rates in Chiapas and México, 2009-2014
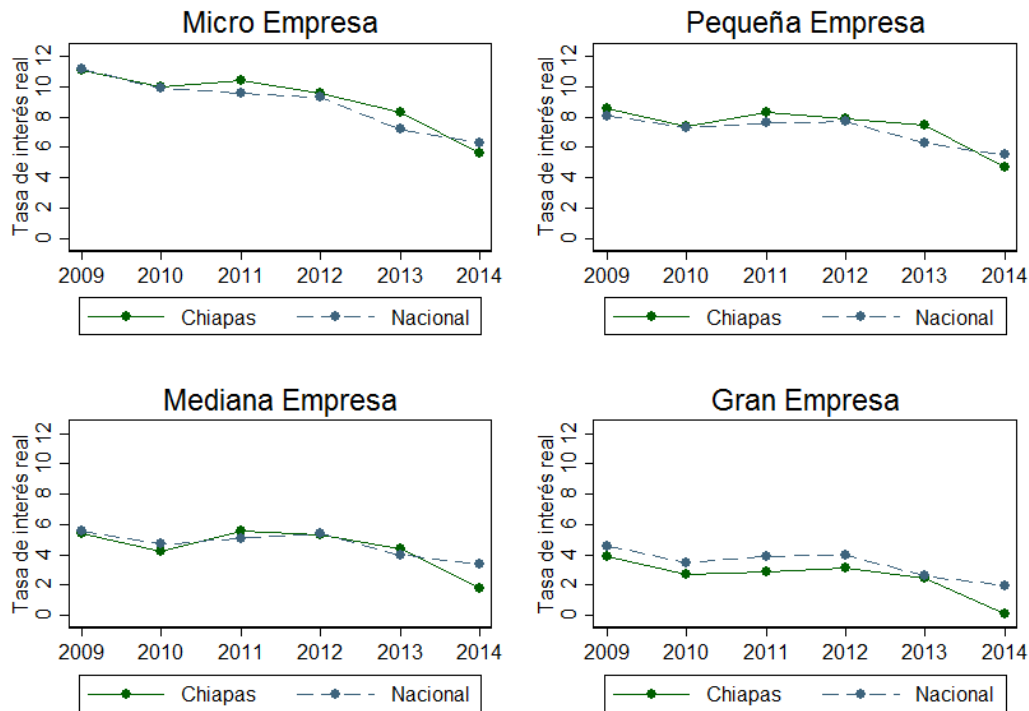
Note: Real interest rates were obtained by subtracting from interest rates (in national currency) inflation rate of national and Tapachula consumer price indexes, respectively.

Source: Comisión Nacional Bancaria y de Valores (interest rates) and INEGI (inflation).

More recently, interest rates in Chiapas were among the lowest in Mexico for any company size. In 2014, the real interest rate in Chiapas was lower than the national average by as much as 0.7 percentage points (for micro companies) to 1.9 percentage points (for big companies).

Figure 3.6: Real Interest rates for company size, for states

2014
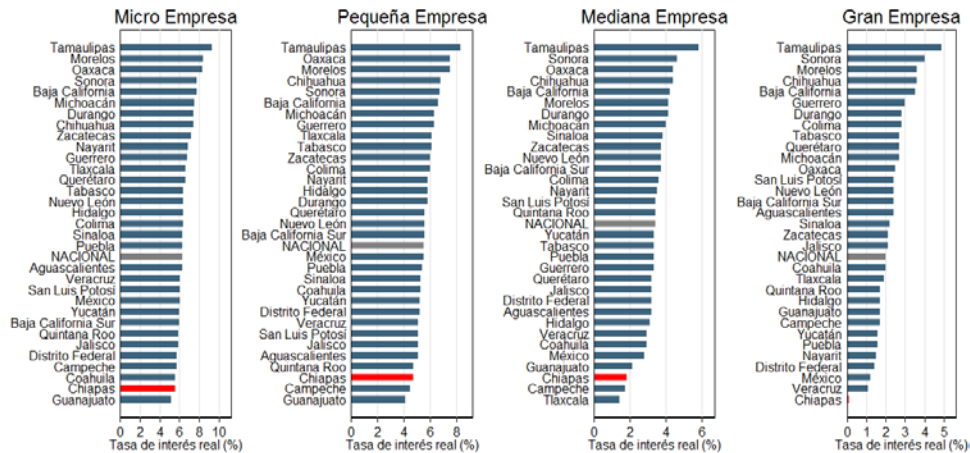
Note: Real interest rates were obtained by subtracting from interest rates (in national currency) inflation rate of consumer price index in every main city of every state.

Source: Comisión Nacional Bancaria y de Valores (interest rates) and INEGI (inflation).

3.4 Preliminary conclusions

In conclusion, interest rate dynamics in Chiapas suggest that lack of credit is not a restriction to growth in the state. This is consistent with the idea that capital is perfectly free to move within the Mexican economy. Given that the size of Chiapas' economy versus the country's is small, if there is low credit, it is natural to suppose that it is because there are few productive investments that are profitable under Chiapas' risk level.

4. Infrastructure

In this section, we study whether Chiapas hasn't been able to grow at the same rate as Mexico because of a lack of adequate complementary infrastructure that would make capital investments profitable. Our analysis focuses on the two central inputs for production: electric power and transportation. Our reading of the available evidence is that neither of these two inputs is a binding constraint. On one hand, infrastructure in Chiapas isn't significantly worse than in the rest of the country. On the other, though investment in road infrastructure has a positive effect in primary and extractive exports in the state, its impact on diversifying manufacturing exports is very low[27]. This is congruent with the fact that Chiapas' main urban centers aren't far from the main export ports, both in the Pacific Ocean and the Gulf of Mexico.

4.1 Electric power

Electric power availability is not a bottleneck in Chiapas. After Hidalgo and Colima, Chiapas is the third largest net electricity producing state in Mexico. Excess power generation in Chiapas equals over 500% of its current electricity consumption. If electric consumption in Chiapas keeps growing at the same rate is has had during the last five years (2.8% per year), it won't saturate Chiapas for at least 65 years, even if gross generation stays constant. In 1995 only 78% of households in Chiapas had access to electric power. By 2010, that percentage had risen to 94%, so the difference with the national average fell from 15 to 2 percentage points. While the electrification gap shrank in such a significant way, the income gap has kept growing. In that context, electric power availability doesn't seem to be the main restriction to growth in Chiapas.

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[27] Molina, Mesquita and Blyde (2013).

Figure 4.1: Electric power net generation as percentage of consumption, 2015
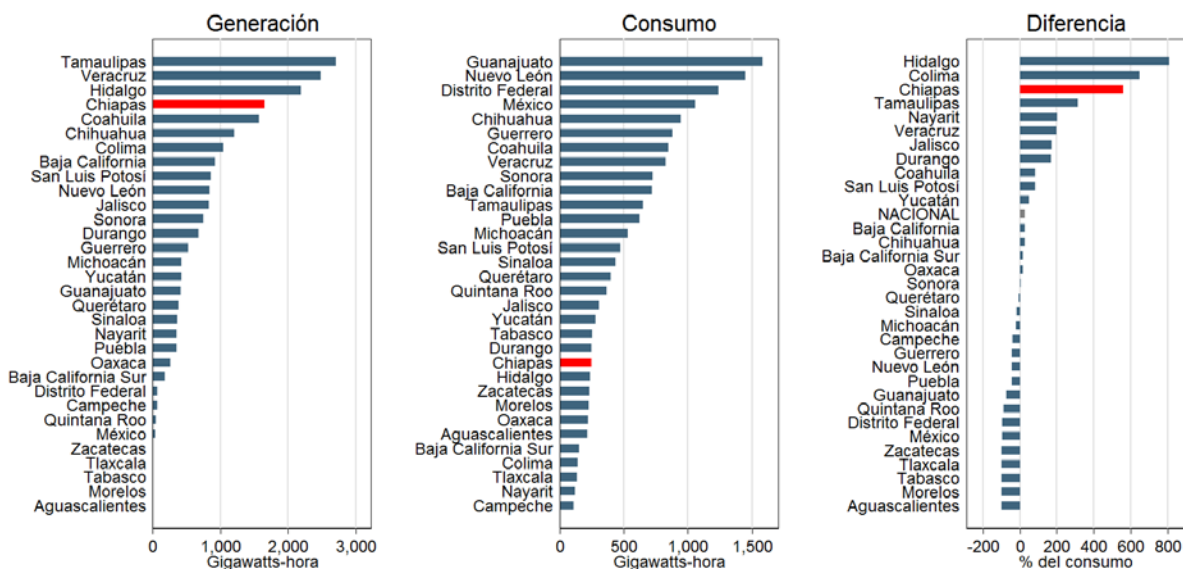
Given the policy of fixed electric prices for commercial clients in Mexico, electricity prices aren't indicative of the relative scarcity of energy in every state. The Comisión Federal de Electricidad (CFE), the public company with the services monopoly, charges different rate to five client groups: (1) domestic, (2) agricultural, (3) industrial, (4) commercial and (5) utilities. Although it's true that rates for domestic use vary according to the minimum median temperature in each region (which means a cross subsidy to the warmer regions), this doesn't happen with the other rates. For example, commercial and industrial rates are classified only in function of tension and consumption[28]. Agriculture and aquaculture sectors have a different rate system, which works under a quotas system established by SAGARPA[29]. In conclusion, if electric power rates are tilted to favor the agricultural sector, this effect is the same through Mexico, so it can't explain the differences between Chiapas and the rest of the country. Notwithstanding, we should note that a fixed price system means, in practice, a cross subsidy

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[28] Consumption of low tension power has two fees, depending on if it's below 25 kilowatts (fee 2) or above (fee 3). Consumption of medium tension and high tension power have their own fees.

[29] Power consumption for pumping water in agriculture has four fees: (1) low tension (fee 9), (2) medium tension (fee 9M), (3) one charge only (fee 9-CU) and (4) nightly (fee 9-N). 3 and 4 are exclusive to "productive subjects inscribed in the census of beneficiaries of agriculture and livestock energetics, by quota established by SAGARPA", as well as the aquaculture fee (*Source*: Comisión Federal de Electricidad).

from the regions when power is abundant to those where it's scarce, which diminishes Chiapas' comparative advantage in energy[30].

4.2 Transportation network

Ground transportation is the most common way of moving goods in Mexico. It moved 56% of freight commerce, on average, between 2000 and 2012, in spite of the fact that when transporting goods beyond 500 kilometers, train and ship are potentially cheaper[31].

The advanced road network is less extended in Chiapas than in the rest of states. First, only 30% of roads in Chiapas were paved by 2013, versus 39% in Mexico[32]. Of all paved kilometers, only 5% were four lane roads (*red carretera avanzada*), half the national average. Only 1.4% of roads in Chiapas were paved and had at least four lanes (3.9% in the rest of the country).

Figure 4.2: Kilometers of paved roads, 2013
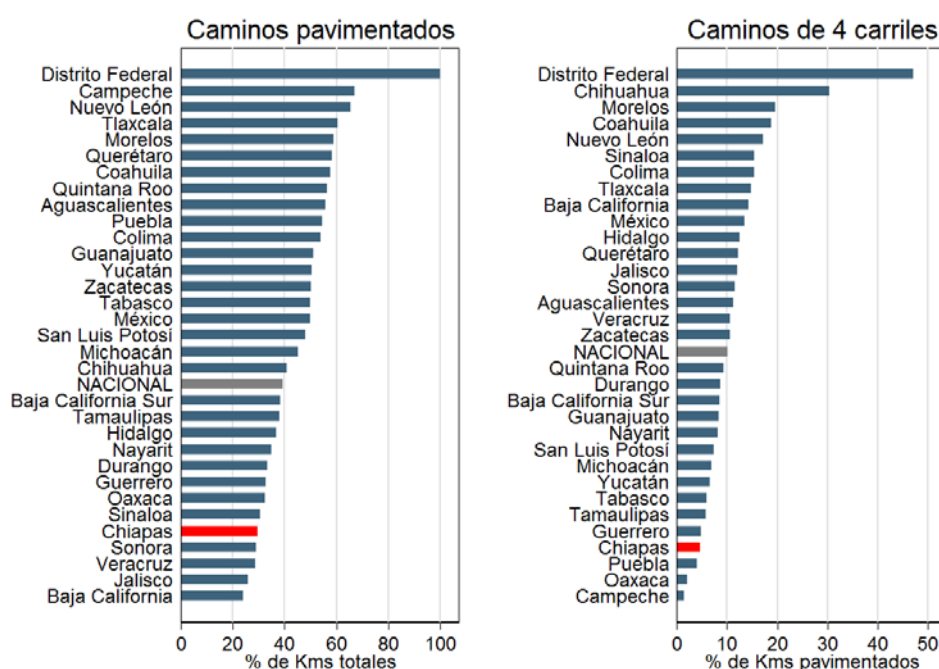
Source: Secretaría de Transportes y Comunicaciones.

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[30] On that subject, see: Dávila, *et al* (2002).

[31] *Source*: Programa Sectorial de Comunicaciones y Transportes 2013-2018.

[32] Though Mexico's percentage is high to Latin American standards (e.g. Brasil, 14% in 2010; Argentina, 30% in 2004; Chile, 23% in 2010), according to *CIA The World Factbook* is far from the US (65% in 2012).

These figures, considering population and area, don't appear worse than the Mexican average. In 2013, Chiapas had 13.2 kilometers of paved roads per 10,000 inhabitants, above the 12.5 kilometer national average. That same year, Chiapas had 9.2 kilometers of paved roads per 100 square kilometers, far from the leading state in this metric (Tlaxcala, with 41.2 kilometers), but above national average (7.6).

Figure 4.3: Kilometers of paved roads per number of people and area, 2013
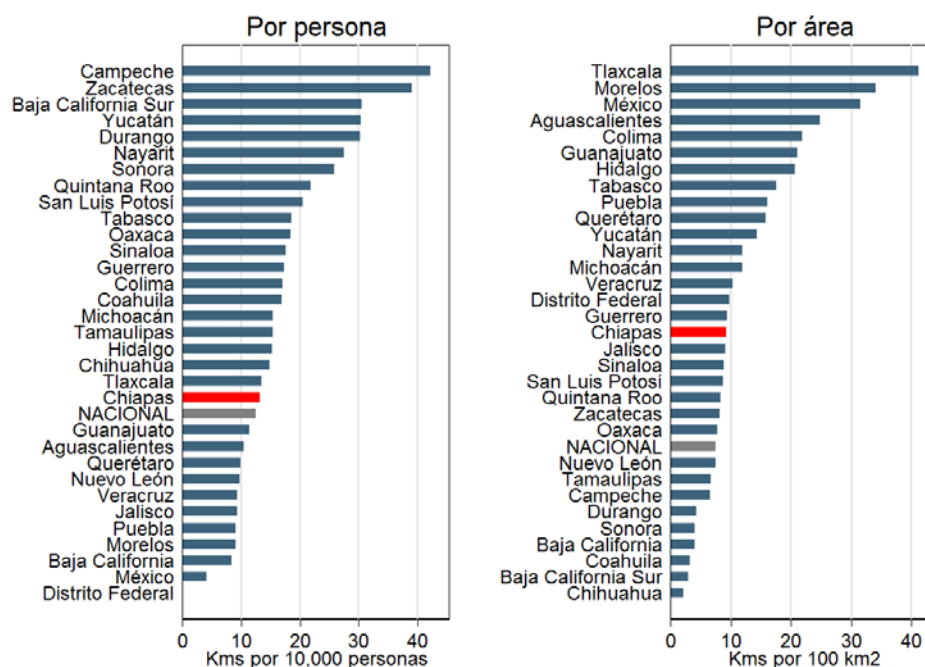
Source: Secretaría de Transportes y Comunicaciones.

In sum, it's a mixed picture. On one hand, the share of paved and four-lane roads in Chiapas is low for Mexican standards, but not low for the state's population and area. Is the lack of better road infrastructure the main restriction to growth in Chiapas? In particular, we wonder if deficient infrastructure is the major obstacle to the supply of tradable goods in Chiapas.

For more than a decade, the "*radiality*" of the road system has been identified as a problem that affects mainly the South of the country. Potential export goods in Chiapas can be shipped by sea (to any destination in the world) or by land (to the US). For sea transportation, Dávila, Kessel and Levy (2002) say that one of the biggest problems in Mexico's transportation

network is its *radiality*[33]: the whole network centers around Distrito Federal, which forces goods to travel up and across high altitudes in order to reach lower lands. This problem persists today. According to Molina, Mesquita and Blyde (2013), radiality is still a problem in the country's principal road network[34]. Dávila *et al* (2002) proposed the building of coastal axes as the main investment to solve this problem. Today, most of the roads included in this proposal have been built, except the corridor of the Pacific, which is currently under construction[35].

Map 4.1: 14 main corridors of the road networks and the projected 15th (2013)

Note: the 15th main corridor under construction goes through Pacific Coast from Santo Domingo Tehuantepec to Tepic (in red).

Source and elaboration: Anuario Estadístico Sector Comunicaciones y Transportes (SCT).

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[33] Dávila, Kessel and Levy (2002).

[34] Molina, Mesquita and Blyde (2013).

[35] The 15th corridor, which will connect Salina Cruz and Tepic through the Pacific coast, began construction during the 2013-2018 administration. Source: Programa Sectorial de Comunicaciones y Transportes 2013-2018.

It's worth wondering if the lack of the Pacific corridor is the main bottleneck for Chiapas exports. Instead of focusing on Chiapas' road infrastructure as a whole, let's focus on what is relevant to its main regions. For instance, if someone wants to take merchandise from Tuxtla Gutiérrez to Nuevo Laredo by land, the Gulf's coastal axis[36] is relevant. There, the optimal route goes first to Coatzacoalcos (Transístmico corridor), to reach Veracruz (Puebla-Progreso corridor) and, finally, head to Nuevo Laredo (Veracruz-Monterrey corridor)[37]. In 2000, the modernization degree of those corridors was of 43%, 73% and 69%, respectively[38]. Twelve years later, those same corridors have been updated in 80%, 91% and 76% on each case[39]. The physical state of the national road network went from 61% in 2000 to 80% in 2012[40].

Accessibility from cities to main ports, both on the Pacific and the Gulf, implies that there isn't a road infrastructure problem. Given that Nuevo Laredo is almost 2,000 kilometers away from Tuxtla Gutiérrez, transport by train or ship are potentially cheaper. Following the Tuxtla Gutiérrez example, the main ports in the Gulf and the Pacific are Coatzacoalcos, in Veracruz, and Salina Cruz in Oaxaca, respectively[41]. Reaching the former takes at least four hours and costs around 3,000 pesos, while arriving to the second needs at least four hours and costs less than 2,500 pesos[42]. If we make the same calculation for Tapachula and San Cristóbal de las Casas, we get similar results. The short distance to these ports and the fact that the cost of the port infrastructure per container in Mexico is similar to the global average (USD 18.10 per container)[43] weakens the hypothesis of infrastructure as the bottleneck.

Additionally, in spite of the fact that Chiapas is geographically closer to the US, Guatemala exports more and more diverse products to that market. Guatemala is a country that resembles Chiapas in history, culture, geography and climate. However, despite the fact

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[36] Part of the policy proposals in Dávila *et al* (2002).

[37] The optimal route was obtained using the "Mapa Digital de México", available on INEGI website, which calculates the better routes by time and cost.

[38] Source: Programa Sectorial de Comunicaciones y Transportes 2001-2006.

[39] Source: Programa Sectorial de Comunicaciones y Transportes 2013-2018.

[40] *Ibid.*

[41] In 2013, 12 and 4 million tons of cargo were exported from the ports of Coatzacoalcos and Salina Cruz, respectively. In comparison, less than 59,000 tons were exported from Puerto Chiapas. Source: Anuario Estadístico Sector Comunicaciones y Transportes 2013.

[42] Source: "Mapa Digital de México" (INEGI).

[43] Source: Programa Sectorial de Comunicaciones y Transportes 2013-2018.

that Guatemala City is 2,493 kilometers away from Laredo, Texas (542 kilometers more than Tuxtla Gutiérrez), its exports have more complexity and diversity. Guatemala not only has a significant presence in products which require significant logistics (e.g. melons, frozen vegetables, fresh and dry frozen fruits), but also exports six times more coffee and thirteen times more bananas, the two major export products in Chiapas.

Lastly, reducing transportation costs appears to have more effects on exported volumes than on diversifying exports. In 2013, the Inter-American Development Bank published research that measured the effects of reducing transportation costs (by 1%) on the export sector[44]. Though the effect of the 1% reduction is always greater in the Southern region (a 5% increase in export volumes versus the national average of 2.6%), most of the gains are concentrated on intensive margins (volumes) instead of extensive margins (diversification). The 1% reduction in transport costs only increases the number of imported products by 1.9% versus 0.8% at the national level[45]. Agriculture, mining and manufacturing are the most benefited tradable sectors in both extensive and intensive margins, and yet the extensive margin of the manufacturing sector is barely affected (+0.2%) by the 1% reduction in transport costs. This is evidence of the fact that investment in infrastructure probably has a positive effect on Chiapas' agricultural export supply, especially in already exporting products, but not on diversifying manufacture exports.

4.3 Preliminary conclusions

In conclusion, Chiapas has room to improve its road infrastructure, but it's unlikely that this is the main factor behind the low economic growth. Though the percentage of paved and four-lanes roads is low, when reconsidered regarding area and population, Chiapas looks better than the average of Mexico. Chiapas also has close access to two important ports (Salina Cruz and Coatzacoalcos), so it's not very probable that infrastructure is the main reason why Chiapas doesn't achieve more exports. In fact, the state should have taken advantage of the finished improvements on the country's road network; nevertheless, it falls still behind in terms of growth. Finally, even if the IDB research shows that investment in infrastructure could increase exports, its effect would be almost null on productive diversification, particularly in manufacturing.

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[44] Molina, Mesquita and Blyde (2013).

[45] The study's database contains 8-digit product data.

5. Human capital

This section looks into whether a potential lack of qualified workforce is driving Chiapas' low growth rate. Our reading of the available evidence is that low education is a part of the growth problem in the state, but that that factor alone cannot explain the gap between Chiapas and the rest of Mexico. Certainly, Chiapas' educational level is low, but workers in Chiapas earn less than in the rest of Mexico, no matter how educated they are. Therefore, workers in Chiapas have greater incentives to emigrate than to invest in education. Besides, education doesn't explain why emigrants from Chiapas earn salaries very similar to workers from the rest of Mexico with the same education level.

5.1 Education level and quality

Chiapas is the state in Mexico with the highest illiteracy rate. 16% of people over 12 years old in Chiapas are illiterate, more than twice the national average (6%). Half of this population works in housekeeping, 38% are employed, and the remaining 10% are retirees, students, disabled and others. Only 0.7% is unemployed.

More than 70% of Economically Active Population (EAP) in Chiapas has little or no education[46]. In Chiapas, 13% of EAP has no education and 21% didn't finish primary school. The share of inhabitants that didn't finish primary school is over twice the national average. On the contrary, 64% of the Mexican EAP has finished secondary school or higher, which is 20 percentage points higher than Chiapas. This is consistent with the 7.2 years of average education of Chiapas' EAP versus the Mexico's 9.4.

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[46] Though since the 1962 constitutional reform EAP is legally defined as people 14 or older who works or is searching for work, tabulations in Population Census 2010 published by INEGI cover people 12 years or older, so we chose to follow this cut-off point.

Figure 5.1: Distribution of schooling years of EAP, Chiapas vs México 2010
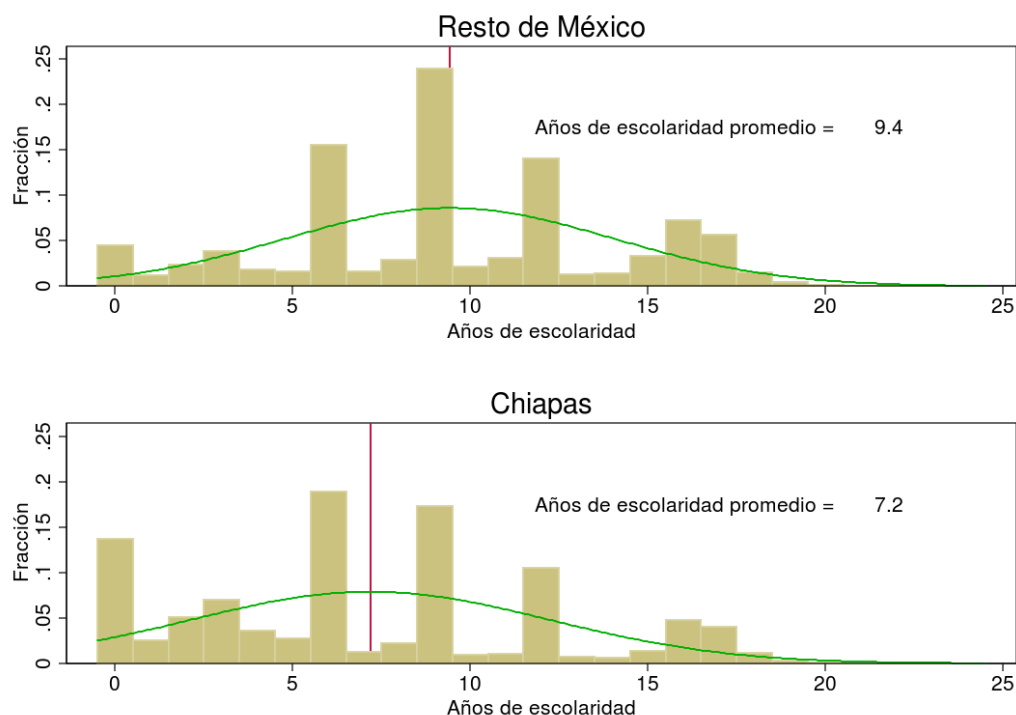
Note: Economically Active Population (EAP) is defined as people 12 years or older who works or searches for work.

Source: Population Census 2010.

Students in Chiapas are among the worst in Mexico in Spanish, but are above the national average in Math. Though there is no information about the quality of the education provided to the people that are currently in the labor market, there is data from the ENLACE test[47]. Therefore, we used the results of this test in 2010 to measure education quality in Mexico and Chiapas, under the assumption that differences in quality have remained constant over time.

In order to analyze the extent to which income levels are associated to differences in education quality between Mexico and Chiapas, we created an indicator for quality, based on

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[47] ENLACE test is performed by Secretaría de Educación Pública in all pre-universitary levels: primary (the last four grades), secondary (the three grades) and media-superior (last grade). The main subject-matters covered are Spanish and Math.

ENLACE results at the municipality level. First, for every grade at every school, we built a composite index that weights the percentage of students in each of the four test categories that takes values from 0 (if 100% of students fall in the "insufficient" range) to 3 (if 100% of students fall in the "excellent" range)[48]. This index was later averaged by municipality and grade and also by state and by grade[49]. Second, every worker was assigned the average of the ENLACE test (in Spanish and Math) of his municipality and grade. Workers who emigrated were assigned the average of the ENLACE test in the state where they were born for their degree of education. Finally, as results in standardized tests are affected not only by the quality of the education provided but also by the students' characteristics, we built an indicator of educational quality controlling for the effects of these characteristics. We controlled for the following characteristics in a regression of the municipal indexes of every grade and subject: (1) maximum education level in the student's household (without considering the student himself), (2) family income for household member, and (3) ethnicity (indigenous mother tongue). [50]

First, the results show the generalized low level of education quality in Mexico. The average of all the states is at a very basic level, and the differences between the worst and best state are not substantial. Second, though Chiapas' average score is below the national average, once we controlled the students' characteristics in order to isolate the "school effect", Chiapas' performance is slightly above the score we would expect based on these characteristics[51]. This suggests that low student scores are more associated with the characteristics of the students or their households, than to the quality of education (in contrast with states like Oaxaca, where we do observe a performance even below the expectations).

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[48] The information published by Secretaría de Educación Pública includes the average score of every school in every subject-matter (Math and Spanish) and the distribution of students evaluated in four categories: "insufficient", "elemental", "good" and "excellent". Because the median-high database only includes distribution, we decided to not exclude it and to create the indicator as it's explained in the body of the document.

[49] Given that the ENLACE test wasn't applied to first and second grades of primary school nor first and second years of median-high in 2010, we gave to the two former the index of primary's third grade and to the two last the index of median-high's third year.

[50] The sample of 10% of the Population Census 2010 where we get the information only has data about if the person's studying for those at least 12 years old. Therefore, the regression only considered students at least 12 years old who has not completed the median-high level.

[51] The indigenous one is the most important of the three variables. A 1,000 pesos increase in the family income per member (that is, to duplicate the average family income per capita) or an additional year of the household's maximum education, are associated with an increase of score of less than 0.01 points. On the other side, the difference between an indigenous student versus a non-indigenous is associated with a lesser score, between 0.22 (Spanish) and 0.16 (Math).

Figure 5.2: Quality of pre-universitary education per state, 2010
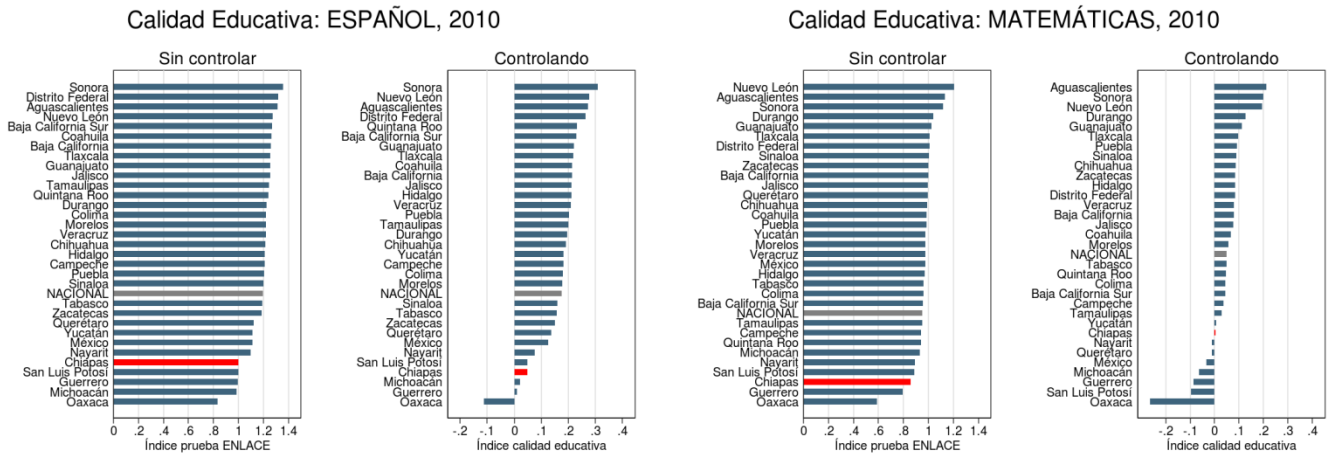
The human capital accumulated in Chiapas is lower than in Mexico. The indicators suggest that the education level of workforce could be an important restriction to growth. Granting that education may well be a policy goal in and of itself, in the following section we will show why the low level of education in the Chiapas' workforce is not the main bottleneck to higher growth in the state.

5.2 Returns to education

Relative returns to education in Chiapas are the highest in the country. Following a similar line of thinking than we used in the capital section, if educated labor scarcity was a problem, we should expect the labor market to remunerate each additional year of schooling with a higher incremental salary. Thus returns to education is defined as the percent increase in salary for each year of additional education. In Chiapas, the average return for each additional year of education is 11.4%, which isn't surprising given that Chiapas is the state with the lowest average of schooling years in all of Mexico. This means that educated labor is scarce in the labor market, which, in principle, can be considered as one of the main constraints to economic growth.

**Figure 5.3: Average of schooling years vs returns to education per state,
2010**
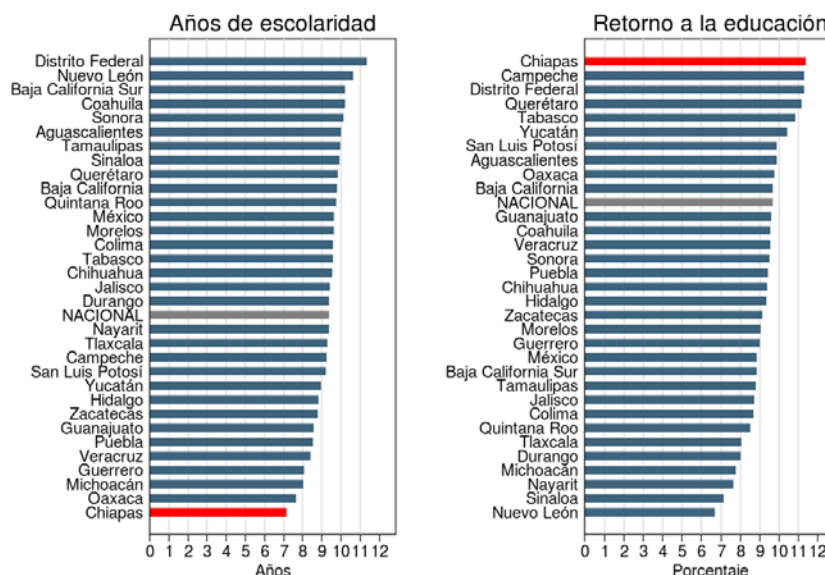
Note: Calculations on occupied population 12 years or older.

Source: Population Census 2010.

However, the differences in average income between a Mexican worker and one in Chiapas are too big to be explained just by the difference in average schooling years. The average worker in the rest of Mexico has 9.4 schooling years and 22.2 years of experience, while the average Chiapas worker has 7.2 schooling years and 22.7 of experience. Based on these figures, the average Mexican worker earns around 4,563 pesos a month, 83% more than the worker in Chiapas (2,487)**.** Given that experience years are quite similar, we wonder if the difference in average schooling years (2.2 years) is the main reason for this income gap. If the average worker from Chiapas had the same education level than the rest of the country, how rich he would be? The answer is that, even considering the higher return to education in Chiapas, the average worker in the rest of Mexico would still be 41% richer than one in Chiapas.

Even with a higher return to education in Chiapas, the initial difference is so high that an average worker in Chiapas could never reach the average income of the rest of the country. Using the aforementioned calculated return rates and assuming the average

experience years of Mexico and Chiapas, a worker in Chiapas could only reach the income level of the rest of Mexico if he had more than 27 years of education[52].

Figure 5.4: Labor income by education years

Chiapas vs México 2010
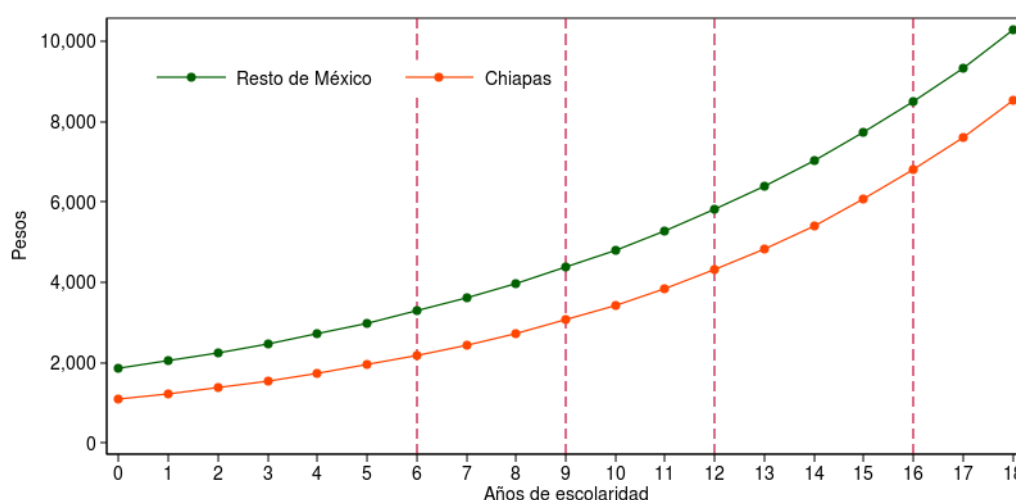
Source: Population Census 2010.

The conclusions are the same if this exercise is repeated considering the quality of education.[53] Using the same assumptions and controlling for the quality associated with the education level of each worker[54], we obtain bigger returns in Chiapas, but even so they explain just a fraction of the gap observed across the spectrum of schooling years. Besides, even considering the expected income of an average worker in Chiapas assuming the same quality of education of the rest of Mexico (the blue curve in Figure 5.5), just after secondary school there is a significant difference with the original curve, and incomes only converge beyond 18 years of education, which is the range for Masters degrees.

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[52] This is an impossible expectation, given that the maximum schooling level in the country is 24 years.

[53] This statement stays no matter the use of pure indicators of quality, or of indicators corrected by the different conditions of workers that could affect their school performance.

[54] Besides the described inputs, there is input of value of quality education equals to zero, on uneducated workers, while on all workers with higher education (no matter their schooling years) there is input of calculated value for their grade of media-superior in their municipality, in the case of those who live in the same state where they were born, or of the state of birth (there is no information about municipality of birth).

Figure 5.5: Labor income by schooling years

(controlling by quality of education) Chiapas vs México 2010
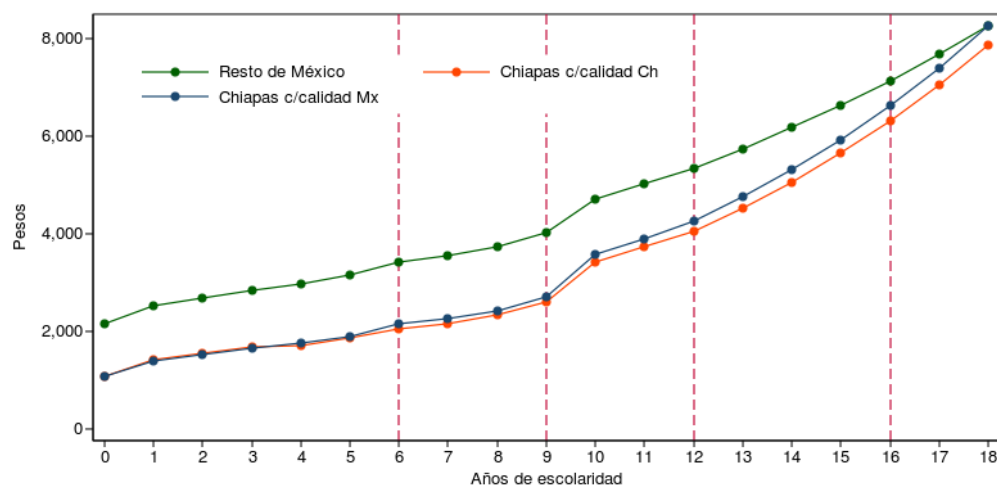
Source: Population Census 2010 and Secretaría de Educación Pública (ENLACE test).

The presence of higher returns in Chiapas suggests that the qualified labor supply can be one of the major bottlenecks to growth, but it is far from being the main constraint. The returns to schooling curves, even when considering the differences in the quality of instruction, show very significant differences that cannot be explained, at all, by factors associated with education. The evidence suggests that the major constraints to growth are not associated with the people of Chiapas, but with Chiapas itself. There is something beyond the characteristics of the inhabitants, and it has to do with the characteristics of the place.

5.3 Migrants

Workers that emigrate from Chiapas to the rest of Mexico reduce their income gap considerably. An additional sign that the educational gap doesn't tell the whole story of Chiapas' performance is the fact that the migrants from Chiapas have higher incomes than those who stayed in the state. While a non-migrant worker in Chiapas earns an average of 2,418 pesos a month, migrants earn 4,600 pesos, 90.2% more.

Even when comparing migrants from Chiapas to migrants from the rest of Mexico, the conclusion holds: migration reduces the labor income gap considerably. The previous comparison isn't entirely conclusive because it's possible that migrants have personal characteristics that made them more likely to emigrate and also impacted their capacity to generate income positively. For example, non-migrant workers in Chiapas have an average of

7.0 schooling years, while migrant workers have 10.0. Nevertheless, even when comparing migrants from Chiapas with other Mexican migrants (with 9.9 schooling years) we find that the income difference between them is only 14.8%.

Controlling for schooling years, migrants from Chiapas have not only a smaller wage gap with the rest of Mexico than non-migrants, but that gap also narrows with more years of schooling. As differences in schooling years among non-migrants are quite significant (7.0 for Chiapas but 9.3 for rest of Mexico), we repeated the exercise of comparing the expected income for schooling years for each one of these four subgroups: those born in Chiapas who emigrated, those born in Chiapas who didn't emigrate, those born in the rest of Mexico who emigrated, and those born in the rest of Mexico who didn't emigrate[55]. The following figure supports our idea: first, that the income gap between migrants is narrower than between non migrants, even for low education levels. Second, the gap shrinks with more years of education, until practically converging at higher education levels.

Figure 5.6: Labor income by schooling years according to migratory condition, Chiapas vs México 2010
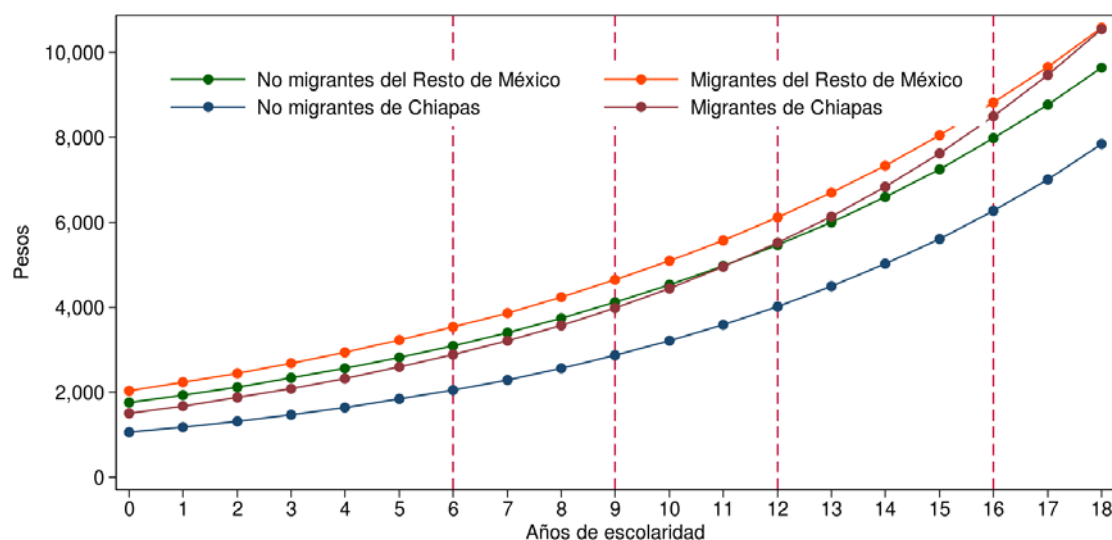
Fuente: Censo Poblacional 2010 (INEGI).

In sum, the problem can't only be education. There should be something else in the Chiapas economic ecosystem that stops educated people from reaching their full potential as

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[55] In this case there were quite significant differences in average years of experience in the four subgroups, thus we chose to fix the experience in 20 years for all.

defined by their potential productivity in other parts of Mexico. In the next section we consider additional evidence: the evolution of the educational gap between Chiapas and the rest of Mexico.

5.4 Education of workforce through time

The median education of the workforce in Chiapas has been increasing over time, but hasn't been accompanied by an increase in the growth rate. Worse yet, while the average education gap between Chiapas and the rest of Mexico shrank, the income gap widened. Therefore, the education gap went from more than three schooling years to a bit less than two (for the generation born in 1988). However, the income gap with the rest of the country has been growing, so is hard to argue that education is what explains the relatively poor performance in Chiapas.

Figure 5.7: Education and gap with Mexico by year of birth

Chiapas, 2010
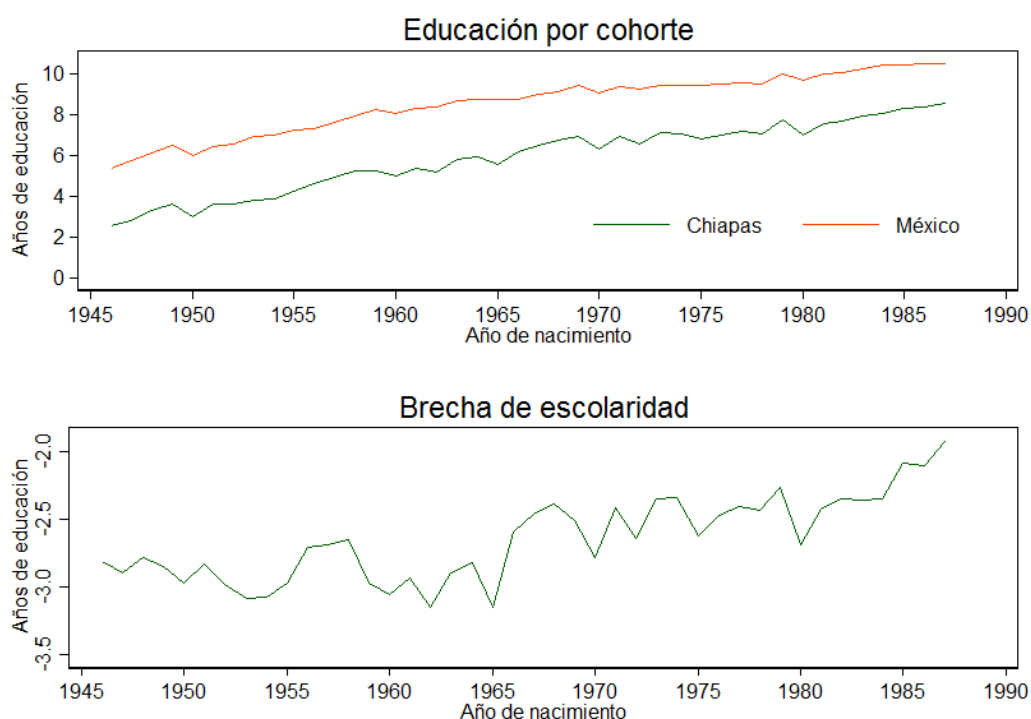
Source: Population Census 2010 (INEGI).

The fact that the education gap has been closing while the income gap has been widening suggests that there should be another factor that explains why Chiapas has such a low productivity. Before concluding, in the next section we consider additional evidence that shows that the bottleneck is not in the education system.

5.5 Unemployment, formality and returns

The unemployment rate is higher for EAP with higher education levels, which isn't consistent with a qualified labor scarcity. On one hand, the unemployment rate is higher among those with medium to high and high education (3.1% and 3.2%, respectively) than among those who have little or no education (1.7% and 3.2%). This differs with what happens on the national level, where unemployment rate is approximately the same for the lower education levels (between 4.3% and 4.9%) and less for EAP with higher education (3.2%). This means that there are relatively fewer job opportunities for the more educated people in Chiapas, which is inconsistent with the idea that qualified labor is scarce.

However, the unemployment rate among less educated workers can be caused by the higher prevalence of informal work among them. In fact, the informal work rate is not only higher in Chiapas than in the rest of the country (65% vs 45%), but it is higher for all education levels, except the highest. Besides, the informality rate remains very high (at levels close to 90% in Chiapas and 80% in Mexico) for very low education levels, and it only starts to diminish with education levels higher than primary school. That's why the fact that more than a third of EAP in Chiapas has less than complete primary could be associated with a higher informality rate. Finally, if we consider only workers in the private sector (90% of total employment), the average informality rates go to 76% in Chiapas and 50% in Mexico.

Figure 5.8: Informality rate for schooling years

Chiapas vs. México 2010
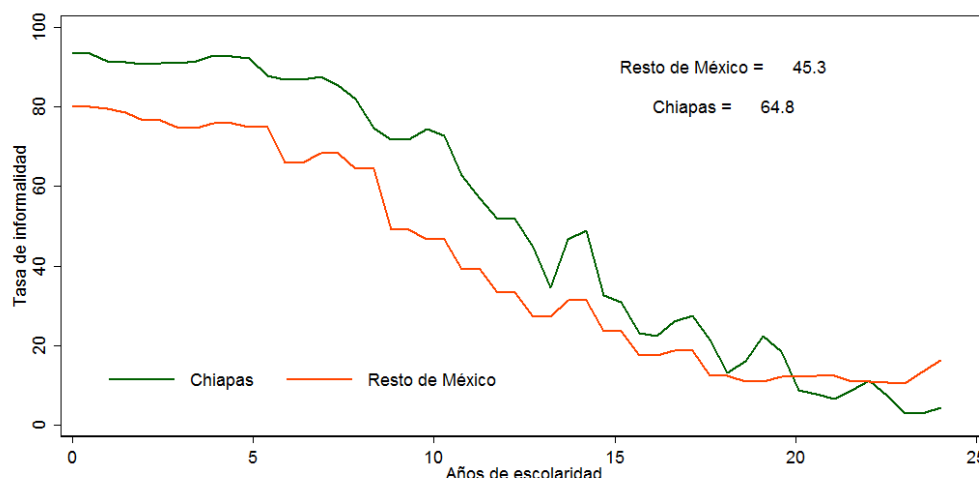
Source: Population Census 2010.

If we repeat the calculation of returns to education only for workers in the formal sector, Chiapas workers continue to earn less than their counterparts in the rest of Mexico, even if they have more schooling years. Though the relative return obtained for each additional year of education is still higher in Chiapas than in the rest of the country[56], the absolute return, that is, the labor income that can be expected given education years, is consistently lower in Chiapas for all levels. Furthermore, formal workers in Chiapas have 1.2 years more of education than formal workers in the rest of Mexico.

5.6 Preliminary conclusions

Educated workers are scarce in Chiapas, but that doesn't mean that by improving the education level in Chiapas the gap with the rest of Mexico will close. As we saw, though Chiapas is the state with the largest relative returns to education, it's also the one with smallest absolute returns. In addition, we've shown that differences in the quality of education don't seem to be the main variable behind the income differences among workers today. In summary, the differences with the rest of the country are too big to be only an educational

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[56] However, the difference shrinks from 1.9 percentage points a year to only 0.8.

problem. What is behind the persistence in this difference, even among the most educated workers?

Most of all, Chiapas offers a limited variety of jobs and in non-tradable sectors of the economy: the bulk of less qualified workers work mainly in low productivity agriculture, followed by retail and construction, while the more educated work in the teaching sector or the government. When analyzing the distribution of employment by sector, for each educational level, we find four things. First, employment concentration by sector is higher in Chiapas than in Mexico for any education level, a symptom of an economy with low diversification. Second, while most people with just primary or no education work in the primary sector, the primary sector in Chiapas is relatively important even for workers who completed secondary school. Third, while the manufacturing sector in Mexico sector is among the main employers of workers with intermediate education (primary, secondary and preparatory), in Chiapas, manufacturing isn't one of the main sectors. Lastly, the public sector is among the most important sectors for the most educated workers in Chiapas (preparatory and professional), but not in Mexico, which is evidence of the limited diversity of job opportunities for the most qualified workers in the private sector in Chiapas.

Figure 5.9: Top 3 economic sectors by employment for education level

Chiapas vs México (2010)
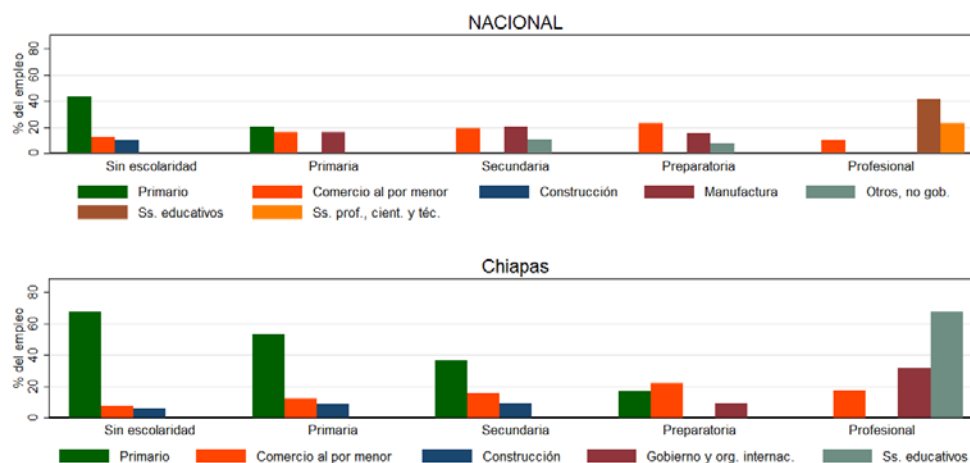
Source: Population Census 2010.

The evidence suggests that Chiapas' low education level is part of the story about why Chiapas is poorer than the rest of Mexico, but is not nearly enough to explain the magnitude of the gap. Certainly, workers in Chiapas are less educated than their peers in the rest of Mexico, but the state is part of a much larger and more skilled national economy, so in principle the state's economy shouldn't depend on local labor. Nevertheless, in spite of the higher relative rates of return to education, we showed that the absolute returns in Chiapas are always smaller than tin Mexico, thus human capital don't flow to Chiapas. This means that there should be a factor beyond the people, which interacts with low education level, making individuals less productive. This same factor can explain why people in Chiapas don't study more, and also why those who do don't stay in Chiapas.

Finally, it is important to highlight three things. First, promoting education as an end in itself is very important, and this section didn't seek to diminish that. Second, to the extent that Chiaps develops and its economy diversifies, the scarcity of qualified workers could become increasingly constraining, which is reason enough to continue investing in education today. Third, though improving education is part of the solution, that doesn't replace a short-term and medium-term *growth strategy*. Chiapas needs to invest in the workers of the future, but also in those who are in the labor market today.

6. Low appropriability: microeconomic risks

In the next two sections, we analyze whether it's possible that the main constraints to growth in Chiapas are associated with difficulties to appropriate returns to private investment. So far, we have analyzed the "usual suspects" of low performance in an economy: credit, human capital and infrastructure. Following the Growth Diagnostics methodology, if it isn't a financing problem or a social returns problem (human capital or physical capital), the next group of possible constraints to growth are the appropriability problems: situations where there are good investment opportunities in the economy and credit is available, but there are also market or state failures that keep private returns below social returns.

In this section we analyze the potential microeconomic failures of the State. The original work by Hausmann, Rodrik and Velasco (2005) subdivides the possible causes of low appropriability into two groups: market failures and State failures. In this section we will deal with the second group and leave the analysis of the former for the next section. Additionally, we will focus only on the so-called "state microeconomic failures", which are the negative effects of ineffective protection of property rights, the presence of extremely high tax rates, rigid labor markets, or generalized corruption can have on the growth rate.

The other type of State failures, the "macro", won't be included in the analysis. The reason lies in that macroeconomic problems, though crucial to explain lack of growth at the national level, are not relevant at the sub-national level where the goal is to understand differences between provinces or states. We could argue that, for some reason, the macroeconomic situation in Chiapas is substantially worse than in the rest of Mexico, but, on the contrary, in the introductory section we showed that unemployment rate in Chiapas is below 3% and that inflation is no more than 6% and has remained in line with national inflation rate.

6.1 Business climate

It is more difficult to measure the effects of several microeconomic distortions on aggregate growth than it is with the "usual suspects". The main reason is the absence of adequate data. For example, it is not evident how to measure the "cost" of insecurity or corruption. Research on the subject has made indirect measurements that are creative, but that also require access to *ad-hoc* databases out of this team's reach.

One alternative is to use the info contained in rankings like the World Bank's *Doing Business* or World Economic Forum's *Global Competitiveness*[57]. These indicators aren't

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[57] See: World Bank (2014) and Klaus & Xala-i-Martin (2014).

necessarily representative of the problems which the economy faces as a whole, but we can use their results in an illustrative way[58]. In this section we will focus in the former, because it has information about Mexico at the sub-national level.

Mexico ranks higher than all but one country in its region, and is also in a better position than China. First, Mexico was in 39th position in the world ranking in 2014, only surpassed in the region by Colombia, and ranked above past and present growth stars of in the region and the world, like Chile (41) and China (90). Besides, according to the 2014 report, Mexico's business climate converges toward the average of high income countries in OECD. Therefore, we can infer that the country's low growth happened in spite of these improvements.

At the sub-national level, Chiapas is among the Mexican states with the best business climate. The 2014 report considers Chiapas the fifth state with best business climate in the country[59]. Though Chiapas dropped two positions on the ranking between 2012 and 2014 (relative position measure), it's also true that Chiapas reduced its distance from the Mexican "border" (absolute position measure)[60]. This means that is not very probable that the governmental regulations are the main constraint to growth in Chiapas.

6.2 Corruption

Regarding corruption, there are two measures at the sub-national level for Mexico. The first is the "Índice de calidad de la transparencia" ("quality of transparency index"), published by Centro de Investigación y Docencia Económicas (CIDE, "Center for Research and Economic Teaching"), which gave Chiapas a score of 83 in a 0 to 100 scale in 2010, in a sample where the worst state (Baja California Sur) got 51 points and the best (Distrito Federal), 92[61]. This indicator signals that there doesn't seem to be a severe scarcity of transparency and access to information in Chiapas *vis-a-vis* the rest of Mexico.

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[58] One more rigourous alternative are the *Enterprise Surveys* published also by the World Bank (for a brief comparison, see: http://www.enterprisesurveys.org/methodology/enterprise-surveys-versus-doing-business), as shown on Hallward-Driemer and Pritchett (2011). Sadly, there is no disaggregated information per state on Mexico.

[59] According to the report, the states were classified using info only about the main cities. In the case of Chiapas, only its capital, Tuxtla Gutiérrez, was considered.

[60] According to the report, "the 'distance to border' of Mexico captures the difference between the performance of a state and the better observed data (the border) in each of the four analyzed indicators (creation of a company, obtention of building permits, property registration and contracts compliance)."

[61] Measurements obtained from database of the "Índice de Competitividad Estatal" 2012 and 2014, published by Instituto Mexicano para la Competitividad.

None of the measures associated with corruption support the idea that corruption could be the main obstacle to economic growth in Chiapas. The second measure is the "Índice de corrupción y buen gobierno" ("corruption and good governance index") made by Transparencia Mexicana[62], which measures the percentage of times that households consulted in the poll had to bribe government employees to complete a procedure or receive public services. With a value of 7.6% for 2010, Chiapas is not among the most corrupt states (like Distrito Federal, with 17.9%) but not among the most honest either (for example, Baja California Sur, with 1.8%). In summary, we haven't found evidence that suggests that factors associated with corruption are significantly different in Chiapas, so it's not likely that this is the principal cause of its economic stagnation.

6.3 Security

Though insecurity and violence associated with drug trafficking have been important problems in Mexico during the last few years, the available evidence shows that that isn't the case in Chiapas. In subjective measurements of insecurity, like the "perceptions of insecurity" index (published by Instituto Ciudadano de Estudios Sobre la Inseguridad), Chiapas ranks as the tenth state with the smallest perception of insecurity in the country (52%). In objective measurements, like the murder rate (INEGI) or the crime incidence (Sistema Nacional de Seguridad Pública), Chiapas ranks among the safest states in the country[63]. For instance, the murder rate in Chiapas is 4.37 per 100,000 inhabitants, the third lowest in Mexico after Yucatán (1.75) and Querétaro (4.17). These rates are an order of magnitude away from other, more violent states like Chihuahua (87.64) or Sinaloa (90.25). Chiapas has also the third lowest crime incidence rate (4.7 crimes per 1,000 inhabitants), only surpassed by Campeche (2.5) and Tlaxcala (4.5). For this set of reasons, it's difficult to blame violence and insecurity for the economic lag of Chiapas.

6.4 Distortions in the labor market

Chiapas has one of the highest rates of informal work in Mexico. Labor market rigidity is a microeconomic distortion with potentially serious consequences economic growth. One potential manifestation of this rigidity is the presence of a high rate of informal work. In effect, in spite of the fact that Mexico already has a high informality rate (59.5%), Chiapas has the third highest rate (77.3%), only surpassed by Oaxaca (81.1%) and Guerrero (79.8%). This relative position doesn't change when we exclude agricultural workers from the analysis (who tend to
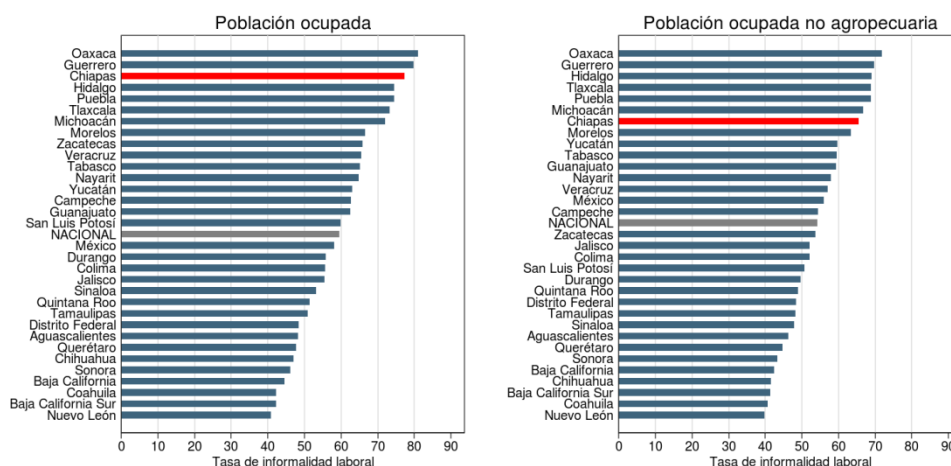
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[62] *Ídem.*

[63] *Ídem.*

be informal and are a much larger share of the workforce in Chiapas than in Mexico overall): Chiapas improves slightly, but remains the 7th state with the highest informality rate (65.6%) versus a national average of 54.2%.

Figure 6.1: Informality rate per state, 2010

Higher informality in Chiapas can't be explained by a difference in labor rigidity. The difference in informality rates between countries can be a symptom of different labor regulations (and, consequently, different labor rigidities). But among states in a same country, this isn't the case, because states usually share same the national labor regulation. So, if Mexico does in effect have excessively rigid labor regulation that needs to be adjusted, that's hardly the main constraint to growth in Chiapas. On the contrary, we wonder how Chiapas is different from, for instance, Nuevo León, which has an informality rate of 40% with the same labor laws.

6.5 Preliminary conclusions

Micro distortions aren't the main restriction to growth in Chiapas. After analyzing the limited statistical evidence about the micro distortions that could be behind low performance in Chiapas, we conclude that there's no way they are the main restriction to growth.

Given their importance in Chiapas' economic structure, restriction to land property in the rural sector can have relevant consequences on the performance of the agricultural and livestock sector, and on labor migration. During our four field trips to Chiapas, we encountered repeated anecdotal evidence of the difficulties related to the land's fragmentation in very atomized common land units (*unidades ejidales*). This could be a factor that amplifies other

economic problems in rural Chiapas. First, because in many Mexican farming communities communal laws on the use of lands by a family require evidence that the land is being used.[64] This tradition causes different kinds of inefficiencies and rigidities. It limits the productivity of small agricultural units. As we saw in the field, the lack of economies of scale, investments and productive knowledge (seeds, production techniques, capital, fertilizers), and the natural limitations of indigenous communities to create partnerships and form bigger units, are only some of the reasons behind the low productivity of common land units. Second, the land use requirement forces families to assign family members to work in agriculture when they could be more productive elsewhere. Lastly, the common land property system, and the fees associated to emigration and other customs related to common lands, become very significant obstacles to labor mobility. This may be a reason why the emigration rate in Chiapas between 2005 and 2010 was the lowest in Mexico, at 2.28 per 1,000 inhabitants versus 6.18 in the rest of the country, despite the fact that emigrants from Chiapas earn substantially better wages outside Chiapas.[65] This phenomenon is even more acute on the rural level, where emigration rate in Chiapas is only 1.42 per 1,000, in contrast with Mexico's 3.42 per 1,000.

Although it's not likely that multiple common lands and the different implications they have on productivity and efficiency are the main constraints to growth in Chiapas, and even less so for Chiapas' urban economies, it is likely that common lands amplify other more significant constraints to growth.

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[64] De Janvry *et al* (2015).

[65] Emigration rate was calculated as the average annual number of emigrants registered in the 2005 and 2010 censuses, divided by the average of the population of origin between 2005 and 2010.

7. The Productivity Trap

In order to grow, Chiapas must be able to make products than can be sold outside the state. No small economy that can produce everything that its population demands, thus is must import some of those goods. To import, it requires the existence of other goods and services that can be sold beyond its borders.

In our view, Chiapas' problem is the low level of sophistication of its productive activities, which in turn makes acquiring new capabilities difficult. This characteristic gives rise to a chicken and egg dilemma dynamic, which perpetuates the low productivity equilibrium in the state. This situation is exacerbated by the presence of two factors: federal transfers and the high relative cost of transportation within the state.

Our diagnosis doesn't seek to explain the origin or relative poverty in Chiapas. The lag of the state versus Mexico goes many years back[66]. Our efforts focus on understanding why the income gap between Chiapas and the rest of the country continues to widen.

7.1 Low complexity

Modern economic productivity requires the simultaneous presence of several capabilities. According to Hausmann *et al* (2011), more dynamic and modern sectors require the presence and coordination of several capabilities. For this reason, these sectors used to be present only in those economies that managed to accumulate the diversity of capabilities they require. Economic activities and the economies in which they occur can be thought of as being on a complexity spectrum: the more complex sectors tend to become feasible in more diverse economies, because such diversity generates the capabilities needed by the more complex sectors. According to this, long-term economic development depends on increasing the complexity of economies and their productive capabilities, which leads to a wider diversity of economic activities, including those that are more complex, i.e. those that require more capabilities.

Increases in complexity can be constrained by difficulties in solving coordination problems. Diversification requires the creation of new industries that could need capabilities

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[66] According to INEGI, GDP per capita of Chiapas in 1970 equalled approximately 50% of national GDP per capita, only above Oaxaca (35%) and Tlaxcala (46%). 30 years later, it shrank to 41%, becoming the state with the lowest income. In 2013, proportion and relative position were the same.

that are not present. Without those capabilities, the industry can't develop, and there are no incentives to acquire those capabilities if there is no demand. The severity of these coordination problems depends on how "close" the region's productive capability is to the new industries that could diversify it. In this part we analyze the productive structure in Chiapas versus the rest of Mexico, within this conceptual framework.

Chiapas' economy is not very diversified; that is, Chiapas knows how to do very few things; and it tends to know how to do things that other states also know how to do. Complex economies have the capabilities required for many economic activities to flourish there. In addition, more capabilities allow economies to produce goods and services that few other places can produce, on average. These two ideas are captured through two indicators: "diversity" (the number of economic sectors present with comparative advantage in a state[67]) and "average ubiquity" (average number of states where the activities are also present with comparative advantage). As we can see in figure 23, Chiapas is the least diversified state, and the few things it's able to do with comparative advantage versus Mexico are things that many other states can also do on average.

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[67] As "comparative advantage" we understand that the employment proportion in a certain sector is bigger than in the Mexican average. This definition is an adaptation of the concept of "Revealed Comparative Advantage" developed in Balassa (1964).

Figure 7.1: Diversity and ubiquity of economic activities, 2010
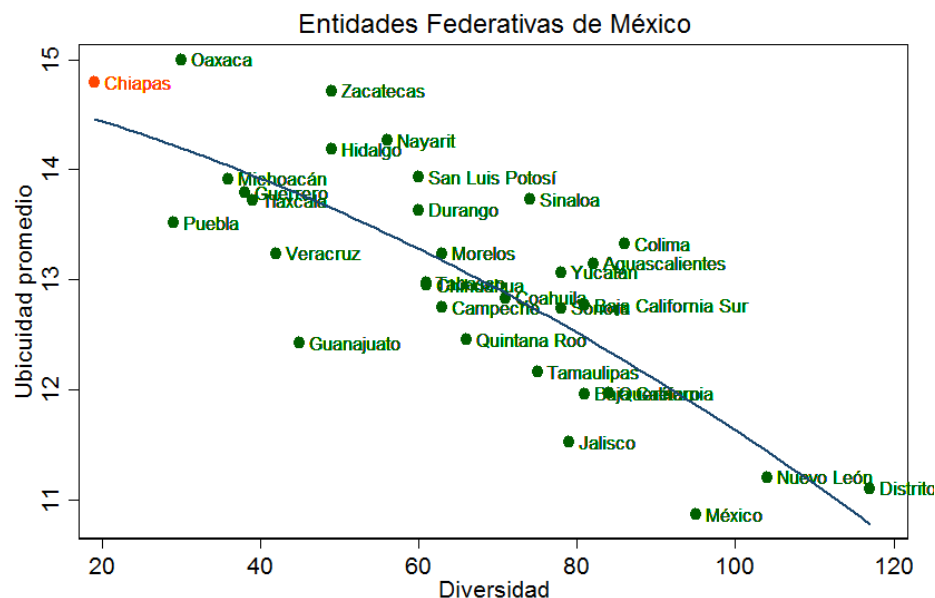
Note: "Diversity" is the number of economic sectors where the economic entity has comparative advantage. "Ubiquity" is the number of entities where an activity is present with comparative advantage.

Source: Population Census 2010, authors' own calculations.

Chiapas is the state with least economic complexity in Mexico[68]. An economy's long-term development depends on its productive capabilities. Based on the works by Hausmann *et al* (2013), we calculated the Economic Complexity Index (ECI), which estimates the productive capabilities of a state from the diversity and ubiquity of the economic activities that show comparative advantage. Hausmann *et al* (2013) reveal that countries tend to converge to an income level related to its complexity. Countries with higher complexity for their income level tend to grow more than those where the relation between complexity and income is weaker. That's why the residual of the relation between ECI and GDP per capita tends to be correlated with the future growth capacity. In figure 24, we present the residual of a regression between ECI and GDP per capita. That Chiapas ranks as the state with the smallest ECI in Mexico means not only that it has a low level of complexity, but also that it has a complexity level too low for

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[68] For further details related to the calculations of complexity and other indexes we used in this section, see the Technical Appendix.

its income level. That implies that, with its existing capabilities, it's unlikely that Chiapas can reach a higher growth. This result is usual among economies where the natural resources extractive sector is important, or where there's an external source of resources. As we will see, this is the case in Chiapas, because it's a net receiver of important transfers from the rest of Mexico.

Chiapas has not only just a few productive capabilities, but also difficulties in acquiring new ones. Hausmann *et al* (2011) show that economies tend to diversify into sectors that require productive capabilities similar to those already present in the region. This reduces the intensity of the chicken and egg problems derived from productive diversification. Therefore, progress is easier for a region if the present activities are "close" to the ones that are more complex but aren't present. The Complexity Outlook Index (COI) measures how close a region's productive capability is to its potential diversification possibilities. Chiapas not only has the smallest ECI, but also a COI below the average. This means that, for Chiapas' economy, it is harder to diversify and to increase its complexity through time, in an organic way, than for the rest of Mexican states.

Figure 7.2: Economic complexity vs complexity outlook, 2010
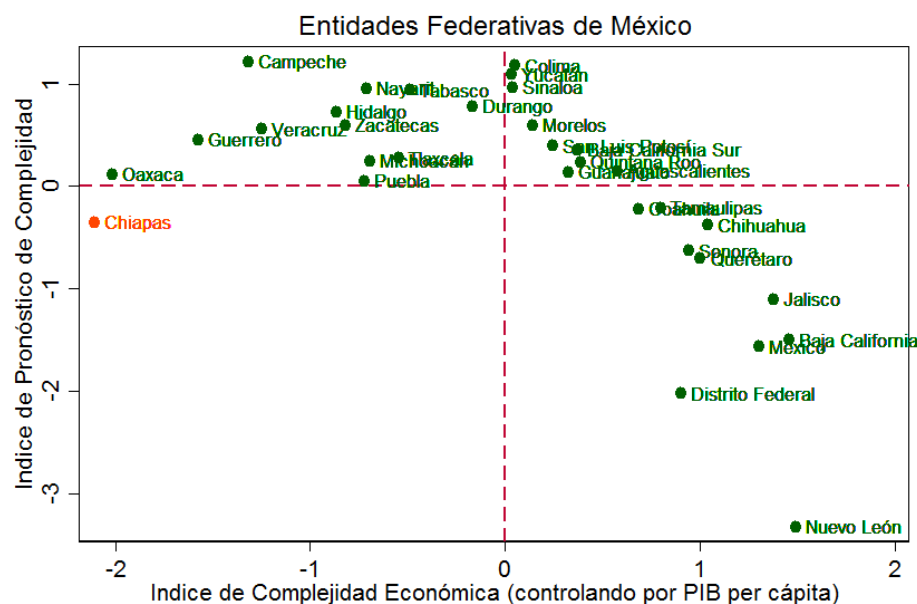
Note: Given the correlation between ECI and GDP non-oil per capita (0.14), the figure shows residuals from regression of the former over the second. This way, we obtain a measure of the higher or lower complexity of each entity regarding the expected, given its GDP per capita. *Source:* Population Census 2010, authors' own calculations.

When we repeat the analysis at the municipal level (figure 25), we find that most of the municipalities have also very low ECI and COI. However, there are also municipalities with

good relative complexity levels and COI for Mexican standards. That is, in Chiapas there are municipalities with higher complexity and more able to get capabilities than the average Mexican municipality. Though this shows the large differences that exist within Chiapas, we must remember that the reference point is the average municipality in Mexico, which is probably rural and low complexity.

Figure 7.3: Economic complexity vs complexity outlook, 2010
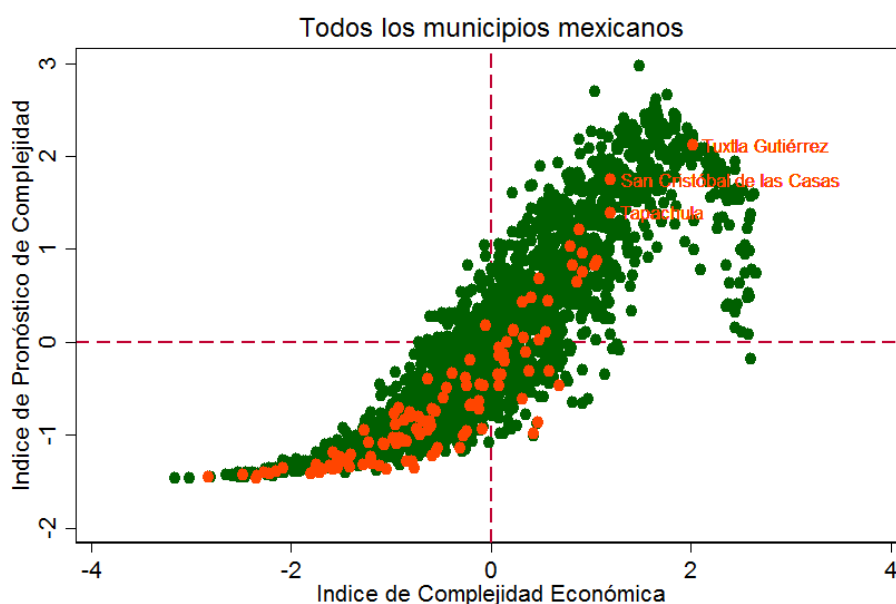
Note: Though there is a correlation between ECI and GDP per capita, there are no estimations of the second on municipal level, so we are using unadjusted ECI. *Source:* Population Census 2010, authors' own calculations.

The three most populated cities in Chiapas have a complexity level lower than the average in cities of similar size, but a COI well above the average. Given that the most of the more complex activities occur in cities, the right reference point for Chiapas' most urban municipalities is not the general Mexican average, but a sample that only considers the most urban municipalities. When doing the same comparison, limiting the number of municipalities to only those with at least 100,000 people, we get a more moderate result for the three municipalities in Chiapas that satisfy this restriction (figure 26). On one hand, the complexity of the three main urban centers in Chiapas is lower than the Mexican average, which is consistent with its economic structure. Notwithstanding, these municipalities have also a COI above average, which means that there are opportunities for diversification into more complex sectors.

Figure 7.4: Economic complexity vs complexity outlook, 2010
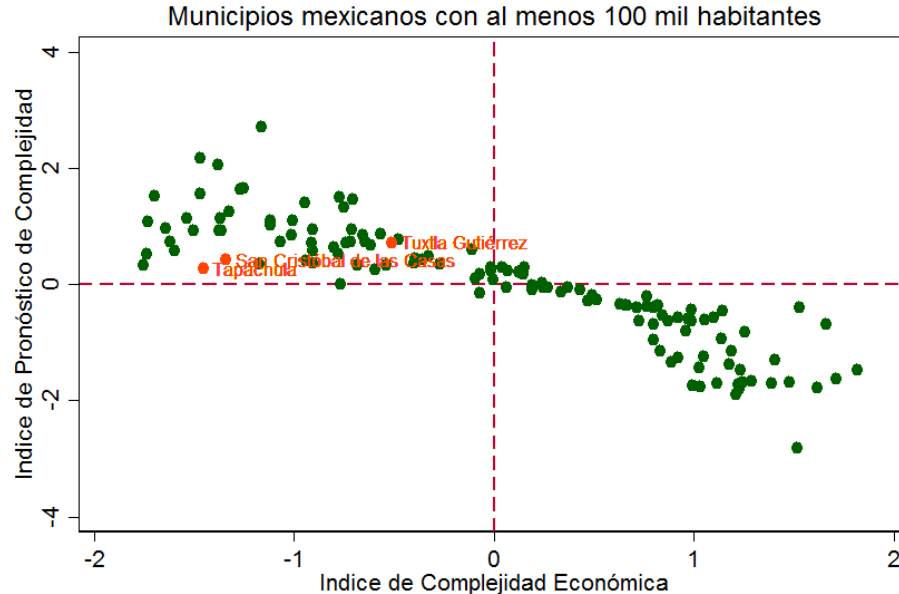
Municipios mexicanos con al menos 100 mil habitantes

Note: Though there is a correlation between ECI and GDP per capita, there are no estimations of the second on municipal level, so we are using unadjusted ECI. *Source:* Population Census 2010, calculations of our own.

The economy's low complexity and the low COI signal the state's difficulties in developing new capabilities. Chiapas lacks the needed capabilities to have a larger presence in more complex sectors. Besides, its low COI is an indication of the coordination problems in the diversification process, because the existing activities have few close activities into which they could easily diversify. We call this vicious circle the "low productivity trap".

The degree of coordination required from the private sector to get out of that equilibrium is higher in Chiapas: there is no private investment because of the absence of complementary inputs lowers profitability. In this context, the State's role as a coordinator (creating incentives that attract private investment in new capabilities), and as a complementary inputs (public goods) provider, gains importance, and thus it is the only agent capable of solving the egg and chicken dilemma. A very representative example is the case of Yazaki-Arnecom, a manufacturer of wire harnesses for cars, that expanded after receiving initial assistance and runs six plants in the state today, with more than 3,850 employees. This shows that if the State intervenes as a facilitator, it can attract more productive activities that later become more profitable and dynamic, even after the initial support is withdrawn.[69]

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[69] In the case of Yazaki-Arnecom, the initial support was made of subsidies to the workers' salaries during the training period. During our meeting with authorities both federal and regional, local entrepreneurs and even

Low urban productivity generates a low salary equilibrium which does not attract much of the rural workforce to the cities. The scarcity of modern tradable productive sectors generates an urban economic structure with predominantly non-tradable sectors and with low productivity, which determines the low relatively attractiveness of the urban labor market on rural labor in Chiapas. The fact that urban activities are non-tradable implies that as the rural-urban migration within Chiapas process unfolds, more and more workers try to sell into the same market, which depresses profitability and makes the subsequent rural-urban migration less attractive. It's a different situation when there are tradable urban sectors where demand is not limited to the local market, but can grow due to a much bigger demand from outside the city.

As we argue in the following sections, this situation is complicated by the presence of dynamics which reduce the available labor supply for the tradable sector and modern activities in general. These dynamics have to do with factors that make workers prefer activities with less productivity. Transportation costs between cities and the countryside, for example, are high enough that they convince many potential urban workers to take jobs in the limited rural markets.

7.2 Transportation costs

In the Chiapas labor market, a large part of the workforce prefers to stay in the countryside (despite the lower productivity), or not participate in the labor market. Of 3.4 million people older than 12 years (the workforce), only 1.6 million (48%) are active. Of this 1.6 million, half are self-employed (and do not hire workers) or family workers without pay, most of which (62%) live in a rural locality. This means that only a fifth of potential laborers are dependent on a formal job.

One factor that influences the net benefit of working in the city is the cost of transportation. Half of the workforce in Chiapas lives in rural localities. It's valid to ask how accessible employment in urban activities is for someone who lives in a rural zone, because transportation costs to the city can be an important obstacle. During the fieldwork in Chiapas, we confirmed that the cost of transport considerably limits the markets that can be accessed by people living in rural communities. For instance, the locality of Cruztón, in the Chamula municipality, is 10.3 kilometers from San Cristóbal de las Casas; a shared taxi ride costs 40 pesos the round trip. The locality of Zinacantán is 11.2 kilometers away from the same city; the round trip costs 36 pesos. If we consider the daily salary of most of people in rural localities that are

company's executives, we couldn't confirm the rumor that the company received as well a significant subsidy for the purchase of the land where it was set at Tuxtla Gutiérrez.

not government workers (mostly directors, teachers, nurses and social workers), which is between 50 and 120 pesos, commuting to the city can represent 30% to 80% of income, although it's just 20 minutes away. The case of Mitontic[70] is worse: its distance to San Cristóbal and the cost of transport are twice of Zinacantán, so transport costs to the city are prohibitive for almost the entire workforce in the zone. In the oil palm plants, in Palenque, where entry salaries are around 75 pesos, the cost of a round trip to the closer locality is 28 pesos (37%). To generalize this result, we estimated the cost of transport using 75 cents per minute[71]. With this information we calculated the cost of travelling to the closest city (defined as a locality with at least 100,000 people) for each worker from a rural locality (of less than 2,500 people) using the distance from the end of the municipality he belongs to. Assuming two trips a day (round trip) and that each worker works 20 days per month, the monthly cost of transportation while ride-sharing is estimated to be 2.099 pesos, a very close amount to the average rural income (2.385 pesos).

The additional income earned by commuting to the city to work working from the countryside only compensates the cost of transport for people with high education. Figure 27 illustrates the result of the exercise simulating, for each schooling level, what the income earned by working in a city would be (locality with at least 100,000 people) *vis-a-vis* the countryside (localities with less than 2,500 people). The result not only shows that urban income is higher than rural income for any education level, but also shows that the gap between them increases with schooling years. So, for a non-educated person, the expected salary in an urban zone is 42% higher (equivalent to 431 pesos more). On the contrary, a worker with median-high education (12 schooling years) earns 75% more (2.122 pesos). However, the high cost of transport implies that the benefit of paying that cost to obtain a better urban salary only becomes positive with 12 schooling years or more. In other words, working in the city (while living in the countryside) only makes sense for people that at least finished preparatory school. The absence of public transport in the region functions as a regressive tax on the urban wages.

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[70] After Adama, Mitontic is the second poorest municipality in Chiapas.

[71] We obtained the cost through a regression between the cost of the trip and the time it takes, fixing the intercept in zero.

Figure 7.5: labor income by schooling years in Chiapas
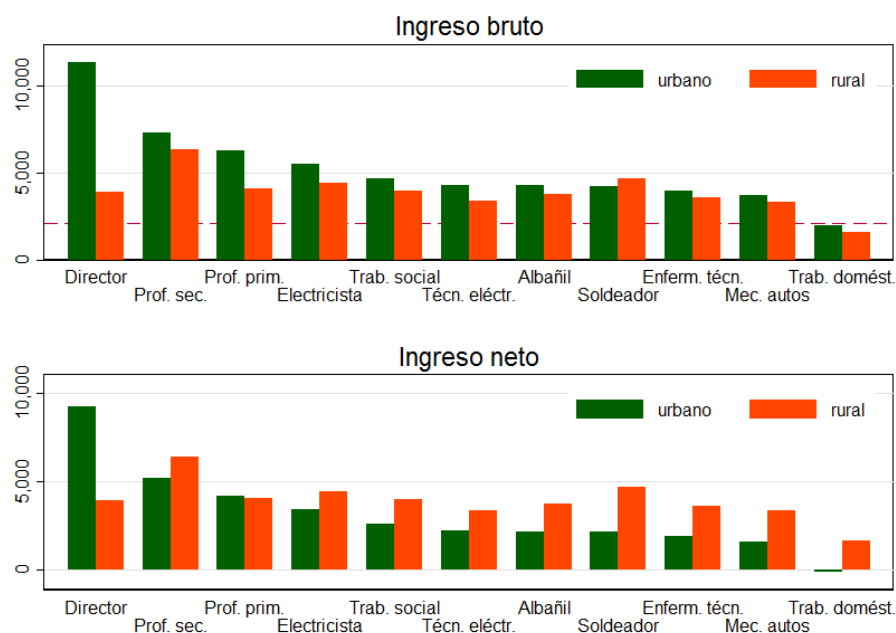
(city vs countryside 2010)
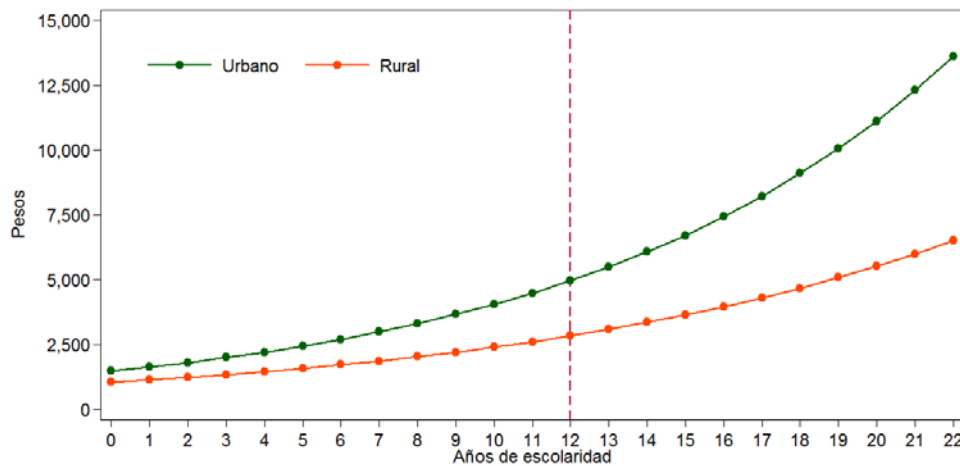
Note: We define "city" as a locality with at least 100,000 inhabitants and "rural" as a locality with less than 2,500 inhabitants. *Source:* Population Census 2010 (INEGI).

It's only profitable to work in the city while living in the countryside for occupations that require higher education. As we noted, the cost of transport is unaffordable for the most rural workers. To illustrate this, we estimated the average salary of some common trades in rural localities and compared them with their equivalents in the city, keeping constant both years of experience and education. Figure 28 shows the estimated salary in rural areas and in the city for each of the chosen trades, where the pointed line marks the average cost of transport. In the extreme case, the marginal salary that a domestic worker could aspire to earn in the city is *less* than the cost of travel there in all cases, with the exception of school director or a primary teacher.

It's fair to ask why anyone would live in the countryside and incur high transport costs if it's possible to simply live in the city and avoid them. The problem is that migration in Chiapas includes several costs. First, the countryside offers lower housing costs. Second, the countryside offers an alternative income associated with agricultural activities that have a different risk profile different than urban employment. Third, communal property makes it harder to sell rural housing to raise funds to buy a home in the city. Last, public housing programs (INFONAVIT) aren't designed to make rural-urban migration easier, because they are funded and directed by workers already employed in the formal sector of the economy. These frictions explain why we observe much higher income levels in the cities than rural areas, while at the same time, people continue to work in the countryside.

Figure 7.6: Gross and net salaries and net cost of transport 2010

The low absorption of the workforce in urban activities reflects the very low level of hectares per worker. In effect, Chiapas has the highest share of workers in the primary sector in the country, but it doesn't have more land per worker than other states. On the contrary, Chiapas is the fourth state with the lowest number of hectares per worker (1.8), only above three states where the primary sector is not relevant (Distrito Federal, Baja California Sur and Tabasco). This is a reflection of the excess of labor in agricultural activities due to the difficulty in transitioning into more urban activities.

Figure 7.7: primary employment and land per worker in the primary sector, 2010
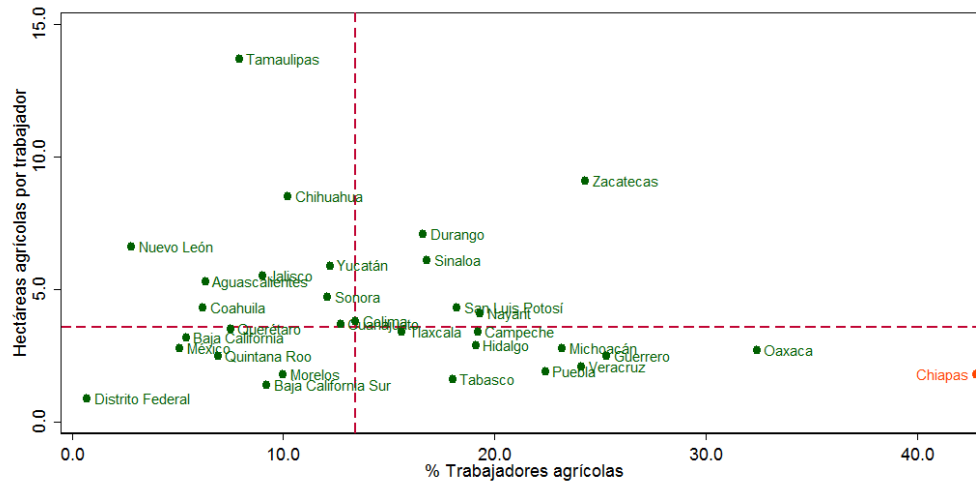
Another characteristic of labor market in Chiapas is that the female participation rate is the lowest in the country. At first glance, there doesn't seem to be a major difference between labor participation in Chiapas (48%) and Mexico (53%). However, while male labor participation in Chiapas is the third highest in the country (76%), the female participation is the lowest, with a rate of only 22% (versus a national average of 33%). This situation is even worse in rural areas, where male labor participation rates are high (between 74% and 78%), but the female rate barely reaches 10%. Among the inactive population, 78% of men are students, in contrast with the 76% of women who are occupied in housekeeping. This is another reflection of the fact that Chiapas families are not very connected to opportunities in the labor market. This is a consequence, partly at least, of their rural living and the high costs of transportation. The implication here is that a policy that integrates these families to more productive sources of work could have important effects, not only on the productivity per worked hour, but also on the total number of hours worked.

Figure 7.8: Female labor participation per states, total and rural 2010
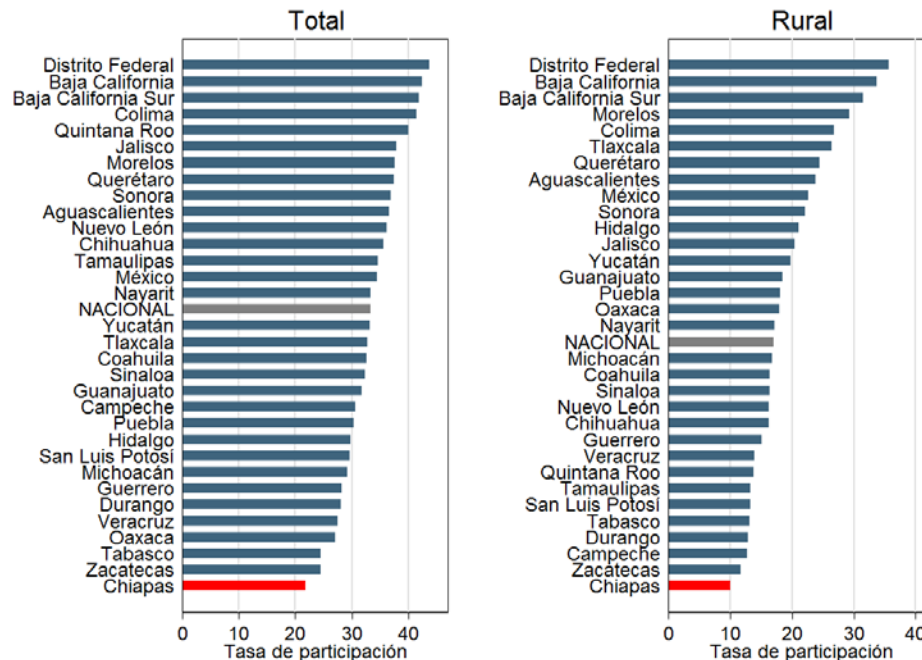
7.3 Fiscal transfers and incentives for diversification and development

Policies that support development in Chiapas can have secondary effects that make economic development more difficult. The weak presence of economic activities that sell their goods or services outside the state has been partly compensated by important net federal fiscal transfers. Such transfers fund a good part of the general public expenditures and also fund transfers to families. For instance, though Chiapas barely generates 1.8% of Mexico's GDP[72] and hosts approximately 3.8% of the country's households[73], it represents 5% of federal transfers, and 10.5% of all the amounts given by the *PROSPERA* program. It's normal that the fiscal solidarity in a country is expressed in net transfers to its poorer states. However, it should be noted that fiscal transfers can have two possible effects that slow economic development.

Net fiscal transfers have similar effects to Dutch Disease. Countries that receive important external resources, be it from natural resources or foreign aid, tend to see a relative

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[72] The number corresponds to 2013, and matches both GDP total and GDP non-oil.

[73] The number corresponds to Population Census 2010.

increase in demand for non-tradable goods and to dedicate a bigger part of their workforce to these activities. This reduces the relative profitability of tradable activities. The same dynamics are present in Chiapas because the state is an important net recipient of fiscal resources. In fact, between 2009 and 2014, Chiapas was able only able to internally generate 6.4% of the state's total income, on average. In that same period, fiscal transfers averaged 24.6% of the state's GDP. These resources allowed the proportion of the workforce dedicated to urban non-tradable activities to increase, which is evident in the increasing of retail and non-tradable services in the total employment.

The productive structure of Chiapas is consistent with Dutch Disease. Employment in the state not only highly concentrated in the primary sector, but also highly concentrated in non-tradable sectors like services and construction, in contrast with the rest of Mexico. The implication is clear: is important to compensate for the adverse effects on the tradable sector of net fiscal transfers. This is not a reason to reduce fiscal transfers to Chiapas, but rather a reason to assure that the allocation of resources and the general framework of productive development policies generate an environment more favorable for tradable activities.

8. Conclusions and policy proposals

In summary, the "low productivity trap" is the result, mainly, of the low level complexity in the Chiapas' economy, due to the scarce diversity or the preexistent productive capabilities of the state, but also of the difficulties to move toward new activities because these are relatively far from the existing ones. In light of this situation, returns on investment are low and, consequently, the development of new capabilities is also low. This syndrome is magnified by three factors: (1) federal transfers, (2) high costs of transportation and (3) low education level. First, the federal transfers have the effect of causing a "dutch disease" that reduces the competitiveness of the tradable sector. Second, the high cost of transport impedes the participation of the workforce living in rural areas relatively close to the cities in more productive urban activities. Lastly, this effect is magnified by the rural population's low education level, because the salaries that correspond with low education are too low to afford the costs of transport.

We have emphasized tradable urban employment for four reasons. One, because every region must "import" in order to access goods that it can't produce. To do that sustainably, every region must "export" (i.e. sell goods and services beyond its borders). Two, because non-tradable activities cannot spur growth in a region indefinitely, as non-tradable activities are limited by the size of the labor market. A supply increase that is greater than local demand diminishes the profitability, and consequently, also employment and investment growth. Three, we emphasize urban employment because modern production requires a great diversity of inputs, among them a wide variety of human skills, and these can only gather in urban agglomerations. Four, because there is excess labor dedicated to agricultural activities for the amount of land in the state. Chiapas has an agricultural future, but it will hardly lead to a higher employment than with current in activities in the countryside.

The difficulties to access urban centers impede Chiapas from using its workers more productively, and takes away one of the state's main comparative advantages. However, part of the reason why those who live in rural areas don't search for jobs in the cities is that the low complexity of the urban activities means that salaries are too low to afford the high costs of transport. This disconnects people from urban employment opportunities, forcing the families to depend on primary activities with low productivity. This feedback loop is a coordination failure, which can only be overcome with a set of policies capable of breaking the vicious circle, through the attraction of productive investments in more complex sectors.

Based on the surveyed evidence, we suggest three pillars for a development policy: (1) policies that stimulate productive diversification, (2) public transport policies, (3) the establishment of Special Economic Zones.

Productive development policies should stimulate diversification in the tradable sector by solving the coordination problems. The transition to a different productive structure faces the simultaneous absence of supply and demand in the inputs that will eventually be needed. Companies don't find workers with experience in the new economic activities precisely because they are new. That said, training in these skills won't make that companies that demand them will potentially move to Chiapas, because other failures can stop that from happening. That's why the formation of those skills and the demand for them should be coordinated. The same logic applies on many other productive capabilities beyond labor skills. Besides, concerted action on the tradable sector intends to compensate, partially, the effects of the Dutch Disease caused by the important transfers that Chiapas gets from the rest of the Federation.

The recent push by the Federal Government to establish Special Economic Zones in the South can be leveraged to provide better job opportunities to workers in Chiapas. On one hand, by the end of 2014 President Enrique Peña Nieto announced the creation of three Zonas Económicas Especiales (Z.E.E.) in several states, among them Puerto Chiapas. The idea behind the Z.E.Es is to guarantee to the participant companies access to the public goods needed to make them productive - modern infrastructure, electric power, financing and better security conditions - besides the generation of a critical mass to justify the existence of a common services network; those usually required to produce and export competitively. The goal is to spur diversification in Chiapas by attracting private investment in economic sectors with higher complexity that don't exist in Chiapas at the moment, but are present in the rest of Mexico.

Our analysis suggests that it could be beneficial to place an Industrial Park close to the major population agglomerations. The original design of the initiative proposes set the Z.E.E. in Puerto Chiapas, in the Soconusco region, probably with the goal of securing access to a port in the Pacific. Our findings point out that access to ports is not one of the main constraints to growth in Chiapas, but rather the lack of access to employment cities fort the people living in the surrounding rural areas. That said, we suggest the possibility of creating an Industrial Park in the Los Altos region, which has the highest unemployment and poverty rate in Chiapas[74].

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[74] According to the Republic's Presidency website, a **Zona Económica Especial** is an area geographically delimited that offers an exceptional business environment through fiscal and labor benefits, a special customs regime, an agile regulatory frame, first-level infrastructure, support programs for human capital, for financing and for innovation, etc. In comparison, the Pro-México website defines a **Parque Industrial** as a terrain delimited for industrial use that *doesn't operates under a customs regime*, but does offer urban infrastructure (land and

Establishing an Industrial Park close to Los Altos would not only gather workers and companies; it would help as well to solve property problems that corporate activity faces due to the presence of other forms of property. Additionally, one common complaint of the companies is that many communities ruled by traditional norms and customs replace their authorities every year, which complicates contract compliance. In this context, a public intervention, from a consensus with the communities, could generate a development anchor around the industrial park, assuring its operations, responding to the communities' demands, and diminishing the uncertainty that worry the private sector. This would open possibilities of higher quality jobs to the people of rural zones.

Finally, a public transport service should be provided to facilitate worker access to companies. Though locating an industrial park somewhere in Los Altos would place the companies closer to a potential source of labor, our findings indicate that it will be also necessary to make access easy. This suggestion is not only relevant for the success of this particular initiative; it has a general importance. Chiapas needs a public transport system that can allow people who live around the cities to participate in the modern economy, ending the dual equilibrium observed between rural and urban salaries across occupations.

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buildings) legally healthy and with guaranteed basic services. This paper looks for the recommendation of these policies as a mechanism to assure at least in parts of Chiapas the complete provision of the public goods and services companies require to operate efficiently. In this sense, we don't have a particular affinity with the specific tool than will be chosen, as long as it achieves such a function.

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Technical Appendix

REVEALED COMPARATIVE ADVANTAGE (RCA)

Following the methodology by Balassa (1964), suppose a state c has a Revealed Comparative Advantage (RCA) in the sector i on a given year if the percentage that represents that sector in the state's (or municipality's) total employment is higher than the percentage of the same sector as a share of Mexico's total employment:

$$RCA_{c,i} = \frac{\dfrac{X_{c,i}}{\displaystyle\sum_i X_{c,i}}}{\dfrac{\displaystyle\sum_c X_{c,i}}{\displaystyle\sum_{c,i} X_{c,i}}}$$

DIVERSITY AND UBIQUITY

Let us define M_{cp}, as a matrix that contains one 1 if the state (or municipality) c has presence in the sector p with revealed comparative advantage (RCA>1), and 0 otherwise. Diversity and ubiquity are simply the result of adding rows and columns of that matrix. Formally:

$$Diversity = k_{c,0} = \sum_p M_{cp}$$

$$Ubiquity = k_{p,0} = \sum_c M_{cp}$$

ECONOMIC COMPLEXITY INDEX (ECI)

To generate a measure of the number of available capabilities in a state (or municipality), or of the capabilities required by an economic sector, we need to use all the information contained in the ubiquity variable to correct the information contained in the diversity variable and vice versa. This iteration can be expressed in recursive way:

$$k_{c,N} = \frac{1}{k_{c,0}} \sum_p M_{cp} k_{p,N-1} \qquad (1)$$

$$k_{p,N} = \frac{1}{k_{p,0}} \sum_{c} M_{cp} k_{c,N-1} \qquad (2)$$

Inserting (2) in (1) we obtain:

$$k_{c,N} = \frac{1}{k_{c,0}} \sum_{p} M_{cp} \frac{1}{k_{p,0}} \sum_{c\prime} M_{c\prime p} k_{c\prime,N-2} \qquad (3)$$

$$k_{c,N} = \sum_{c\prime} k_{c\prime,N-2} \sum_{p} \frac{M_{cp} M_{c\prime p}}{k_{c,0} k_{p,0}} \qquad (4)$$

Which can be rewritten as:

$$k_{c,N} = \sum_{c\prime} \widetilde{M}_{cc\prime} k_{c\prime,N-2} \qquad (5)$$

where

$$\widetilde{M}_{cc\prime} = \sum_{p} \frac{M_{cp} M_{c\prime p}}{k_{c,0} k_{p,0}} \qquad (6)$$

Note that (6) is satisfied when $k_{c,N} = k_{c,N-2} = 1$. This is the proper vector (*eigenvector*) of $\widetilde{M}_{cc\prime}$ which is associated with the higher proper value (*eigenvalue*). Given that this proper vector (*eigenvector*) is a vector of ones, is not informative. We will look instead for the proper vector (*eigenvector*) associated with the second higher proper value (*eigenvalue*). This is the proper vector (*eigenvector*) that captures the biggest quantity of variation in the system, and that will be our measure of economic complexity. From then on, we will define the Economic Complexity Index (ECI) as:

$$ECI = eigenvector\ asociated\ to\ the\ second\ largest\ eigenvalue\ from\ \widetilde{M}_{cc\prime} \qquad (7)$$

PROXIMITY

Proximity measures the probability that two sectors *i* and *j* on year *t* are in the same state or municipality. This measure is used as an indirect measure of how many "capabilities" are shared by two economic sectors. It's defined as:

$$\varphi_{i,j,t} = \min\{P(x_{i,t} \mid x_{j,t}), P(x_{j,t} \mid x_{i,t})\}$$

where, for any state (or municipality) c,

$$x_{i,c,t} = \begin{cases} 1 & if\ RCA_{i,c,t} > 1 \\ 0 & others \end{cases}$$

And where conditional probability is calculated for all states (or municipalities) on year t, using disaggregated employment data.

DENSITY

Density is the distribution of employment by sector in a state (or municipality) around a sector in particular, and is expressed by the average proximities of sectors i of the distribution by sector of employment in the state (or municipality) c on year t, calculated as the addition of all paths between that sector i and others where the same state (or municipality) is present (that is, with RCA > 1), divided by the addition of all paths that lead to that sector. Density varies between zero and one, with higher values showing that the state (or municipality) has reached a comparative advantage in many sectors close to sector i, and consequently it should have a higher probability of adding it to its productive matrix in the future.

$$density_{i,c,t} = \left(\frac{\sum_{k} \varphi_{i,k,t} x_{c,k,t}}{\sum_{k} \varphi_{i,k,t}} \right)$$

Hausmann and Klinger (2007) show that this measure of density is significant for predicting changes in the productive structure of a country through time: is more probable that countries move toward products where they have higher density, which means that are relatively close in terms of knowledge and capabilities to their current production basket.

COMPLEXITY OUTLOOK INDEX (COI)

The measure of density in a sector can be aggregated at the state (or municipal) level, to create a measure of the "total connectivity" of its distribution by sector of employment with the sectors where it doesn't have a comparative advantage. This state or municipal level measure is defined as the *complexity outlook index*. A high COI value indicates that the distribution of employment by sector is well connected to other valuable opportunities for diversification and structural transformation. On the contrary, a low COI value indicates that the state (or municipality) has specialized in sectors that share few capabilities with other sectors, meaning it is disconnected from good opportunities for productive diversification. The COI is calculated this way:

$$COI = \sum_{i} density_{i,c,t}(1 - x_{i,c,t})PCI_{i,t}$$