

# Overcoming Remoteness in the Peruvian Amazonia: A Growth Diagnostic of Loreto

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## Executive Summary

“Here in the jungle, anything is possible, but nothing is certain,” comments our guide, who descends from several generations of *Iquiteños*, while maneuvering a small motorboat between the narrow margins of the Tapira River, on our way to the Amazon River. By saying this, he is sharing the common wisdom about the ups-and-downs and the contrasts typical of the Peruvian State of Loreto, located at the Western side of the Amazon jungle and closer to the border states of Brazil and Colombia than to the capitals of the neighboring Peruvian regions of San Martin and Ucayali.

Loreto’s history seems to be forged by hard, discontinuous strikes. The region has been shaped by a sequence of incidental interactions involving indigenous tribes organized in small communities that cultivated all their needs from the Amazon rainforest, and successive waves of adventurers who entered by the water gates of the rivers to get into the jungle and exploit its natural resources. These incursions initially generated wealth and income for the region, first from the extraction of rubber – mostly between the second half of the 19th century and the First World War – and more recently from oil and lumber, at the same time of somewhat disorganized and loosely connected urban agglomerations.

But these discontinued periods of prosperity also left a legacy in the region’s collective conscience, which oscillates between the condemnation of the appalling effects on the environment and on the society associated with this wealth – slave labor in the case of rubber, oil spills and pollution in the case of oil, degradation of the jungle with illegal lumbering – and the nostalgia for a rich past which seems unlikely to return without those extractive industries. A witness of that era is that sort of derelict beauty<sup>1</sup> that predominates in Iquitos, where the historic district still shows the decaying two-storied European buildings with cast iron balconies, in some cases adorned with tiles brought from Portugal where, according to the legend, upper-class families would send all the white laundry to Europe because the water of the local rivers “wasn’t clean enough.” The weight of these memories is not trivial. To this day, the numerous conflicts around extractive industries are still sparking intense debates about development and public policies in Loreto. Along with the still failure of the State to decisively solve conflicts associated with the extraction of oil and lumber, the region seems to be on a sort of productive paralysis.

All in all, aggregate economic indicators from the National Institute of Statistics and Information (INEI) suggest that Loreto has been falling behind the rest of the country during the last forty years. From 1980 to 2018, the region’s economy grew at a compounded annual average rate (CAGR) four times lower than the rest of Peru. In other words, while the rest of Peru was able to multiply the size of its economy threefold during that period, Loreto’s economy grew a bit less than a third. In the last decade (2008-2018), the region has also diverged from its Amazonian country peers (the regions of Ucayali, San Martin and Madre de Dios), which have grown at an average rate five times higher than

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<sup>1</sup> This simil comes from Spanish author Javier Pérez Reverte – “belleza decrepita” – in his book *El río de la desolación: Un viaje por el Amazonas*, published by Penguin Random House, Barcelona (2004).

Loreto. During this last period, the average income per capita in Loreto went from being equivalent to three-quarters of the national average in 2008 to less than half by 2018. In addition to this, Loreto is also among the Peruvian states with the worst indicators in social development, anemia, and child malnourishment.

It is in this context that the Growth Lab at Harvard University started the research project *Economic Growth and Structural Transformation in the Amazon Region of Loreto, Peru*. With the support of the Gordon and Betty Moore Foundation, the project aims to provide research-based policy recommendations to accelerate the region's development and generate prosperity in a sustainable way.

The first research product of this collaboration – *Loreto's Hidden Wealth: Economic Complexity Analysis and Productive Diversification Opportunities*– focused on identifying the productive capacities that exist in the region and activities with potential to lead structural transformation. This led to three relevant findings.

First, leaving aside activities associated with the extraction of natural resources, Loreto has a more complex productive ecosystem than one would expect, given its geographical isolation. The existence of these activities allows to infer that Loreto has a set of productive capabilities that can be reused in economic activities with higher value-added, able to contribute to increase productivity, wages, and living conditions.

It is possible to recognize the contours of this productive ecosystem in Loreto's economic trajectory in the evolution of its oil and non-oil sectors. Oil production in Loreto boomed between 1975 and 1980, but since then has been in free fall, losing 78% of its 1980 value by 2018. The plummeting has been particularly acute between 1998 and 2018, years when the real gross value-added of the mining and hydrocarbons sectors contracted at a compounded annual average rate of 4%, equivalent to a cumulative fall of 56%. Without the collapse of oil production, Loreto's economic lag compared to the rest of the country would have been much less dramatic.

Meanwhile, during those twenty years, the non-oil economy in Loreto grew at an average of 4.2% per year, a rate not only closer to the country's growth rate during that same period (4.7%) but also way more stable and less volatile than its oil counterpart. A similar trajectory can be found when analyzing labor market indicators, mainly employment and wages. Despite the recent disruptions in the lumber and oil sectors – at least up until 2017 –unemployment kept falling and real wages increased, although less than in the rest of Peru and at similar rates than other Amazonian regions. This reality doesn't exactly fit in the described collective conscience, and the narrative that the research team heard during the numerous field interviews with different institutional actors in Loreto and about Loreto, where the shocks suffered by the forestry and oil sectors, the fall of the associated income and its unequal distribution, and repeated social conflict dominated the discussions.

The second relevant finding of the economic complexity report was that income per capita in Loreto is lower than one would expect given its agglomeration and diversity of productive knowhow. This means that the region is yet to leverage its stock of knowhow to grow faster and diversify its economy

into other industries of higher value-added. Finally, the third relevant finding was the identification of five thematic areas with potential to lead Loreto's productive transformation: i) Food and Chemical Industries, ii) Tourism and Creative Industries, iii) Forestry, Flora, and Fauna Activities, iv) Manufacturing and Transport Services, and v) Construction Manufacturing.

This study, *Overcoming Remoteness in the Peruvian Amazonia: A Growth Diagnostic of Loreto*, aims to identify the most binding constraints that have prevented Loreto from taking advantage of its productive ecosystem and translating it into higher levels of income per capita.

One plausible hypothesis is that Loreto's remoteness has acted as a protection barrier. The costs derived from the region's distance to other Peruvian cities are working as an effective tariff against imports, giving local companies the opportunity to supply goods and services at lower levels of efficiency and higher costs. That would explain why the diversity of its economic complexity profile doesn't translate into faster growth rates and the income levels observed in other places. Protected by its geography, the region's local production hasn't developed at the efficiency levels needed to sell beyond its borders.

There is space to develop a policy strategy to sort the most binding constraints of Loreto, leveraging on its set of existing productive capabilities. Amid all the factors analyzed in this report, we have detected three binding constraints to sustainable growth and development, associated with different aspects of low connectivity in Loreto, that interact and reinforce each other: i) its fluvial connectivity, ii) the State's incapacity to solve coordination failures associated to the process of self-discovery, and iii) electricity provision, as a transversal input for Loreto's productive transformation.

Given that the region is not connected by road transportation to the rest of the country, its possibilities of commercial exchange depend exclusively on air and fluvial transportation. In terms of air transportation, Iquitos is well connected with the rest of the country, compared with other five regional capitals with relevant air traffic (Arequipa, Cusco, Pucallpa, Trujillo, and Piura), with no significant differences in the costs of such connections. Inside Loreto, air mobility is way more limited, and it is reduced to four routes connecting Iquitos with El Estrecho, Caballococha, Gueppi and Colonia Angamos. These air routes – as in Amazonas, San Martín, and Ucayali – are subsidized by the Ministry of Transport and Communications (MTC). The costs of airborne cargo are aligned with international standards, but the possibilities of commercial exchange by these means are restricted to a small array of products with high value-added.

Thus, reducing the natural barriers that affect production in Loreto entails more efficient and predictable ways of moving merchandise goods along the rivers. According to different sources investigated in this report, the direct costs of fluvial transportation are relatively low, but the nature of the trips impose additional costs on the companies that go beyond the freight rate. Our findings are consistent with those of other researchers who have documented the key drivers of such elevated costs, mostly around the duration, risks and uncertainty associated with existing transportation modalities. For the producers of perishable goods, the transport times required to move cargo between



Iquitos and other regions, or even inside Loreto, are at present, an important barrier. For the rest of industries, the wide time intervals between freights and the uncertainty associated with river transportation impose significant financial costs, as well as higher inventories – both in transit and on land – and storage costs.

The second binding constraint we have identified is related to the State's capacity to articulate the actions of different actors – both inside the public administration and the private sector – to sort coordination and information failures associated with the process of self-discovery. This process – through which a place discovers new goods and services that it can produce in a competitive way – is one of the key drivers of productive diversification and structural transformation. These coordination failures can happen between the public and private sector (for instance, when there is no previous knowledge about the public goods required to enable a new sector), between the areas of the public sector (when there is a need for consistency between regulations and oversight within different levels of the public administration), or even within the private sector itself (when there are several industries that depend on each other, but they are not able to coordinate simultaneous investments to guarantee the provision of intermediate goods or other productive inputs).

Our findings suggest that Loreto tends to diversify less towards industries that are closer to its productive capabilities than the rest of Peru's regions, suggesting that the State has a low capacity to solve coordination and information failures. This incapacity then translates into a slower process of self-discovery and might explain why Loreto shows a significant agglomeration of knowhow but has been unable to leverage it into more sophisticated industries, able to sustain higher wages.

Two flagship examples of the region's difficulties to solve the coordination failures around the self-discovery process caught our attention. The first one is the commercialization of drinks based on *super-fruits*, which is integrated to the fruit extraction value chain developed by Amazonian communities. To make this industry possible, it was necessary to coordinate the initiative and knowhow of a multinational company (AJE) with the support of the Ministry of Environment and associated institutions (SERNAP and the Natural Reserve Pacaya Samiria), Loreto's regional government, the company that extracts the fruit and process it at a local level (Frutama), and an NGO, Nature and Culture International (NCI). At the other end of the spectrum, the second example comes from the Tourism sector, where we observed the difficulties in coordinating private sector with the Government to provide Iquitos of a touristic fluvial port, whose absence inhibits tourism development in the region.

The last binding constraint we identified – which affects transversally Loreto's productive ecosystem – is electricity provision. For starters, power generation does not display - at first - the symptoms that characterize a constraint. Besides the mining and oil sectors, electricity prices, which are regulated, are in line with national averages. Additionally, only 4.5% of companies in the region considered power as one of their main obstacles for growth.

Yet, in a market where the electricity prices are regulated and aren't adjusted to the marginal long-term cost of providing electricity, these signals should be considered carefully. It must be stressed that none of the existing companies in Loreto demands enough electricity to fall in the category of 'free and non-regulated tariff', set by the regulator. Given that Loreto's generation depends on one of the sources which are more costly, volatile and pollutant – diesel and residual fuel plants –, companies in the region benefit from a crossed subsidy the rest of the country grants to Loreto. This situation constitutes an incentive for a more intensive use of electricity. And yet, the productive ecosystem of Loreto relies significantly less on electricity than the national average – one of the key symptoms of a potential binding constraint.

Electricity provision should probably have a more strategic role in Loreto's sustainable development than the one suggested by our initial analysis. The absence of companies with a demand high enough to pay the unregulated tariff given the cross subsidy is an indicator that the marginal cost of electricity could be a restriction for the growth of existing companies. Even more important, it is a restriction for the establishment of industries that could tend to organize around firms of larger size.

Within the context of Loreto, developing an alternative source of electricity generation besides diesel may be the cornerstone of a sustainable development strategy. First, it would reduce the costs to existing companies and new potential entrants, lifting constraints to larger companies, more intensive in the use of electricity, and capable of producing tradable goods and services. Second, it would contribute to reducing the environmental pollution caused by the current generation system. Finally, it would free oil production, thereby increasing the region's exports of hydrocarbons.

According to our research, these are the three binding factors that inhibit sustainable growth and productive diversification in Loreto for the median industry. This doesn't mean that the other areas analyzed within the Growth Diagnostic exercise – access to credit, water provision, telecommunications, human capital, taxes, and property rights – do not have issues or are not susceptible to improve. We have analyzed here, extensively, all those areas to identify the deficiencies, but constraints are to be evaluated in *relative* terms.

The differential contribution of the Growth Diagnostic methodology, according to the terms originally proposed by Hausmann, Rodrik and Velasco (2005), is the identification of public interventions with high impact. That, in turn, allows to prioritize the government's economic resources, political capital, and administrative capacity, which are usually limited given the number of problems and needs that require attention. In other words, the identification of constraints is done in relative and not absolute terms. For this reason, our research concludes that any intervention oriented to improve Loreto's fluvial connectivity, to strengthen the State's capacity to solve coordination failures, and to develop alternative sources of electricity generation, will have greater impacts on investment and growth than any other policy area. Given the likelihood that these three constraints interact and reinforce each other, one would expect incremental effects from addressing them simultaneously.

The Growth Diagnostic methodology is oriented to identify constraints and prioritize public interventions in terms of its impact for the *median* industry. But constraints may affect different industries in different ways. There could be specific industries that would not be constraints by these factors, and there could be specific constraints to growth of a particular industry that are not binding for the median industry.

One of the most illustrative examples is the oil sector. This industry is not more or less likely to appear in a place because of its agglomeration of knowhow but shows up wherever the resource is located. In this case, the existing oil pipeline in Loreto allows getting around the connectivity issues that affect other industries and grants access to international markets. The activity's high margins have also allowed it to develop its own electricity generation sources. Potential constraints for the growth of the hydrocarbon sector in Loreto seem to be more associated with how property rights are allocated within the region's territories, mistrust amongst its relevant stakeholders (national government, regional government, private sector, civil society, and federated indigenous communities), and the State's incapacity to facilitate and ensure an agreement where every party's interests are considered and properly compensated, but further research is required.

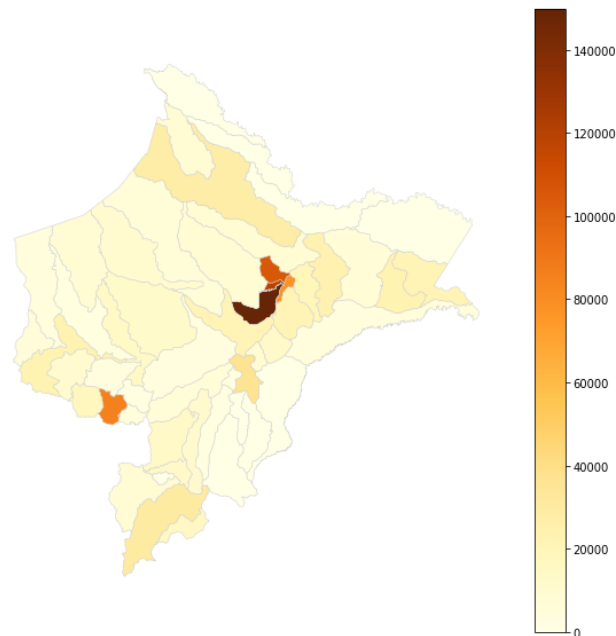
## 1. INTRODUCTION

### 1.1 Characteristics of the state of Loreto

**Loreto is Peru's most remote region.** With 369,000 square kilometers – most of them of Amazon jungle and ranging from 70 to 220 meters above the sea level – it stretches over almost a third of the country. The region shares borders with Ecuador on the Northwest, with Colombia in the Northeast, with Brazil in the Southeast and with other regions of the Peruvian Amazonia – San Martin and Ucayali– to the Southwest. Loreto is also one of Peru's regions with lower population density, with a population of approximately one million people. Roughly, half of its population lives in the capital, Iquitos, which is closer to the border with Brazil and Colombia than to Tarapoto or Pucallpa, the closest regional capitals (at 460 and 540 kilometers, respectively). Iquitos is not integrated to the national electricity interconnected system or the national highway system, only accessible by plane or fluvial navigation.

**Loreto is an heterogeneous region, where urban and rural realities coexist.** According to the 2017 Census, Loreto has ~316,000 citizens living in rural areas (34%) and ~607,000 in urban areas (66%), mainly concentrated around the cities of Iquitos and Yurimaguas. Out of Loreto's 53 districts, six are home to 60% of the population (see Figure 1). The rest of its population is dispersed along more remote areas, only accessible by boat and – only in some cases – by plane.

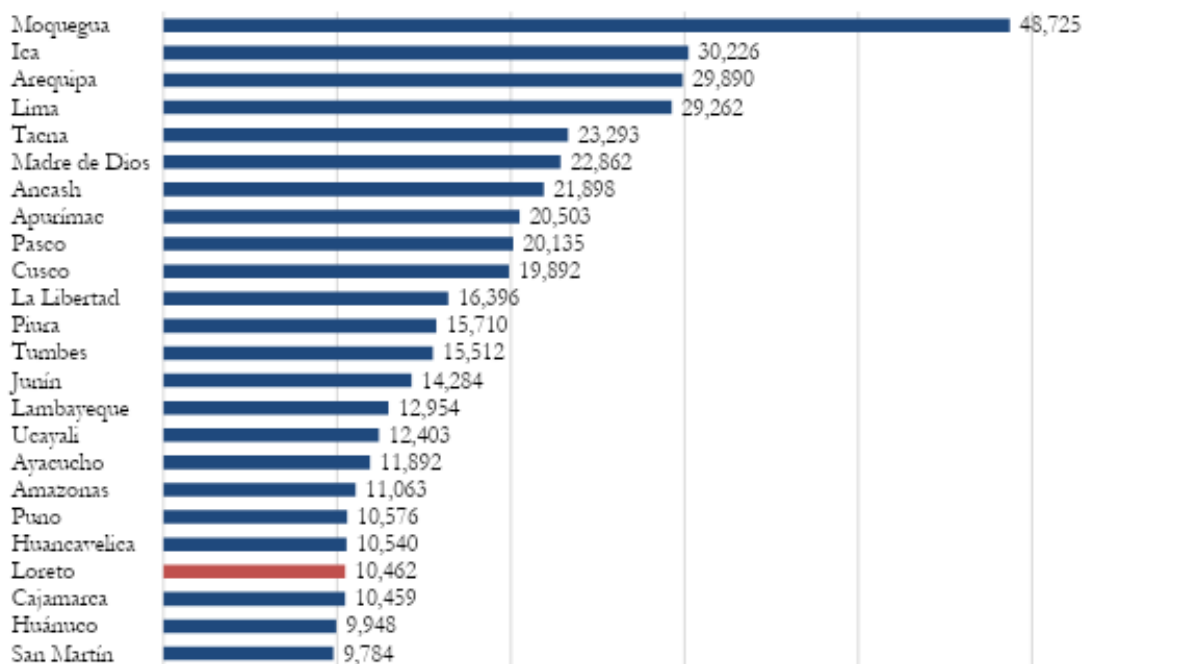
**Figure 1: Spatial Distribution of Population in Loreto**



Source: ENAHO (2018), prepared by the authors.

**Loreto is also one of the poorest regions of Peru.** With only 10,462 soles of gross value-added (GVA) per capita (*approx.* US\$ 3,150), Loreto is the fourth State with lower income per capita in Peru (see Figure 2). Its level of GVA per capita is equivalent to two-thirds of the country's average (15,611 soles, *approx.* US\$ 4,702). We used GVA per capita to characterize the income level of Loreto instead of GDP per capita, because – as it happens with the rest of the countries in the region – neither the INEI nor the Central Bank of Peru (BCRP) publishes GDP figures at the regional level. Even if GVA is a good approximation to GDP in market prices (also known as just GDP), both aggregates have conceptual differences.<sup>2</sup>

**Figure 2: GAV per capita of regions (current soles, 2018)**



Source: INEI, calculations by the authors.

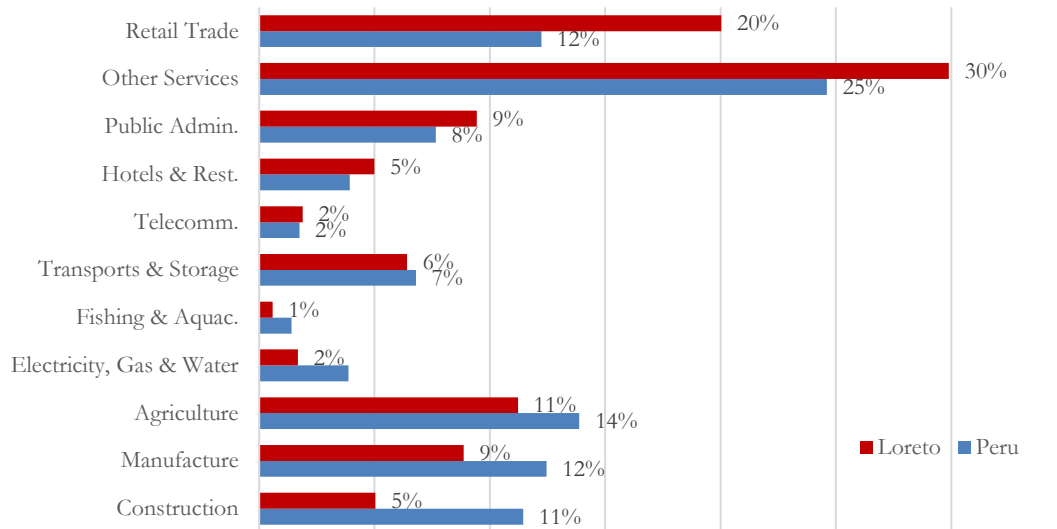
**Regarding the structure of its economy, Loreto also differs from the rest of Peru, relying more on services and commerce, and less on construction and manufacturing.** According to data from INEI, the largest economic sector in the region is services (23% of GVA).<sup>3</sup> It is followed by the oil sector (18% of value added), commerce (17%), agriculture and cattle (9%), public administration and defense (8%), and manufacturing (7%). As shown in Figure 3, the composition of GVA is significantly different to the average region in Peru, even if we don't include extractive sectors such as

<sup>2</sup> While GVA characterizes economic activity from the point of view of the supply or the producer, GDP in market prices does it from the point of view of the demand or the consumer. To build GDP with the income or the production method, we start with the total GVA of the economy, and we add the total taxes on products and subtract the total subsidies on products (O'Connor, 2018). In Brazil, for example, the GDP of the states is approximately 8-20% higher than the corresponding GVA, with little variation through time.

<sup>3</sup> Figures from INEI for GVA current 2018.

mining and oil. Commerce, for instance, represents eight percentage points more than the average region, while construction represents six percentage points less.

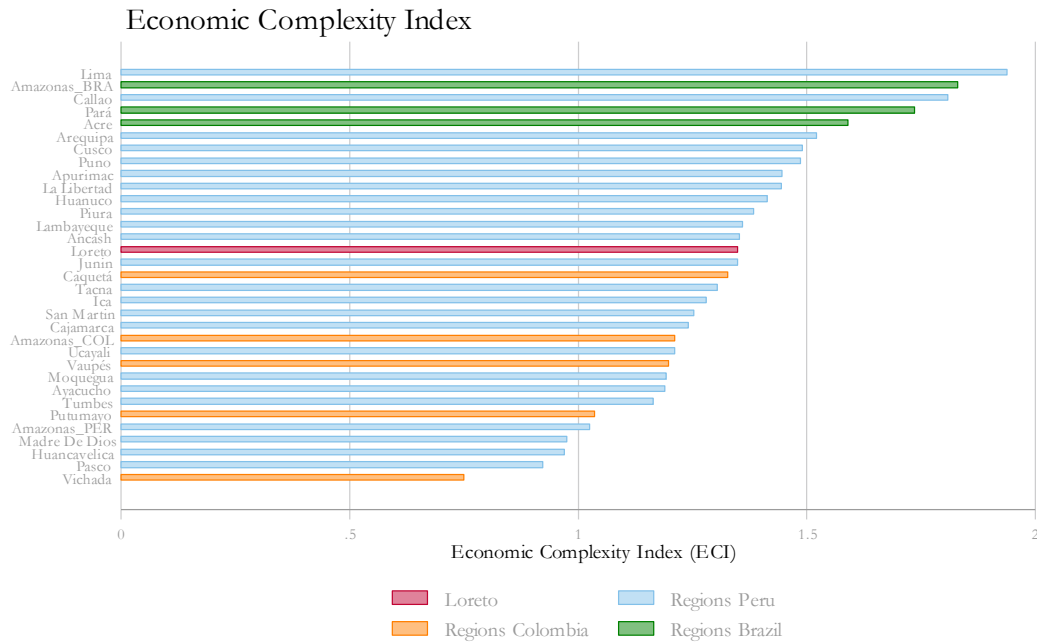
**Figure 3: Composition of non-oil GVA in Loreto and Peru (2018)**



Source: INEI, calculations by the authors.

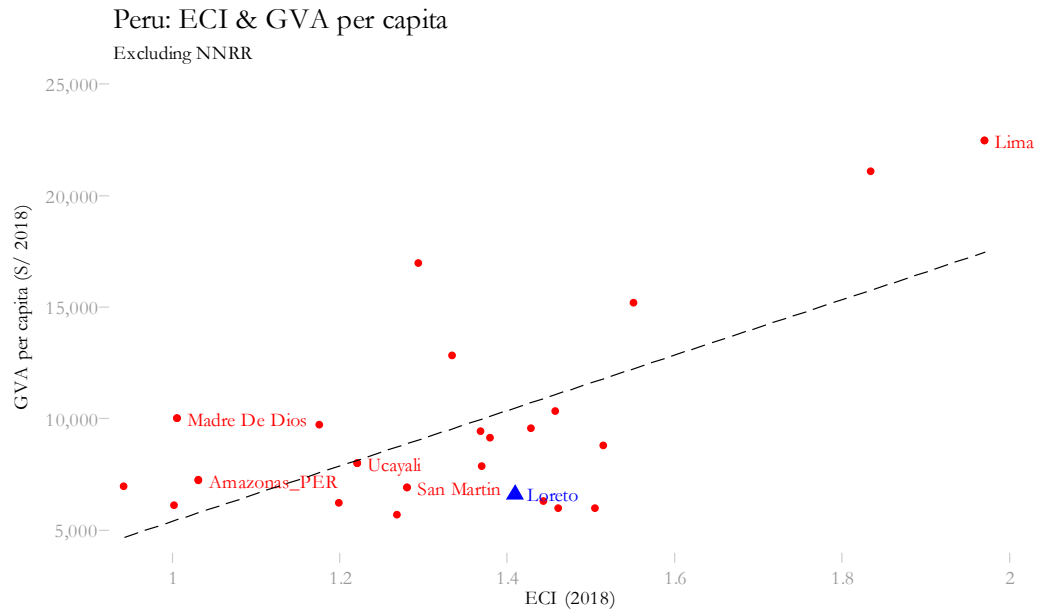
As reported by Hausmann, R., Santos, M.A., Tudela Pye, J., Li, Y., and Grisanti, A. (2020), Loreto has a level of sophistication and productive knowhow that ranks close to the median of other Peruvian states. That is in stark contrast with its level of income per capita, which is below what one would expect given its knowhow agglomeration. The Economic Complexity Index (ECI) of the region is higher than that of all Amazonian provinces of Peru and Colombia (see Figure 4). This characterization of Loreto as a region with intermediate sophistication, higher than its Amazonian peers, is also consistent – at the exports level – with what was reported in the Peruvian Atlas of Economic Complexity. However, as shown in Figure 5, Loreto’s per capita income is lower than one should expect from its level of knowledge agglomeration.

**Figure 4: Economic Complexity Index (ECI), Loreto and comparable regions**



Source: Own calculations based on Dun & Bradstreet.

**Figure 5: Economic Complexity Index (ECI) and Gross Value Added (GVA) per capita  
Loreto and rest of regions in Peru**

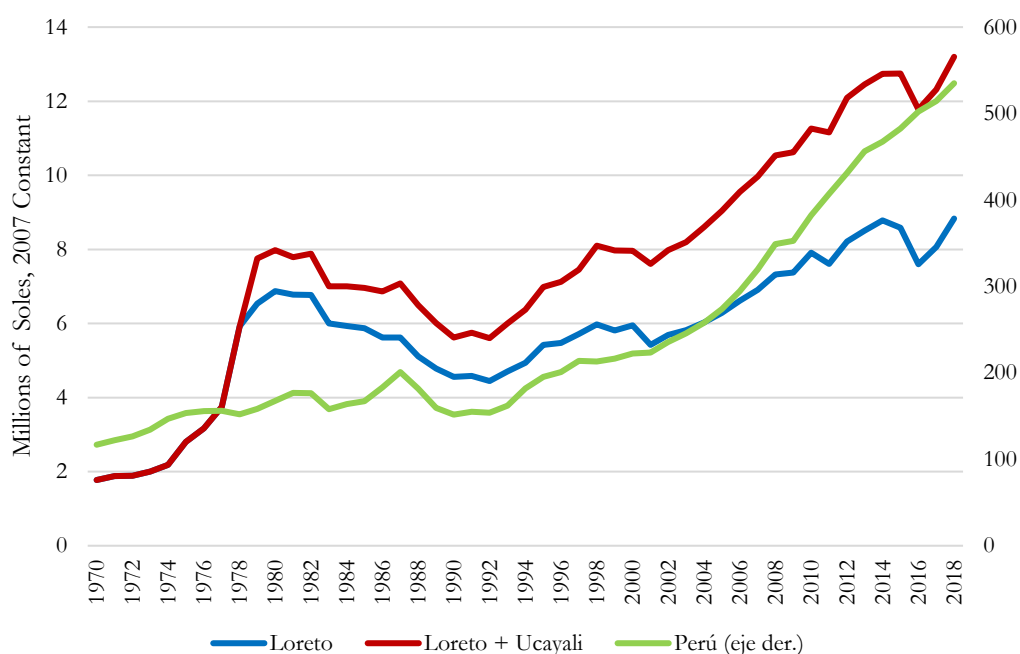


Source: Own calculations based on Dun & Bradstreet.  
\*Excluding Moquegua.

## 1.2 Growth Trajectory

Since 1980, economic growth rates in Loreto have been below the rest of the country, resulting in a widening income gap. In the decade between 1970 and 1980, Loreto's economic activity (which included what is now the state of Ucayali) multiplied by four times in real terms, mostly driven by the oil sector (Figure 6). From then onwards, the economy has been lagging behind, growing at a compounded annual average rate (CAGR) of 0.7%, four times less than the rest of the country (3.0%). This gap – compounded over a period of forty years – has resulted in a significant cumulative difference: while the economy of Peru tripled in size during this period, Loreto grew barely 30%.

**Figure 6: Gross Value Added in Peru and Loreto**

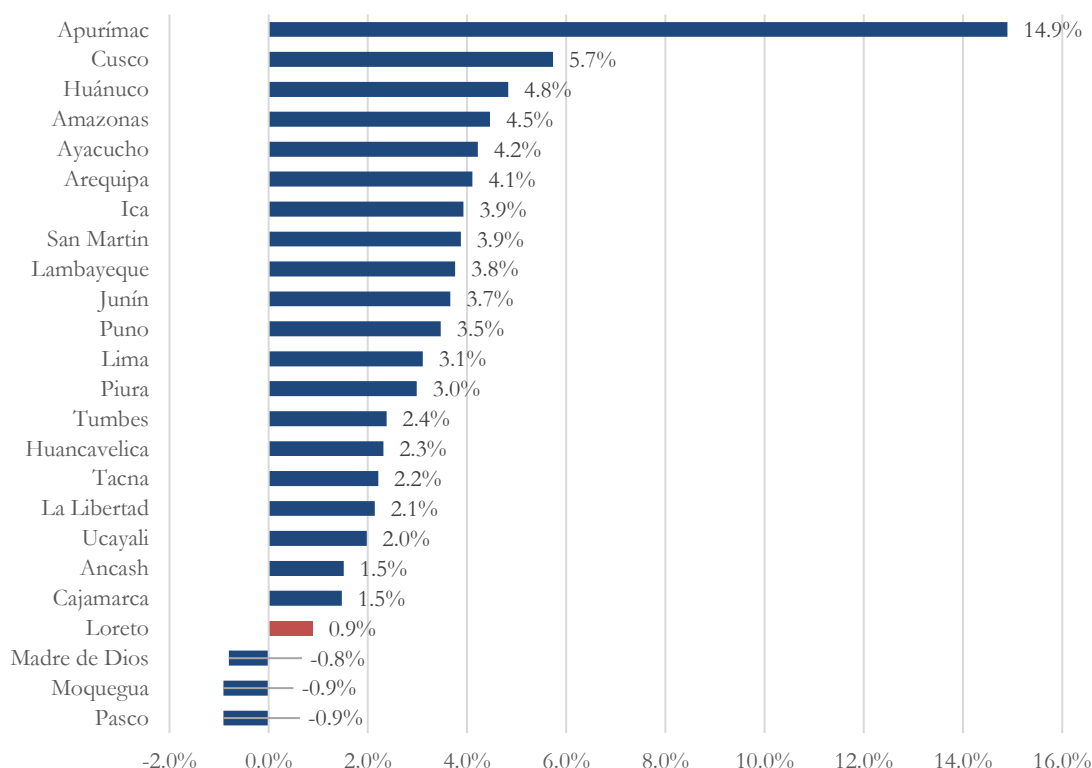


Source: INEI, Mendoza and Gallardo (2012), authors' own calculations.

**Loreto is one of the regions of Peru with the lowest average growth in the last decade. Instead of converging in per capita terms with the rest of the country, Loreto became poorer in relative terms.** As it's shown in Figure 6 and Figure 7, in the last decade (2008-2018) gross value added per capita in Loreto not only grew four times less than in the rest of Peru (0.6% vs. 2.5%) and five times less than the rest of Amazon Peruvian states (2.9%), but also has been more volatile. At this growth rate, Loreto would need 115 years to double the size of its economy. In that same period, the gap with the rest of the country has widened, with per capita GVA in Loreto passing from being equivalent to 75% of the national per capita GVA in 2008, to less than half of it (49%) by 2018.



**Figure 7: Average per Capita Growth (GVA), Peruvian Regions (2008-2018)**

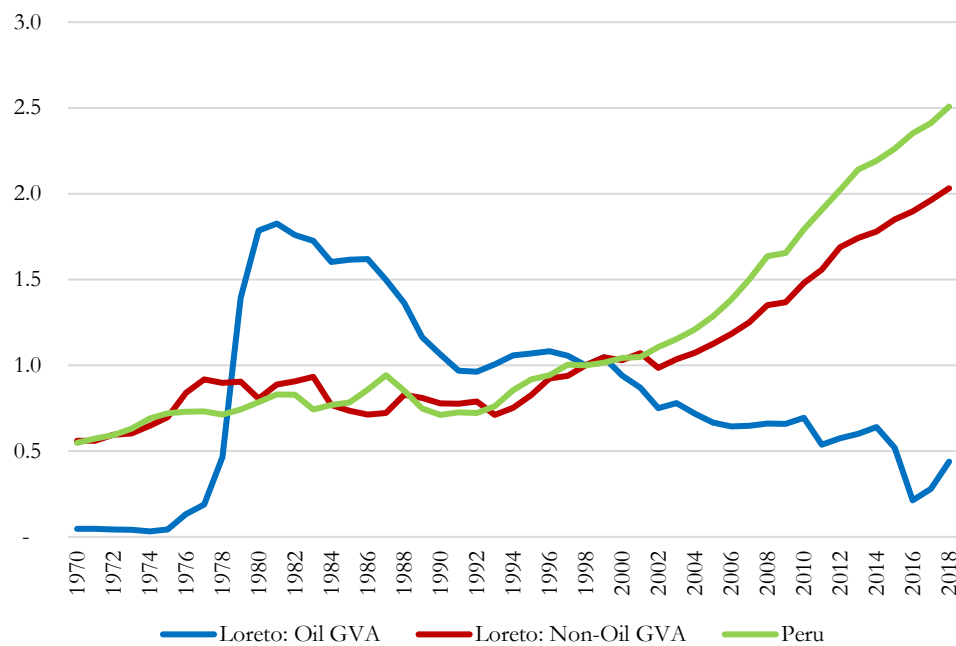


Source: INEI, calculations by the authors.

**When we decompose growth by sector, it becomes evident that the oil sector has fallen behind the rest of the economy, which have been growing steadily.** As shown in Figure 8, the oil sector contracted in cumulative terms over the previous four decades (1980-2018). During the last twenty years, the sector plummeted at an average annual rate of 4.0%, resulting in a cumulative fall of 56%.<sup>4</sup> In the meantime, the non-oil economy grew at a compounded average annual rate of 4.2% in the last decade and 3.6% over the last two decades – not that far from the growth rates registered by the Peruvian economy (4.4% during the previous decade, 4.7% in the last twenty years).

<sup>4</sup> The figures of oil activity come from the statistics of mining and oil GAV from INEI and show loss of volume which is lower than the one reported by PeruPetro. The differences could come from a set of factors, including the quality of the extracted oil, the variations in the natural gas production, and the conceptual differences between real oil GAV and production volumes.

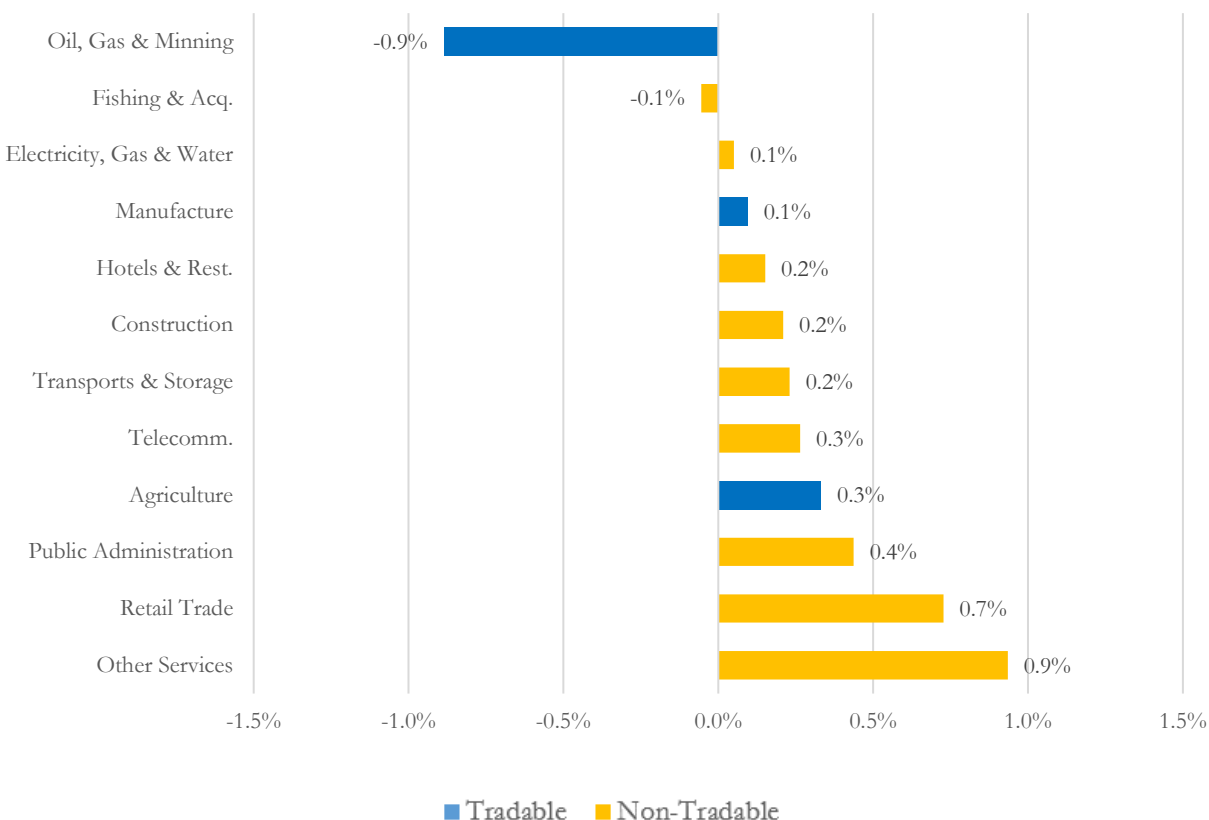
Figure 8: Loreto and Peru: Real Growth by Sector (1980=1)



Source: INEI, authors' calculations.

**The non-tradable sectors have been driving growth in the region during the last decade. Non-oil tradable goods have contributed as well, but in a lower proportion (Figure 9).** In particular, services, commerce and public administration – essentially non-tradable – have been the driving engines of growth in the last decade, contributing 2.1 percentage points to total growth (2.4%). When adding the remaining sectors, the contribution of the non-tradable sector amounts to 2.9 percentage points, more than the total growth of Loreto in that period. On the other hand, the contribution of non-oil tradable sectors barely reached 0.5 percentage points - less than a fifth of non-tradable contribution.

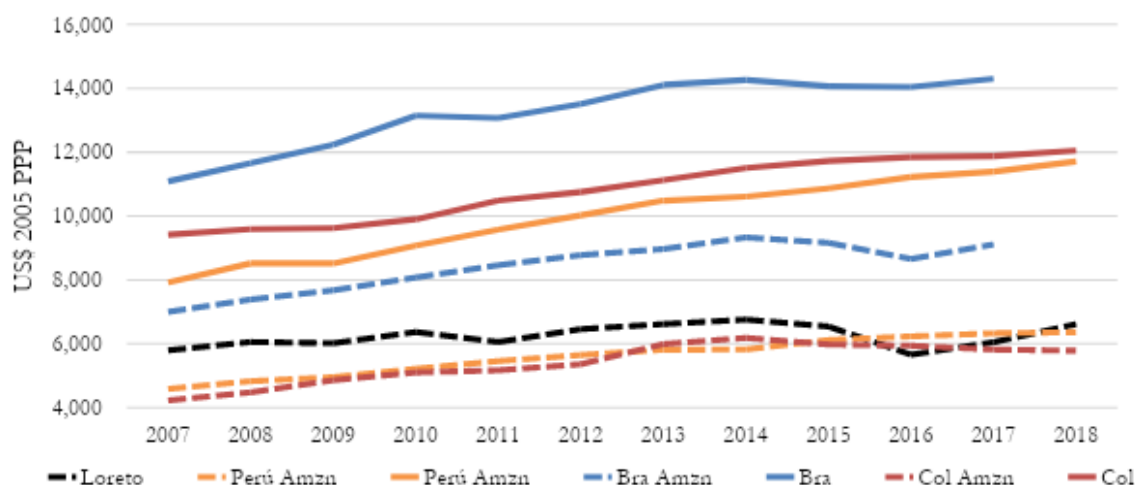
**Figure 9: Loreto: Contribution to Growth by sector (2008-2018)**



Source: INEI, authors' calculations.

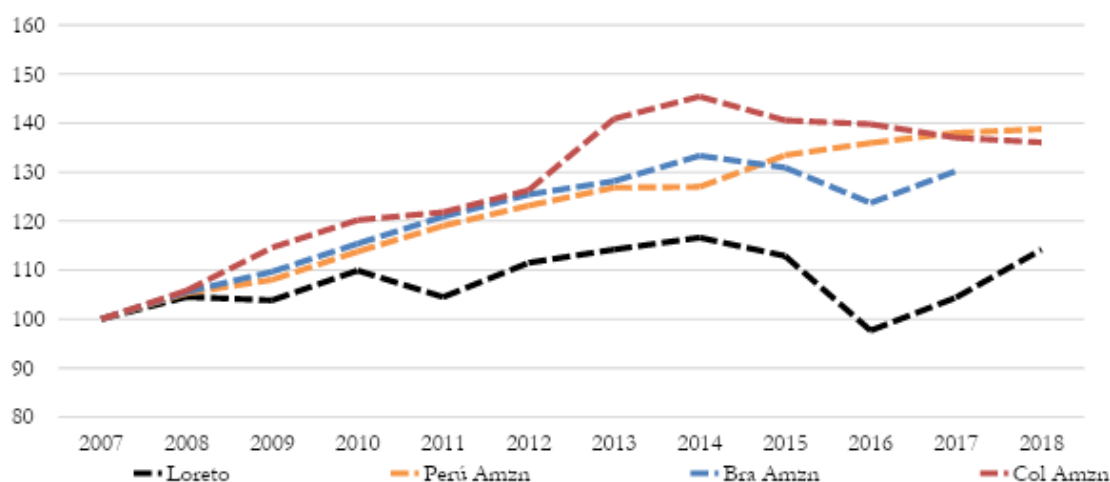
**The level of income per capita in Loreto is similar to other Amazonian regions in Peru and Colombia and lower than the one in the Brazilian Amazon (Figure 10), but Loreto has been the State growing the least of the group over the last decade (Figure 11).** Even if income level comparisons between countries are not exact because of the differences in the methodology to construct subnational figures, the lag in relative terms between the income levels of the Brazilian, Peruvian and Colombian Amazon regions is evident. While the Brazilian Amazonian regions have an income per capita equivalent to 63% of Brazil's, the ones in the Peruvian Amazonia are equivalent to 54% of Peru's.

Figure 10: Income level in Loreto and other Amazon regions



Source: INEI, Banco de la República (Colombia), Banco Central do Brasil, WDI, authors' calculations.

Figure 11: Growth of Income in Loreto and other Amazon Regions (2007=100)



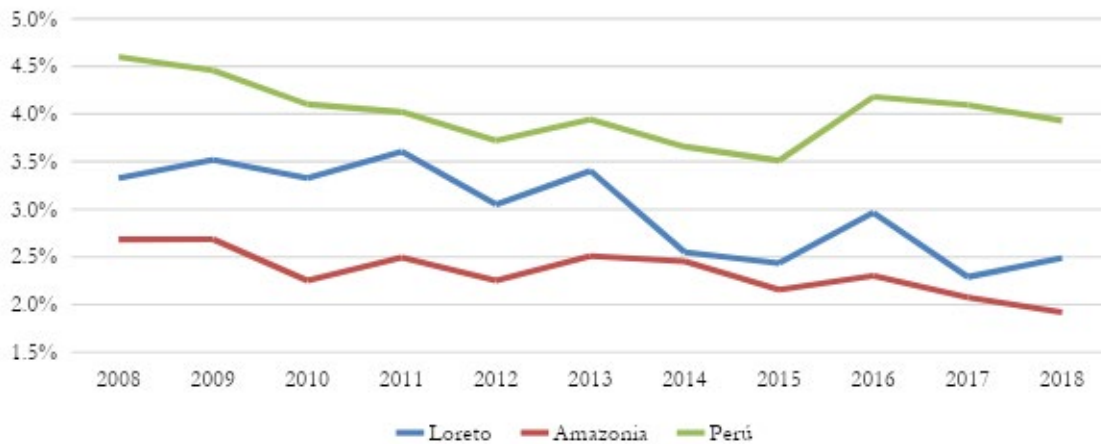
Source: INEI, Banco de la República (Colombia), Banco Central do Brasil, WDI, authors' calculations.

**Despite recent disruptions<sup>5</sup> in the forestry and oil sectors, labor market indicators in Loreto – at least until 2017 – point toward the right direction, with unemployment falling and real wages growing.** Since 2013, – with data from INEI – unemployment in Loreto has been trending

<sup>5</sup> In the lumber sector, the only company that transported lumber from Iquitos to Mexico and the United States – Yaku Taski S.A. – ceased to effectively operate between 2014 and 2015, after the confiscation of a vessel with a massive cargo of illegal lumber. This paralyzed the lumber export business (both legal and illegal) because no transport company was willing to operate the route to North America. In the oil sector, there were spills caused by sabotage to the North Peruvian oil pipe, which reduced oil production in 69% from 2015 to 2016.

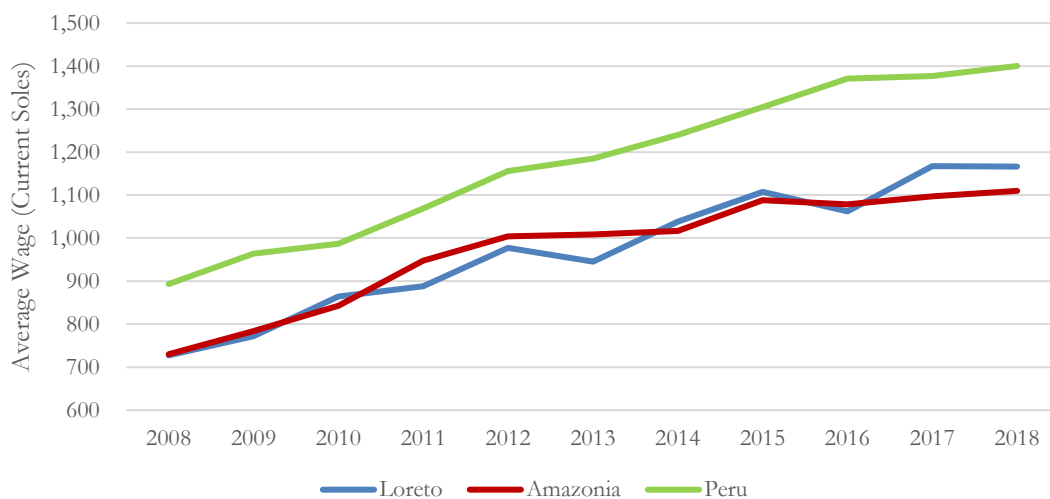
down (Figure 12) and average wages have increased (Figure 13), which contrasts with the vision and narratives in the numerous interviews we held in Loreto, highly influenced by the shocks suffered to the lumber and oil sectors. Nominal average wages grew 75%, from 665 soles a month in 2007 to 1,116 soles in 2018, which represents a real increase of 25% in eleven years (compounded average annual growth rate of 2.1%).

**Figure 12: Unemployment Rate in Loreto, Other Amazon regions and Peru**



Source: INEI, prepared by the authors.

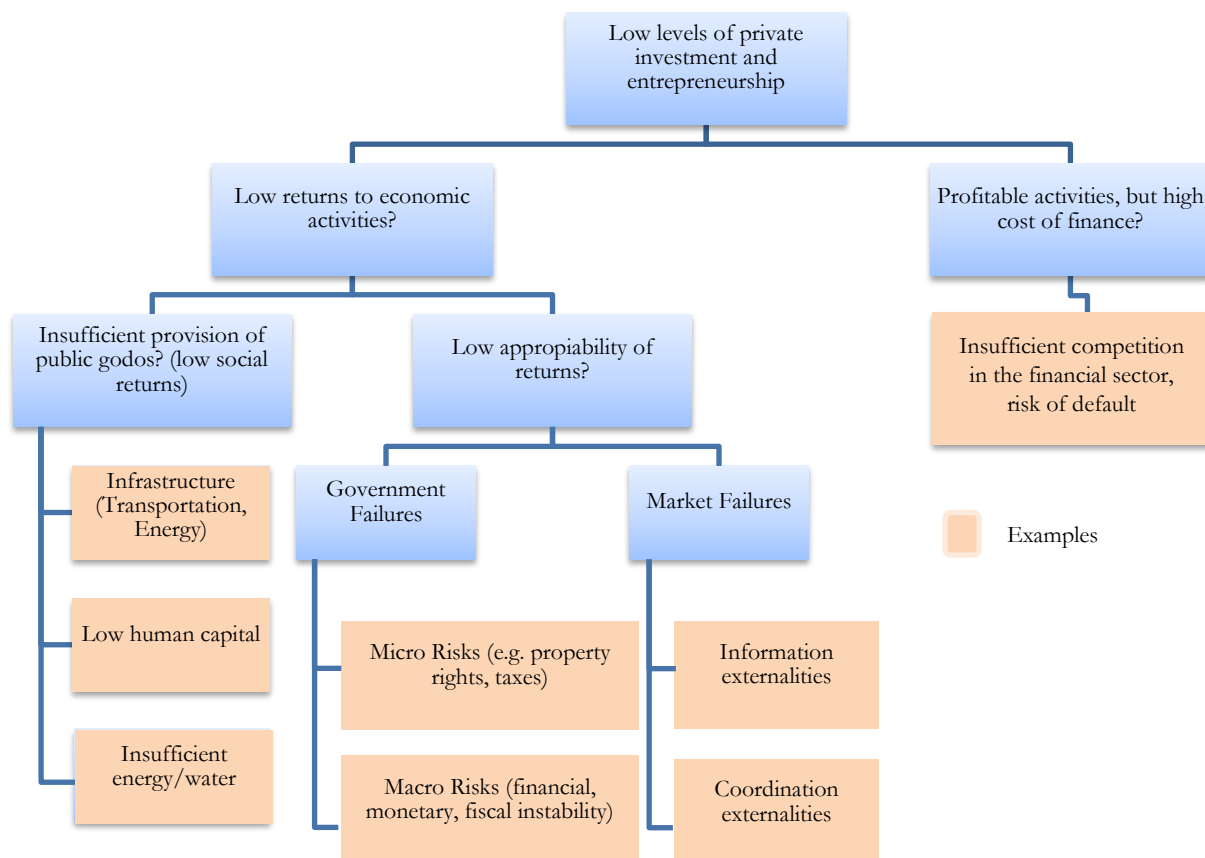
**Figure 13: Average Wage in Loreto, other Amazon regions and Peru**



Source: INEI, prepared by the authors.

In the following sections, we deploy the Growth Diagnostic framework to identify the most binding constraints preventing Loreto from translating its knowhow agglomeration into higher income levels per capita and sustainable development. The main objective of the Growth Diagnostics method is to identify policy interventions that would bring the largest impact on growth, allowing governments to prioritize scarce economic resources, political capital, and state capacity. The framework is aimed at identifying restrictions for the median industry. These restrictions might not affect all industries in the same way, and there may be industry-specific constraints that are not binding for the median industry. Our research follows the route stated on the Growth Diagnostic tree (Figure 14). We begin our analysis by exploring one of the usual suspects – access to finance, at the right side of the tree – and move onwards other factors of production and inputs that may be constraining returns on investment (the left side of the tree).

Figure 14: Decision Tree for Growth Diagnostic



Source: Hausmann, Klinger and Wagner (2008), prepared by the authors.

**Some additional relevant topics are not considered in the analysis due to lack of data or methodological limitations.** For example, drug trafficking or illegal mining are not considered as potential constraints. According to press reports and interviews with actors in the public and private sectors, these activities potentially play a significant role in the economy, particularly in remote areas, where the footprint of the State is less intense. However, the absence of data makes it difficult to assess its size, impacts, and interactions with the formal economy of Loreto. Something similar occurs with the perception of corruption, which in Loreto – as well as in the rest of Peru – seems to be regarded as high, but to measure and estimate its economic effects pose a serious methodological challenge. The best data available on this matter are the corruption maps made public by the national Ombudsman Office (*Defensoría del Pueblo*), which include the number of misconducts committed by public officials in several stages of governmental procedures in Loreto. Yet, this data is available only for 2016 and 2018 by the time this report was written. Data is also lacking in matters related to security and crime. Despite these omissions, it is somewhat comforting that none of these factors were mentioned as a relevant constraint neither for the companies we interviewed nor stood out as a differential problem for growth in the national enterprise survey (*Encuesta Nacional de Empresas -ENE*).

**Our Growth Diagnostic does not elaborate either on other factors that are constant or display little variance across Peruvian States, as by definition they would not be the drivers of *differential* economic performance in Loreto.** For instance, we didn't go deep on the business climate in Loreto because subnational differences are small; countries share the same laws and justice systems (including the labor laws), political representation system, financial architecture, and macroeconomic context (exchange rate, interest rates, etc.). Informality wasn't considered because there is little variation between rates within Peruvian regions – which suggests that it might be driven by constraints that prevail at the national level. Loreto has an informality rate of 81.6%, higher than the national average (72.4%), but at an intermediate level when compared to other Amazon departments such as Ucayali (77.5%), Madre de Dios (76.2%), San Martín (84.5%) and Amazonas (85.3%).

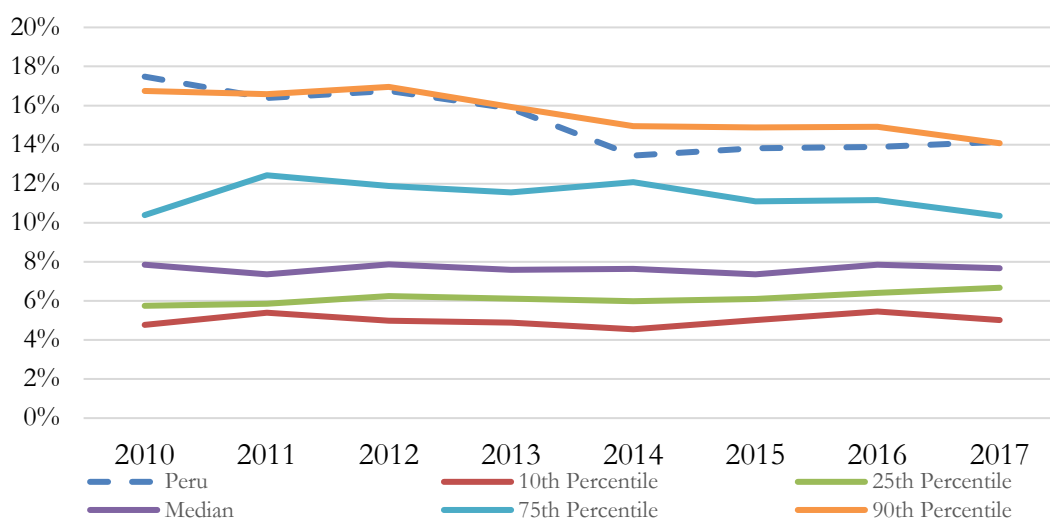
**The Growth Diagnostic approach focuses on the *status quo* of public policies within a specific context and does not include policy proposals or reforms aimed at removing the identified constraints.** The methodology focuses in deploying the principles of differential diagnosis throughout various tests and aims at identifying the most binding constraints. Policies to accelerating growth should stem from the identified constraints, but their definition, design and implementation lies out of the scope of this report. For example, when considering the cost of transportation in Loreto as a potential constraint, the analysis is based on existing modalities (fluvial and air travel). Policy proposals to make fluvial transportation more efficient shall be analyzed from a cost-benefit standpoint (including proper assessments of environmental impacts), an exercise that lies outside the scope of this report.

## 2. ACCESS TO FINANCE: NOT ENOUGH DEMAND OR LIMITED SUPPLY?

### 2.1 The Financial System in Peru and Loreto

Peru's financial system shows a high degree of concentration. The four major banking institutions control 72.2% of direct domestic credit. According to the data from banking and insurance regulator, *Superintendencia de Banca, Seguros y AFP* (SBS), at the end of 2019 the largest bank of Peru – *Banco de Crédito del Perú* – had 28.7% of total granted loans, followed by BBVA Peru with 17.8%, Scotiabank Peru 14.9%, and Interbank with 10.9%. Our own estimations – in line with the characterization made by the IMF<sup>6</sup> – put the Peruvian financial system in the range of the “moderately concentrated.”<sup>7</sup> Within that context, it is not surprising that banking spread – the difference between the active and passive average interest rates of Peru – was at 14.1 percentage points by 2017,<sup>8</sup> close to the ninetieth percentile for Latin America and the Caribbean (see *Figure 15*), only below Brazil (43%), Mexico (21.2%) and Honduras (14.6%).

Figure 15: Average Spread: Peru and Latin America (2010-2017)



Source: CEPAL, authors' calculations.

The rest of the credit market in Peru is composed of twelve municipal institutions that comprise an aggregate of 7.2% of the country's total granted loans, followed by ten financial companies with 4.2%,

<sup>6</sup> “Peru: 2018 Article IV” (2018).

<sup>7</sup> Herfindahl-Hirschman Index of 1544.

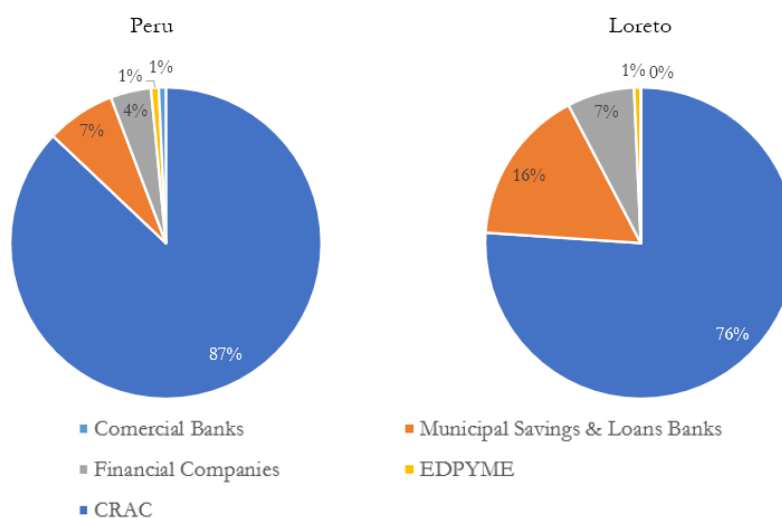
<sup>8</sup> 2017 is the year with more recent data from all the countries.



nine development banks for small and micro companies (EDPYME) which hold 0.8% of total loans, and seven rural saving and loan institutions (CRAC) with the remaining 0.7%.

**These patterns repeat with some variations in Loreto.** Banking institutions (*Banca Múltiple*) comprise 76.1% of total credits in Loreto,<sup>9</sup> eleven percentage points below the national level (see Figure 16). The first four banks in Loreto are the same four main banks of Peru. BBVA Peru has the largest market share of loans in Loreto (28.6%), followed by *Banco de Crédito del Perú* (17.0%), Interbank (12.6%) and Scotiabank (11.1%). However, municipal institutions play a higher role by granting 16.2% of loans, with the municipal institutions of Maynas and Piura granting 9.0% and 4.4% of total credit, respectively.

**Figure 16: Composition of Credit in Peru and Loreto per type of institution, 2018**



Source: SBS, prepared by the authors.

**Regarding the use of credits, in Loreto corporate loans and mortgages represent a lower share than in the rest of Peru, which is compensated by a higher share to midsize, small, and micro enterprises and more consumption credit.** Figure 17 shows the composition of credit in Peru and Loreto per type of institution and creditor by the end of 2019.

<sup>9</sup> There is a small inconsistency between this figure and Figure 17, which is originated in the SBS numbers.

**Figure 17: Credit in Loreto (local currency units) by market segment (% of total) by 2019**

	<u>Credit in Peru (% of Total)</u>						<u>Credit in Loreto (% of Total)</u>					
	Commercial Banks	Municipal S&L Banks	CRAC	Edpymes	Financial Companies	Total	Commercial Banks	Municipal S&L Banks	CRAC	Edpymes	Financial Companies	Total
Corporate	21.9%	0.1%	0.0%	0.0%	0.0%	22.0%	0.4%	0.6%	0.0%	0.0%	0.0%	1.0%
Large firms	14.1%	0.0%	0.0%	0.0%	0.0%	14.2%	6.5%	0.1%	0.0%	0.0%	0.0%	6.6%
Medium-size firms	12.9%	0.6%	0.0%	0.1%	0.1%	13.7%	24.1%	2.1%	0.0%	0.0%	0.0%	26.2%
Small firms	4.9%	3.0%	0.2%	0.1%	1.0%	9.3%	8.7%	5.6%	0.0%	0.0%	1.1%	15.3%
Micro-enterprises	1.1%	1.4%	0.1%	0.1%	0.8%	3.5%	0.8%	2.8%	0.0%	0.0%	1.0%	4.6%
Consumption	17.1%	1.5%	0.3%	0.5%	2.3%	21.7%	27.8%	4.3%	0.0%	0.7%	5.0%	37.7%
Mortgage	15.0%	0.5%	0.0%	0.1%	0.0%	15.6%	7.5%	1.0%	0.0%	0.0%	0.0%	8.5%
Total	87.1%	7.2%	0.7%	0.8%	4.2%	100.0%	75.7%	16.5%	0.0%	0.7%	7.1%	100.0%

Source: SBS, prepared by the authors.

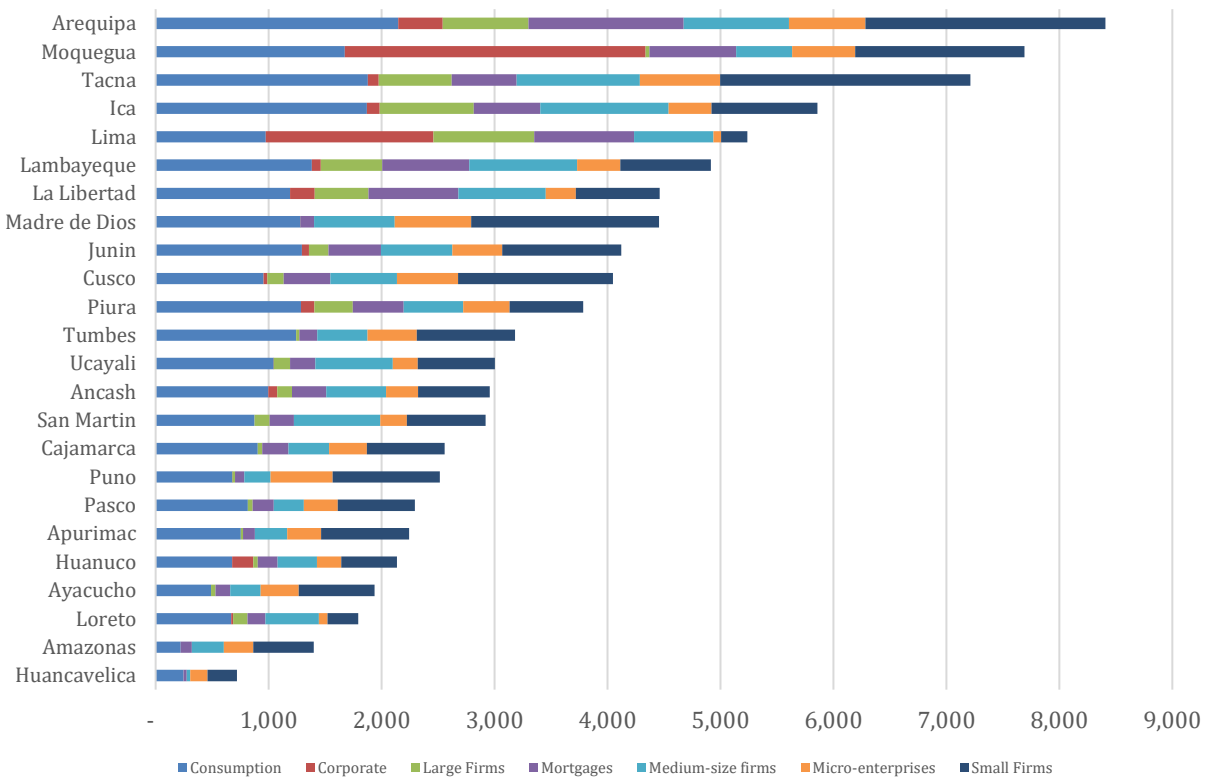
**The Peruvian financial system is solid and enjoys high levels of capital and liquidity.** The dollarization rate in credits and deposits has been consistently falling, from more than 80% in 1990 to less than 30% by 2017. The trend suggests that there is trust in the local currency and the financial system is perceived as solid and resilient. However, as reported see in the next section, Loreto's patterns clearly differ when it comes to the specific use of funds.

## 2.2 Quantity and Use of Funding

**Loreto has one of the lowest credit rates per capita in Peru.**<sup>10</sup> After Huancavelica and Amazonas, Loreto is the region with less loan volume per capita with respect to the whole country. By the end of 2018, Loreto registered 1,792 soles in total loans for individuals and organizations per capita, 55% of the national median (3,180 soles). Excepting Amazonas, Loreto's financial system registers significantly lower credit than the rest of the Amazon states: Ucayali (2,992 soles per capita), San Martin (3,003) and Madre de Dios (4,456).

<sup>10</sup> Within Peru, there is free capital mobility. Economic agents can get loans in any part of the country and deploy the proceeds in another one. Though the SBS makes public the quantity and kind of credit per region, this data does not necessarily show the quantity of credit effectively destined to each region. It is possible, for example, that a company can take a loan in Lima to fund activities in Loreto, which would distort the credit data per region.

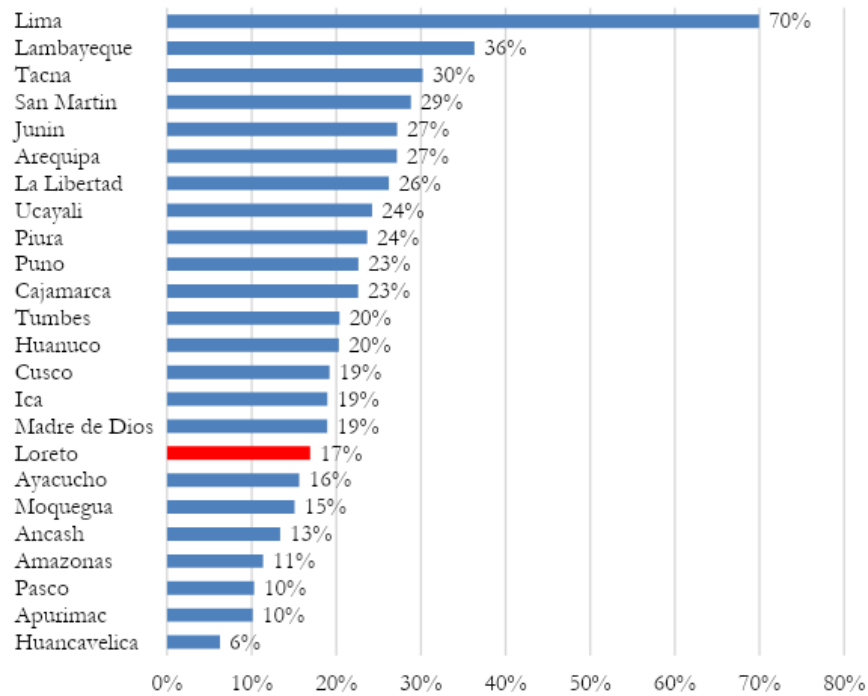
Figure 18: Credit per capita by segment; Peruvian states (2019)



Source: SBS, INEI, calculations by the authors.

**The credit level in Loreto is relatively low with respect to its level of economic activity.** The quantity of credit in the region is only 17% of its annual GVA, a figure not only far from the one in Lima (70%), but also – at a lower distance – from San Martin (29%), Ucayali (24%), and Madre de Dios (19%) (Figure 19). The high penetration of credit in Lima can most likely be attributed to its higher productivity, lower informality rate, and the fact that many companies operating in Peru are headquartered in Lima (even if credit could get diverted to activities in other parts of the country). The contrast with its Amazonian peers suggests that, in Loreto, economic activities are less productive, the credit is scarce, or a combination of both factors.

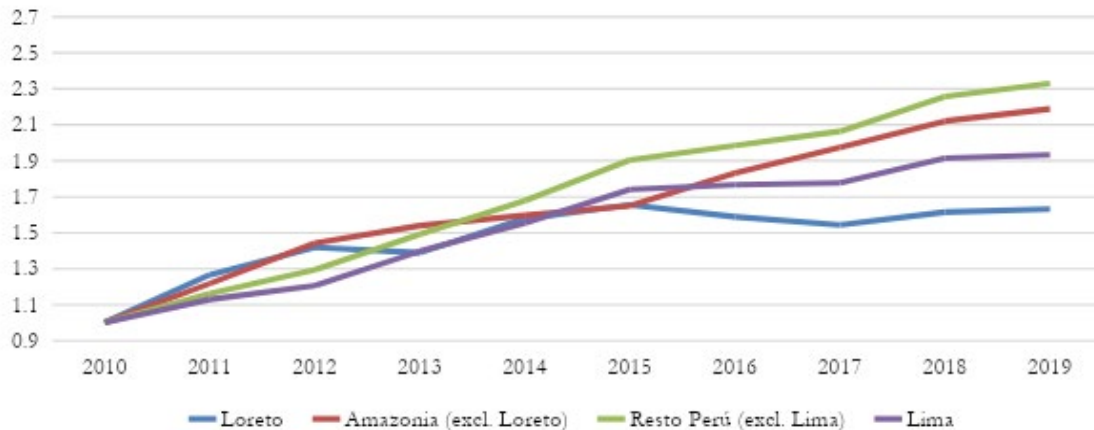
Figure 19: Credit as % of GVA in regions (2018)



Source: SBS, INEI, authors' calculations.

**Loreto is also the region with the lowest credit growth during the last decade in Peru.** From 2010 to 2019, the median in credit growth per capita in Peru was 134%, almost twice the one registered in Loreto (70%, see Figure 20), which is roughly at the level of Madre de Dios (74%), but way below Ucayali (109%), San Martin (128%), and Amazonas (241%).

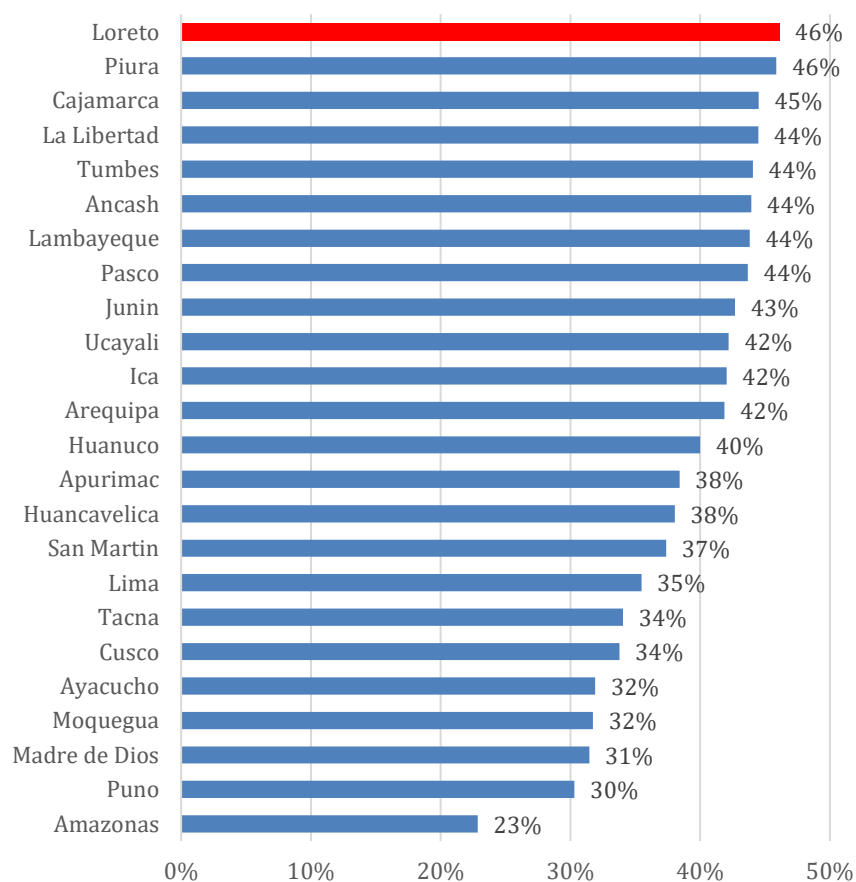
Figure 20: Credit Growth per Capita in the Regions (2010=1)



Source: SBS, INEI, authors' calculations.

The composition of credit in Loreto is noticeably different than the rest of the country, with a higher share of credit going to consumption and home acquisition, and a lower share to investments and firms. As shown in Figure 21, 46% of all the credit in the region goes to consumption loans or mortgages, higher than both the national median (41%) and other Amazonian states. In Loreto, the proportion of non-productive credit is closer to Ucayali (42%), and higher than San Martín (37%), Madre de Dios (31%) and Amazonas (23%), where most of the credit goes to big or small corporate clients, midsize or small companies.

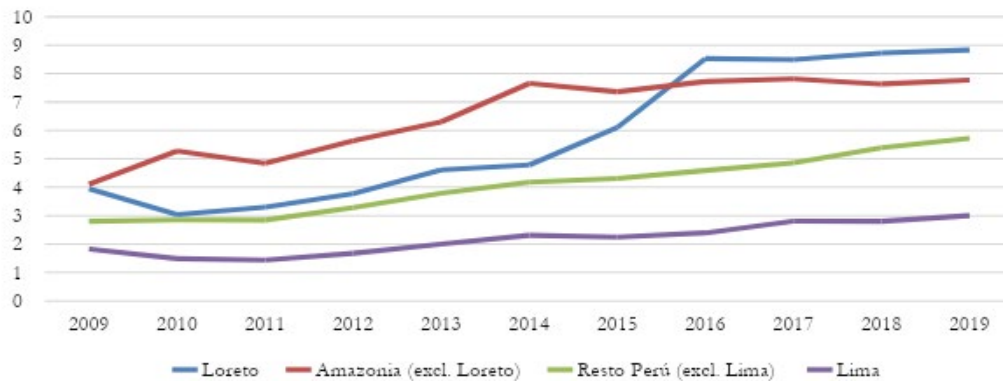
**Figure 21: Mortgage and consumption credit as % of total credit, 2018**



Source: SBS, INEI, calculations by the authors.

Loreto has also a relatively high incidence non-performing loans, associated with two important sectors of the region. As shown in Figure 22, Loreto registered non-performing loan rates similar to the rest of the country and lower than in the Peruvian Amazon until 2014. That rate increased significantly in 2015 and 2016, with the disruptions in the lumber and oil industries. The data doesn't allow us to establish causality, but it is hard not to think of a relationship between both phenomena.

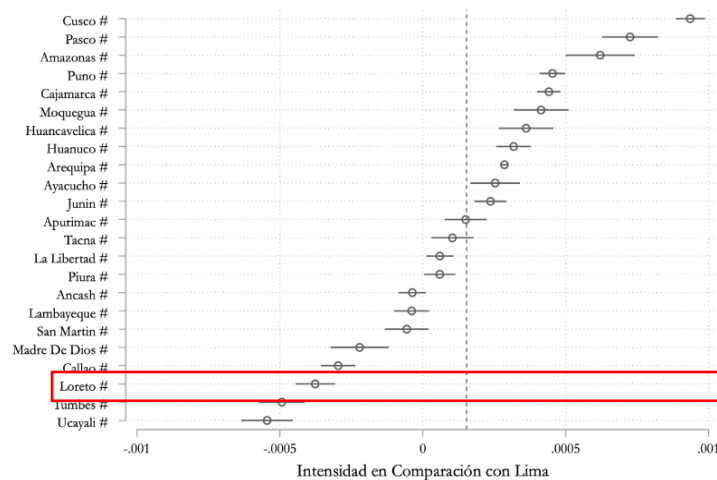
Figure 22: Non-performing loans per region (as % of total credit)



Source: SBS, authors' calculations.

Consistent with the evidence reported above, companies doing business in Loreto tend to be less intensive in the use of credit than in the rest of Peru. Factor intensity at the regional level – whether the aggregate of existing industries rely more on specific inputs than a national benchmark, in this case Lima – can be measured and represents a potential symptom of binding constraints. When a factor is binding, one would expect industries that are more intensive in the use of that factor to be less prevalent (in terms of value added or employment), and industries that rely less on the factor to be more likely to thrive.<sup>11</sup> As shown in Figure 23 – where Peruvian states are ordered from the more credit intensive to the less credit intensive – the industries existing in Loreto tend to depend significantly less on credit, in a proportion only superior to Ucayali and Tumbes.

Figure 23: Credit intensity in credit in Peru



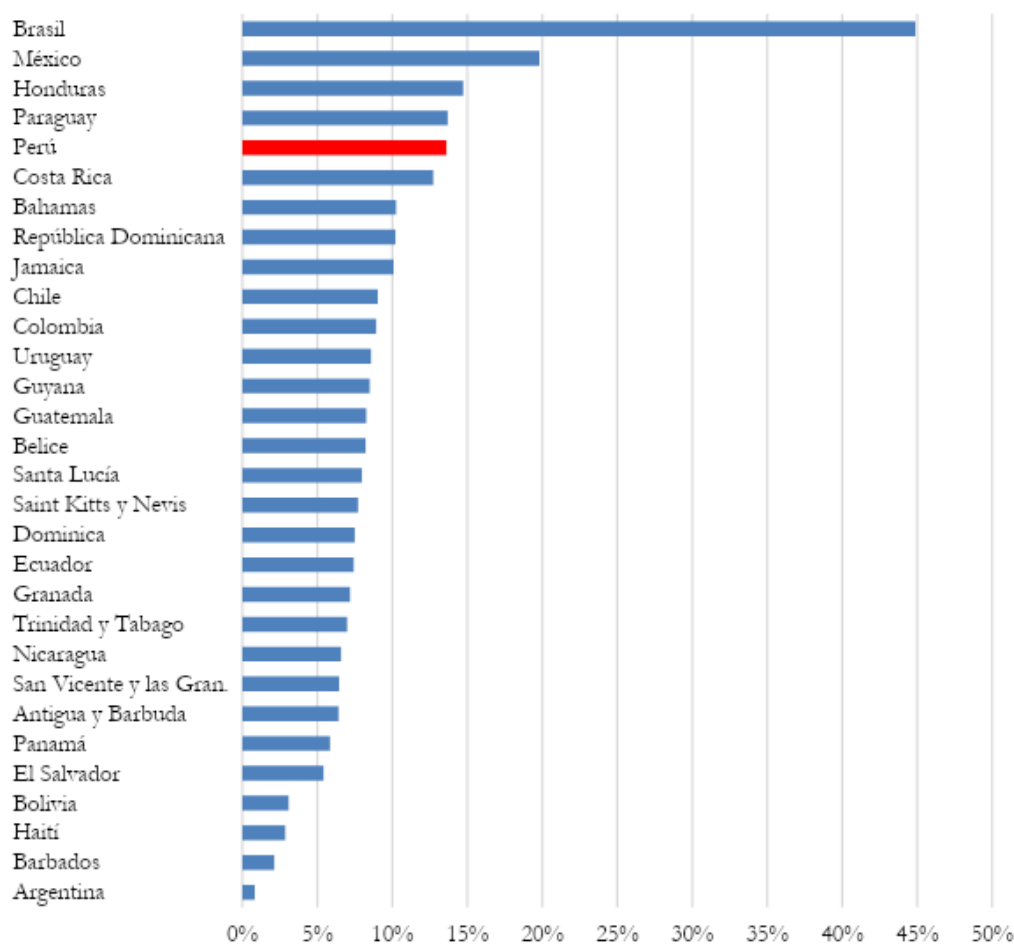
Source: Dun and Bradstreet 2019, BEA 2012, ENAHO, authors' calculations.

<sup>11</sup> Appendix 1 comprises a detailed explanation of the methodology used to measure factor intensity at state level.

## 2.3 Cost of Funding

**In Peru, interest rates are high for Latin American standards.** The real (inflation adjusted) *active* average interest rate of Peru in 2017 was 13.6%, ranking fifth behind Brazil (44.9%), Mexico (19.8%), Honduras (14.7%), and Paraguay (13.7%) in a sample of 31 countries from Latin America and the Caribbean (see Figure 24).<sup>12</sup> This value is more than five percentage points above the median of the sample (8.0%) and four percentage points above the simple average (8.3%).

**Figure 24: Real Interest Rates in Latin America and the Caribbean, 2017**



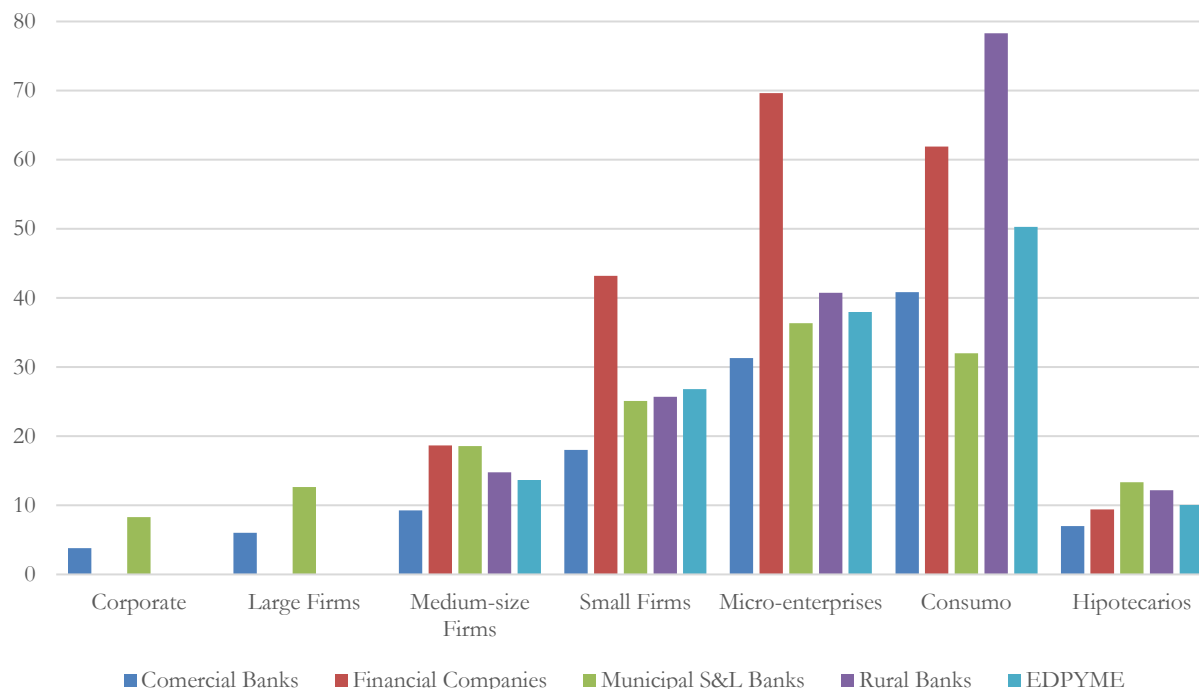
Source: CEPAL, prepared by the authors.

**For smaller businesses, interest rates tend to be significantly higher.** Data from SBS for 2019 indicates that credit to corporations and large companies is relatively cheaper, whilst credit rates to

<sup>12</sup> In the original sample of 33 countries, we only included countries with positive real interest rates, which led to the exclusion of Suriname (-4%) and Venezuela (-77%).

small and micro enterprises are significantly higher. As shown in Figure 25, interest rates for small firms go from 18% (banking institutions) to 43% (financial companies), while credit for micro-enterprises go from 31% (banking institutions) to 70% (financial companies). Consumption credit also comes at higher rates. These large differences in the cost of credit by type of creditor are common and can be explained by differences in non-performing loan risks and administrative costs.

**Figure 25: Annualized interest rate per creditor and debtor, 2018**



Source: SBS

**Given data limitations,<sup>13</sup> it is not possible to establish if interest rates are differentially higher in Loreto compared to other regions.** SBS has an online tool to gather interest rates by region, product (fixed asset, working capital, mortgage, etc.) and conditions (amount and currency), which gives a quote for all the financial institutions that participate in that product with those conditions in the indicated region.<sup>14</sup> However, interest rates show no variation at the regional level, which could reflect the process of data collection or simply the fact that, in a country with free capital mobility, where savings in a region can fund loans in another, rates don't vary noticeably across subnational states.

<sup>13</sup> We can't derive many conclusions from the tool because the interest rate at every financial institution varies only per product and conditions, not by region. For example, BBVA charges 25.6% annual for 20,000 soles loans for 24 months for fixed assets in all the regions where it operates, and the EPYDME Progreso S.A. charges 34.5% annual for 10,000 soles loans for 9 months for working capital in all the regions where it operates.

<sup>14</sup> The tool can be accessed here: <https://www.sbs.gob.pe/app/retasas/paginas/retasasInicio.aspx?p=C>



**The frequency at which businesses in Loreto identify credit as an obstacle is not significantly different to the rest of the country.** In the most recent National Enterprise Survey (ENE, 2015), 13.9% of companies reported access to funding as the biggest obstacle to growth. This answer was the second more common after informality (26.0%). If we calculate a weighted average<sup>15</sup> of the three main obstacles affecting companies, we reach a similar result. The main complaints from business in Loreto are informality (32.0%), access to funding (17.0%), and limited demand (11.8%). Loreto and the other Amazonian states don't show significant differences with respect to the rest of the country.

## 2.4 Conclusions

**Even though credit penetration in Loreto is low, and that industries present in the region tend to depend significantly less on access to funding, we find no evidence to think that access to finance is differentially higher in Loreto than in the rest of the country.** Even though it is true that credit levels in Loreto are lower, and credit has been growing at a slower pace, it is also true that the quantity and composition of such credit is endogenous to the productive environment of the local economy. The evidence reported in this section suggests that it is more likely that low credit levels in Loreto are a consequence of the lower demand and dynamism, and not because of limited supply. Given that the low quantities of credit in Loreto are not constrained by supply but by demand, the low penetration of credit is rather a *consequence* of low economic dynamism than a *cause*. If that were not the case, credit (or the lack thereof) would feature more prominently in business surveys. Accordingly, we turn now to evaluating other factors potentially hindering productivity – and the demand for credit – in Loreto.

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<sup>15</sup> In this calculation, we pondered the first obstacle to growth with a weight of five, the second problem with a weight of three and the third one with a weight of one.

### 3. LOW SOCIAL RETURNS: BAD INFRASTRUCTURE?

#### 3.1 Water

**There are important limitations in coverage, quality, and supply of drinking water in Loreto.** Paradoxically, despite the amount of rain that falls into the region and water which flows through many of its rivers, supplying drinking water to towns in Loreto is a challenge. In Iquitos, a state-owned company in charge of providing water – SEDALORETO (an EPS, *Empresa Prestadora del Servicio*) – pumps water from the Nanay River to treatment plants and distributes to the city through a pipeline system. As the Growth Lab team came to know from an interview with the general manager of the EPS, the main problems around the provision of drinking water include increased waste (given its low price and the lack of measurement tools), theft (pipes are not deep enough and are easily accessible), low water pressure in the homes (due to narrow pipes) and the irregularity of the provision (water is pumped only for eleven hours a day). It isn't surprising, then, that a key problem reported by companies in the ENE survey are related to unscheduled service interruptions (42% of respondents), limited servicing hours (33%), and even increasing scheduled service interruptions (20%). Other towns in Loreto pump and treat river water in the same way, while the use of wells is also common.

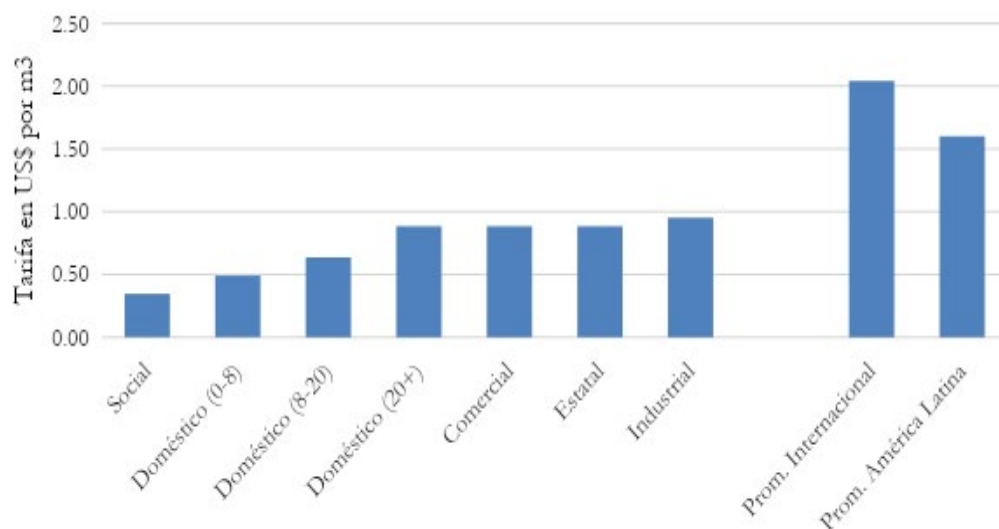
**According to Latin American and international benchmarks, water services in Loreto are cheap** (see Figure 26). The price of the cubic meter of water charged by the EPS varies by type of customer (households, commerce, industry, etc.) and the volume of monthly consumption. In Iquitos, for example, its cost goes from 1.14 soles per cubic meter in the “social fare”<sup>16</sup> rate to 2.92 soles for stores, state offices and homes that consume more than 20 cubic meters of water per month (including sewers, charged apart). For the industrial sector, water is more expensive, with a fare of 3.14 soles per cubic meter. In sum, as in the rest of Peru, water in Loreto is cheap compared to the rest of Latin America and to the world, with a cost 30% to 50% lower than the average rate, respectively.

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<sup>16</sup> The social fare applies to homes classified as vulnerable in a survey that evaluates socio-economic variables, such as employment, income, lodging and health, and applies to subsidies.

<https://pdfs.semanticscholar.org/0985/ca70008e5f1932da185831bb22e93a6b81bc.pdf>

Figure 26: Water fares in Loreto, Latin America, and the world, 2018



Source: SEDALORETO, Global Water Intelligence.

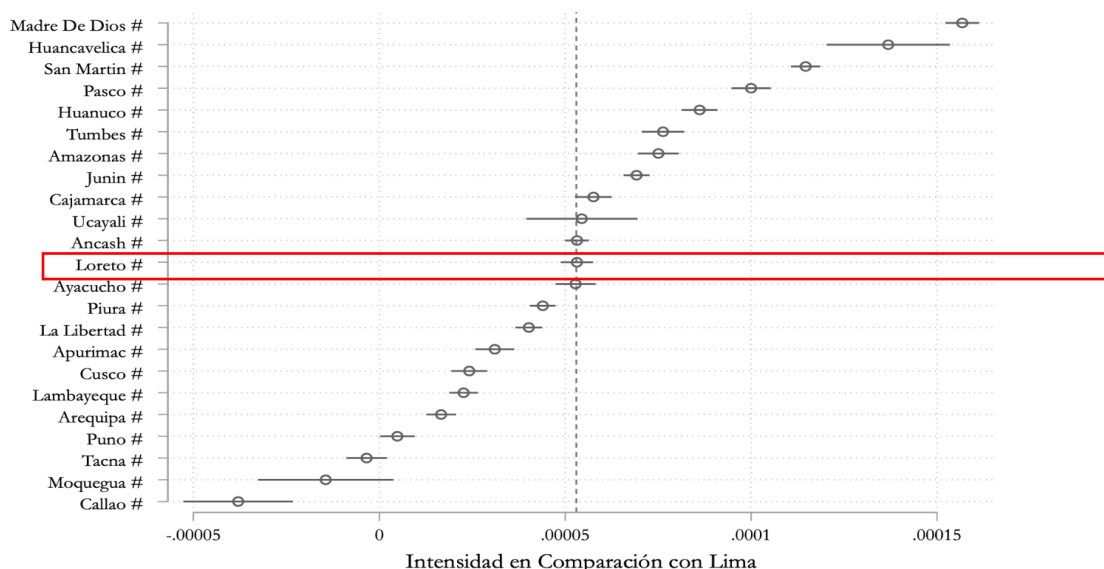
**That said, most companies face additional costs associated to the low quality of water services.** More precisely, if 24-hour access to water with acceptable pressure is required, companies in Iquitos must install elevated water tanks, which require pump engines whenever the water pressure is low. Another option to get a constant provision of water with enough pressure is using water wells and electric or diesel pumps. The use of these technologies is very common in Loreto and the rest of Peru. According to the ENE survey, 44% of companies in Loreto have a tank to store water in its main location (compared to the national average of 40%) and 15% of companies own a well (compared to national average of 14%). Preliminary research<sup>17</sup> shows that the cost of water tanks in Peru is in line with the prices surveyed for 396 water tanks of different brands and capacities in the USA.<sup>18</sup> Beyond a certain minimum size, the kiloliter of storing capacity costs about 475 soles and about 1,000 soles for a 2,000-litre tank. It's certainly an additional cost derived from the lack of a sufficient water provision, but it is not differentially higher by international standards.

**The intensity of water use in Loreto is within the average intensity for Peru, which indicates that water is not a differentially troubling aspect in the region.** Figure 27 orders Peruvian regions according to the intensity of water usage of existing industries. Loreto is close to the national average, which suggests that water might not be a differential constraint for Loreto's firms (if that were the case, the spectrum of water-intensive companies would be lower).

<sup>17</sup> According to quotes for water tanks in different sizes in Lima in [www.mercadolibre.com](http://www.mercadolibre.com) (April 2020)

<sup>18</sup> See database here: <https://www.tank-depot.com/product.aspx?id=123>

Figure 27: Intensity of water use per state



Source: Dun and Bradstreet 2019, BEA 2012, ENAHO, prepared by the authors.

**SEDALORETO was recently restructured to address solvency problems.** The Technical Organism of the Sanitizing Service Administration (OTASS) intervened SEDALORETO and is providing technical and financial support. In the process, OTASS changed the composition of the EPS's board to give more decision-making power to technical personnel and less to local and municipal governments. With this intervention, there were improvements in the company's management and important investments were made to increase the quality of the infrastructure of pipes and pumps. Despite these changes, the price of water is still determined by the National Superintendence for Sanitizing Services (SUNASS), which sets a tariff below the level that would allow the EPS to invest in maintenance and secure financial stability.

**The unfortunate case of the residual water treatment plant is proof of the deficiencies in the provision of public services in Loreto.** This flagship investment, that Iquitos needed to handle sewage water and reduce the impact of human-generated pollution in the river, was contracted with Odebrecht for 242 million US dollars. The works started in 2006 but have been paralyzed since 2014. That year, the works were initially completed and delivered to the regional government but were rejected because of alleged technical failures. The event triggered a series of disputes and litigations that were still undergoing at the time of writing this report. The plant was inaugurated and re-inaugurated several times, amid successive floodings and closings for repairs.

**In conclusion, despite the described problems, water services don't seem to be a differential constraint to economic activity in Loreto.** First, the price of water is relatively low, even when considering the additional costs that the agents must pay to overcome the supply failures. Second, industries present in Loreto tend to be as intensive in water use as the national average, which suggests

that water service isn't a differential constraint in the region.<sup>19</sup> These results are consistent with anecdotal evidence collected by the research team in field interviews with companies in the state. After 17 meetings with companies in six industrial sectors in Loreto, none of them mentioned water supply as a relevant obstacle for their growth plans or investment projects.

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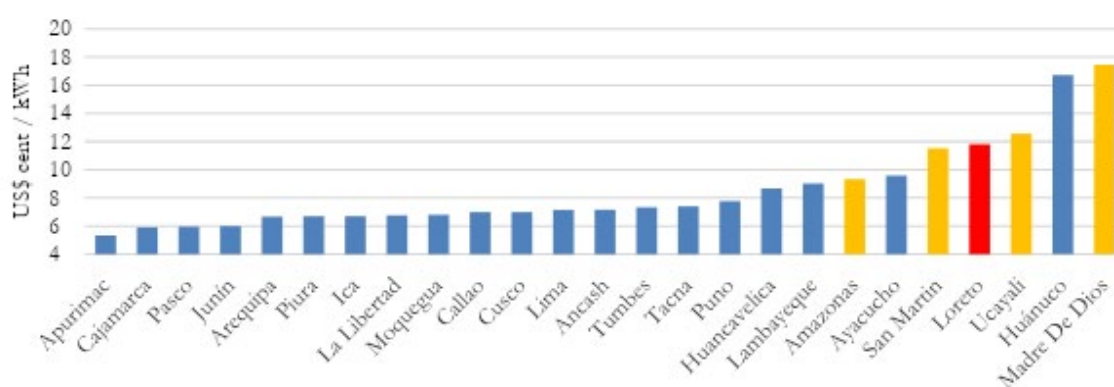
<sup>19</sup> The intensity of water use per industry comes from standards derived from the United States market. In Appendix 1 is explained in further detail the nature of this analysis and where the measures of intensity per industry for water and other factors derive from.

## 3.2 Energy

**Loreto is not connected to the national electricity grid and relies on an expensive isolated system of thermal generation and distribution that need subsidizing, causing significant pollution.** *Electro Oriente* – the regional power generation and distribution company in Loreto and neighboring provinces – provides power from at least 14 thermal plants that consume hydrocarbons, mostly diesel (D2) and residual fuel (R6). The price is determined by the regulator (OSINERGMIN) according to a scaled fare structure. The marginal costs associated with generating power with diesel and residual fuel are high, and the average price resulting from the scaled fare and Loreto’s consumption profile does now allow for cost recovery. The resulting losses are covered by a monthly subsidy to Electro Oriente, determined by a mechanism to compensate isolated systems created in 2006.<sup>20</sup> For example, just in December 2019, Electro Oriente received 10,217,668 soles (3.08 million dollars), totaling 116,121,766 soles (35.3 million dollars) in the year. This kind of power generation emits carbon dioxide and polluting particles to the region’s environment.

**Even with subsidies, electricity in Loreto turns out to be more expensive for the industrial sector; less so – albeit still more expensive than national average – for commerce and services.** According to the Ministry of Energy and Mines (MINEM),<sup>21</sup> in 2018 electricity for the industrial sector in Loreto (which includes the sectors of agriculture and cattle raising, construction, manufacturing, mining and fishery) had an average cost of 11.8 cents of US\$ per kilowatt (¢ US\$/kWh), 73% higher than the national average of 6.83 ¢ US\$/kWh. The equivalent cost for commercial and services activities is also more expensive, albeit at a much lower premium (12%). Residential electricity, by contrast, is among the cheapest in Peru.

**Figure 28: Average price of power for the industrial sector, 2018**

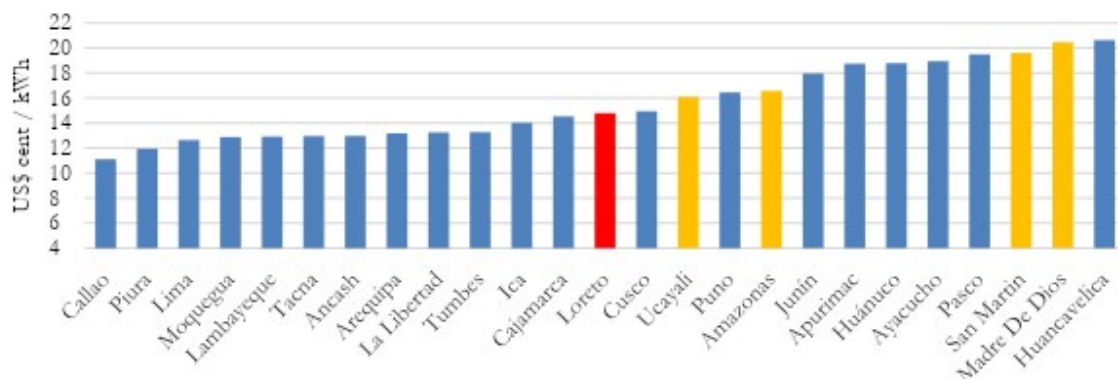


Source: MINEM.

<sup>20</sup> “Regulación Tarifaria: Sistemas Aislados” (n.d.).

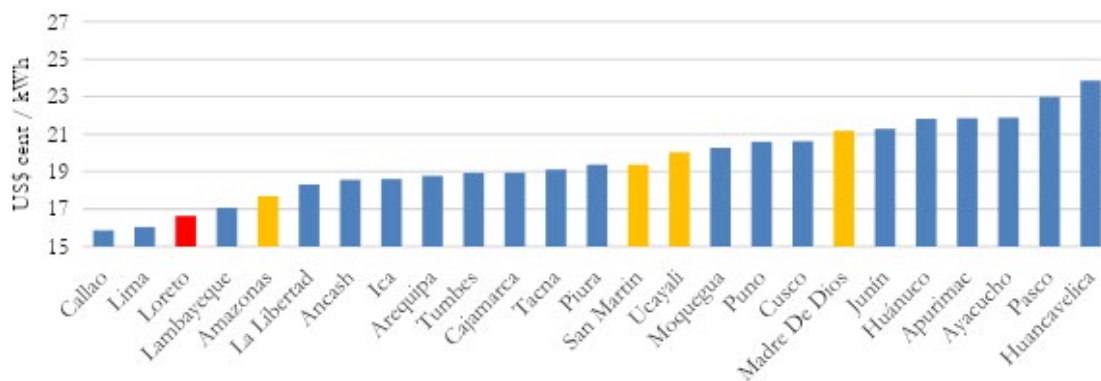
<sup>21</sup> See Chapter 2 of the report *Estadística Eléctrica por Regiones* from MINEM.

Figure 29: Average price of electricity for commercial and services sectors, 2018



Source: MINEM

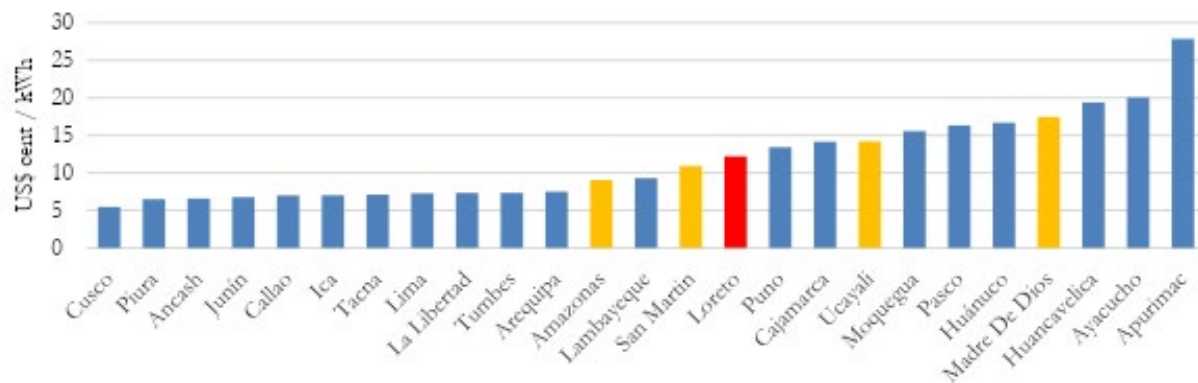
Figure 30: Average price of electricity for the residential sector, 2018



Source: MINEM

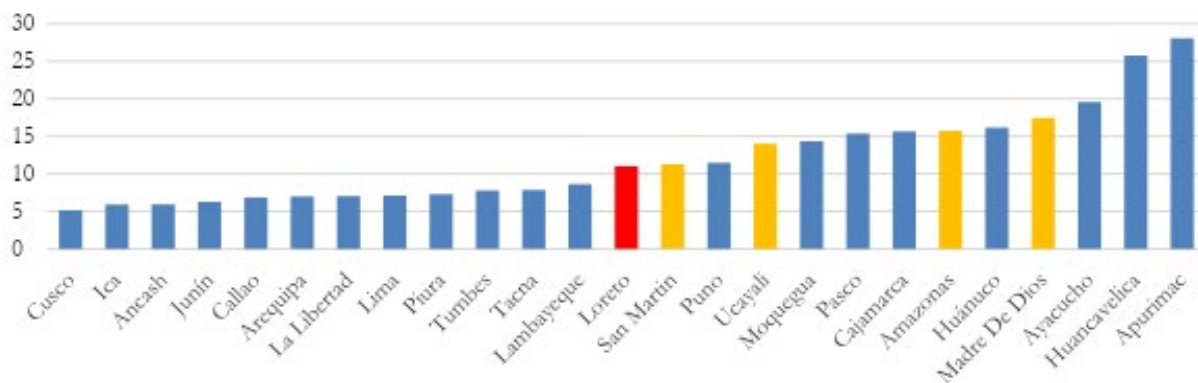
Mining and oil activities increase the average cost of electricity for the industrial sector. When these sectors are excluded, the average cost of electricity for the other industrial sectors is relatively lower – especially for the manufacturing sector. As portrayed in Figure 31, excluding these activities takes Loreto down in the rank of more expensive energy for the industrial sector from fourth (Figure 28) to eleventh. As shown by Figure 32, prices for the manufacturing sector – excluding oil and mining – are similar to the national median and cheaper in Loreto than in all the Amazonian regions.

Figure 31: Average price of electricity for the industrial sector, excluding mining and oil, 2018



Source: MINEM

Figure 32: Average price of electricity for the manufacturing sector, 2018

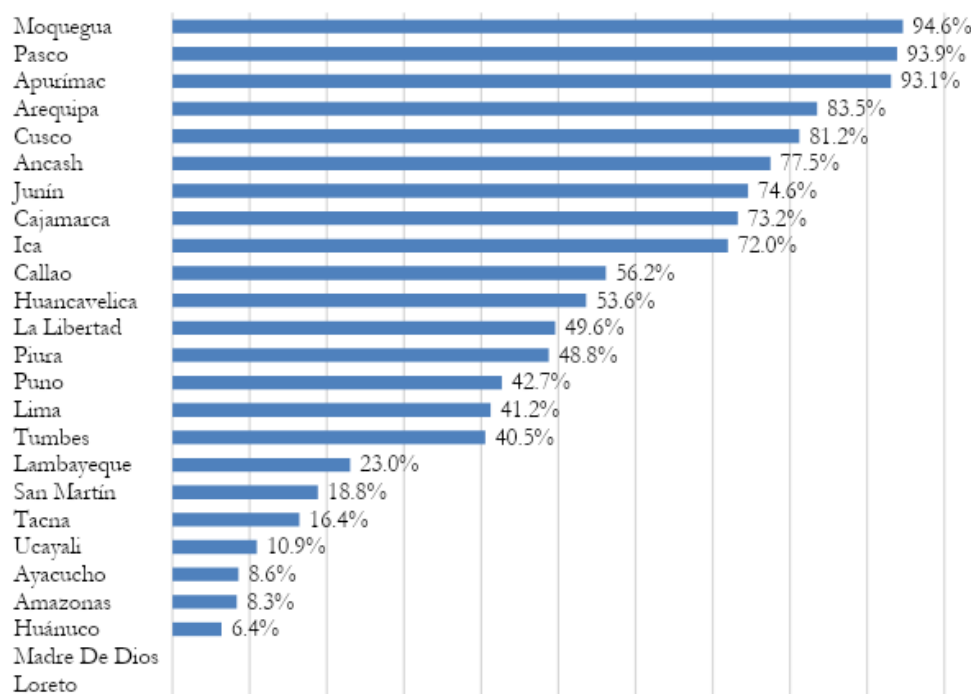


Source: MINEM

In the Peruvian electricity market, a small set of agents buy electricity at the “free” fare (unregulated) and consume more than half the country’s energy. However, this practice has not extended to Loreto and Madre de Dios, where there are no companies big enough to pay the unregulated fare. In 2018, 1,834 final customers (0.02% of the total) bought 26,716 GWh of electricity (58% of the total) from private generators and distributors, through public contracts that are accessible through the website of OSINERGMIN. Figure 33 – which shows the share of electricity sales per state from unregulated clients– indicates that the share of firms buying electricity at the unregulated fare is relatively low in all the Amazonian states; not a single energy contract at unregulated fare in Loreto.



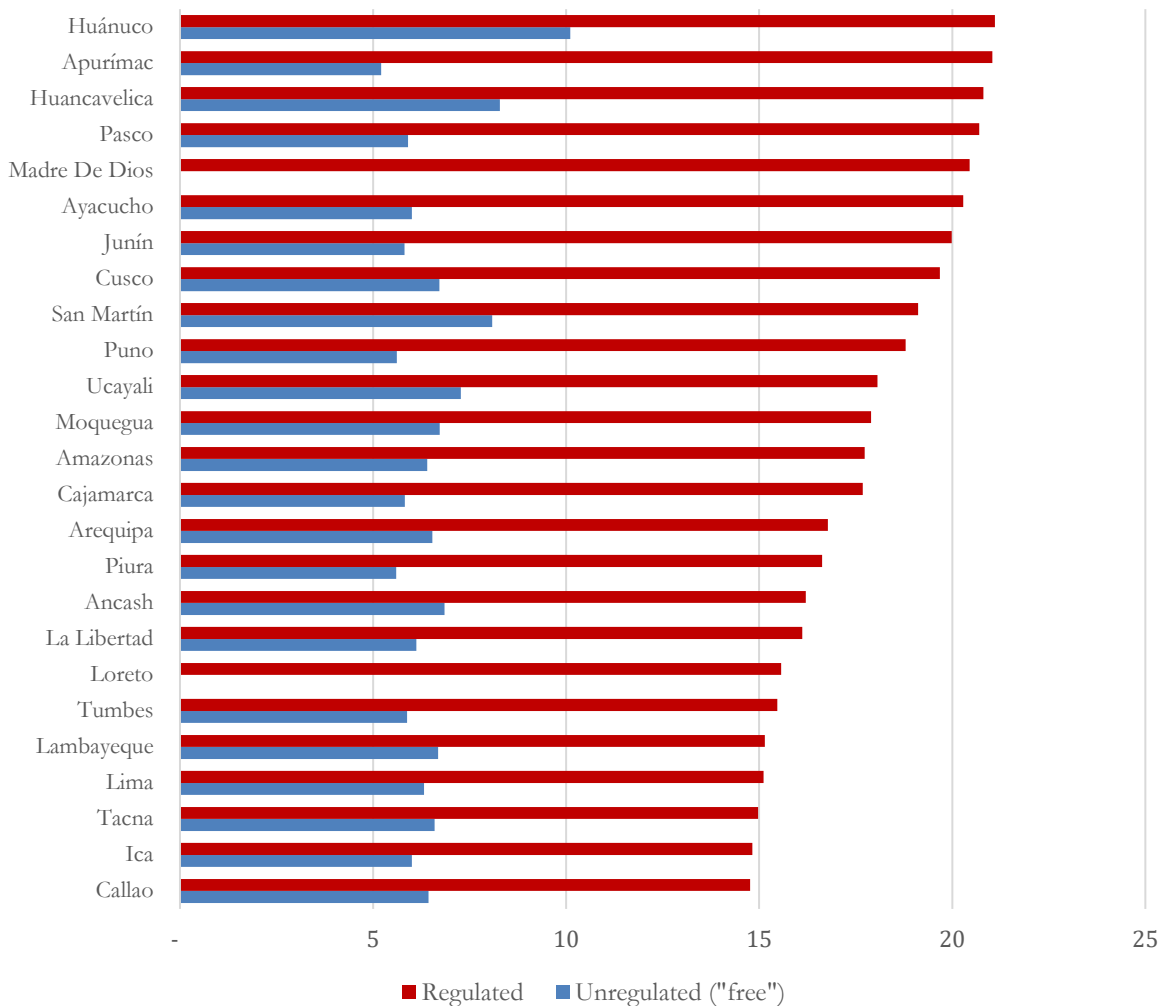
Figure 33: Sales of unregulated energy (% of the total), 2018



Source: MINEM, authors' calculations.

**At the time of writing this report, the average fare of unregulated energy is way lower than the regulated fare, due to oversupply in the Peruvian market.** While the average unregulated fare of electricity is 6 US\$ cents per kWh, the regulated average regulated fare is 16 US\$ cents – 152% higher. The gap between the average unregulated fare and the regulated fare varies in every region (see Figure 34). As supply and demand in the power market regain equilibrium, it is likely that the gap between the two fares closes again.

Figure 34: Average fare, regulated and unregulated (“free”) (US\$ cent/kWh), 2018

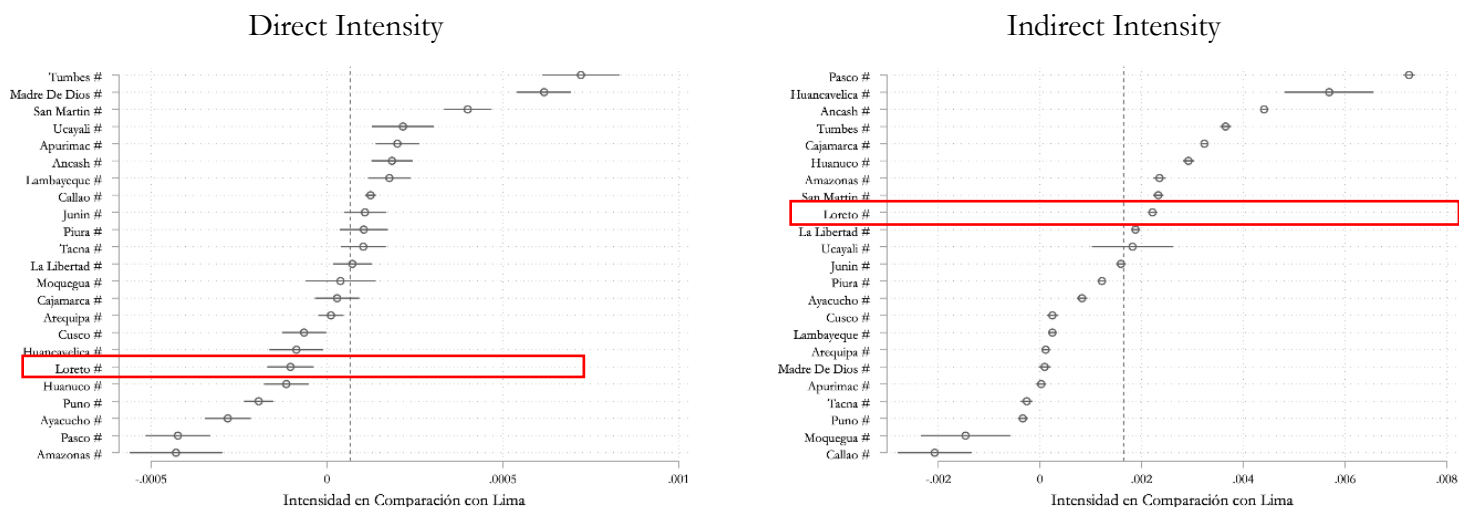


Source: MINEM

**In Loreto, manufacturing companies tend to be more intensive in energy use than in the rest of Peru, which would suggest that the cost of electricity is not a constraint for the firms in that sector.**<sup>22</sup> For the rest of the industries, the results are less informative. Figure 35 and Figure 36 rank Peruvian regions from most to least intensive in electricity for all companies and for the subset of manufacturing firms. The results of our analysis for all companies (Figure 35) are somewhat mixed and therefore less informative: firms in Loreto tend to be less intensive in the use of electricity when measured in direct terms, but more intensive when indirect impacts are included. In the case of the manufacturing sector (Figure 36), the evidence is more conclusive, as firms in Loreto tend to be more intensive in the use of electricity than the national average, regardless of whether we measure in direct or indirect terms.

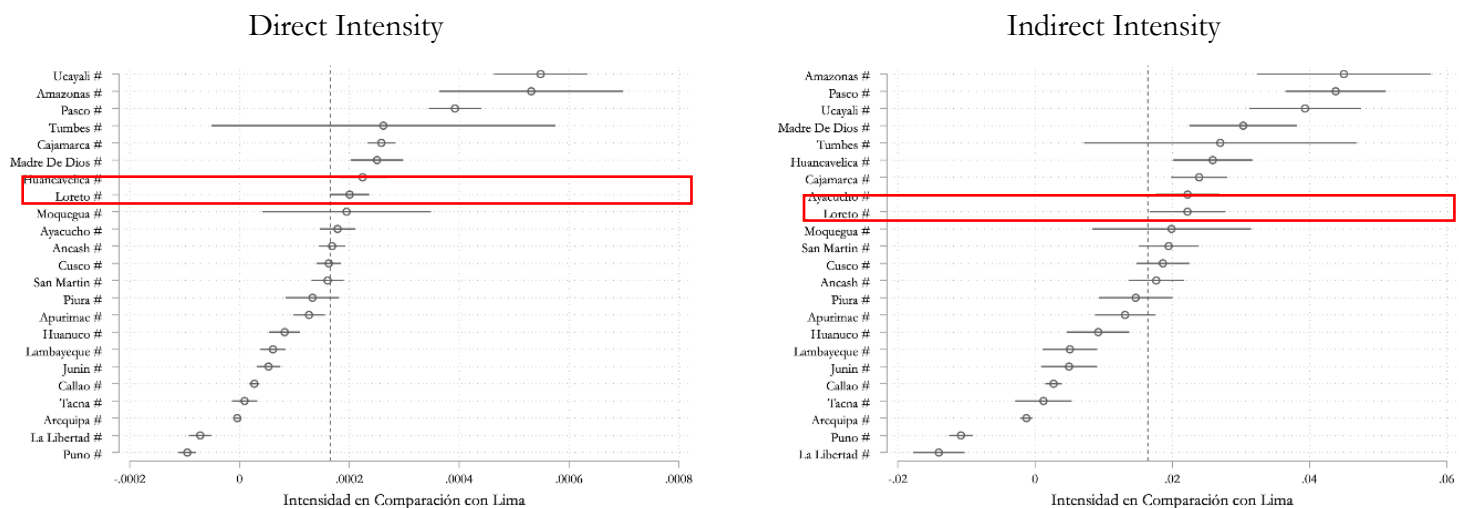
<sup>22</sup> Appendix 1 explains how we measure the intensity of the state on an input, and the analysis' methodology.

Figure 35: Intensity in the use of electricity of regions in Peru (all companies)



Source: Dun and Bradstreet 2019, BEA 2012, ENAHO, prepared by the authors.

Figure 36: Intensity in the use of electricity in regions of Peru (manufacturing companies)



Source: Dun and Bradstreet 2019, BEA 2012, ENAHO, prepared by the authors.

**Companies participating in the ENE survey did not rate positively the quality of the electricity services in Loreto.** In 2015, 80% of surveyed companies reported that unscheduled interruptions in electricity services were among the main problems of the sector main problems, compared to 61% in the other Amazonian states and 32% in the rest of Peru. However, changes in the power generator in Iquitos in the last 5 years have improved the quality of the service. Power cuts in Loreto now tend to last less than in the other Amazonian states and the rest of Peru. *Electro Oriente* is no longer the main power generator in Iquitos, where most of the surveyed companies are based. A new company, GENRENT, became the main electricity provider in 2016 and 2017 and since then, according to interviewed companies, the quality of the service has improved significantly.

**These symptoms would suggest that electricity – both access and costs – is not a binding constraint for the economic activity in Loreto.** Beyond the segments of mining and oil, prices (regulated) are not high with respect to the Peruvian averages. Industries located in Loreto tend to be more intensive in electricity than the national average. Besides, just 4.5% of companies in the region consider electricity as one of the main obstacles to their growth.

**Nevertheless, these results and conclusions must be pondered carefully, in a market with regulated fares that do not reflect the long-term marginal costs of providing the service.** It is remarkable that no company in Loreto demands enough power to fall into the segment of the non-regulated fare. This suggests that, given that Loreto depends on one of the more expensive, volatile and pollutant sources of electricity, local companies benefit from a cross-subsidy coming from the rest of the country to Loreto. That, in turn, should stimulate the presence of industries that use power with higher intensity.

**Electricity in Loreto probably has a more strategic role in its sustainable development than what our initial analysis suggests.** The absence of companies with enough demand to pay the unregulated fare indicates that the marginal cost of electricity may be constraining investment and growth for existing companies, and more importantly, to the establishment of industries that tend to organize around bigger firms.

**Switching generation from oil-based to cleaner energy sources of electricity generation may well be the cornerstone of Loreto's sustainable growth strategy.** First, it would free oil production and increase the region's oil exports. Second, it would contribute to reducing the environmental pollution caused by relying on oil-based generation. Finally, it could have a significant impact in Loreto's productive ecosystem, by lifting constraints to the appearance of industries that tend to organize around firms of larger size, more intensive in the use of electricity.

### 3.3 Transport and Logistics

#### **Loreto's geographic isolation poses significant barriers to the transport of goods and people.**

As previously mentioned, the Region's capital Iquitos is closer to the border with Brazil and Colombia than to other Peruvian cities connected to network of national highways. Yurimaguas and Pucallpa, the more proximate state capitals, are ~400 km (3–4 days by boat) and ~530 km away (4–7 days by boat) in lineal distance, respectively. Transport in Loreto can be analyzed in three dimensions: 1) the route, from Iquitos to Lima or within Loreto from Iquitos; 2) the modality of transportation, plane, or boat, and 3) the type of cargo, people or merchandised goods (Figure 37).

**Figure 37: Stylized Facts on the Movements of People and Goods in Loreto**

	Fluvial Transport	Air Transport
Outbound: Between Lima (or rest of Peru) and Iquitos	- Cargo vessels - Precarious passenger ferries	- Daily passenger flights with cargo capacity
Within: Between Iquitos and the rest of Loreto	- Small vessels for passengers and cargo	- Limited availability to selected destinations with little capacity for cargo and passengers

Source: Prepared by the authors.

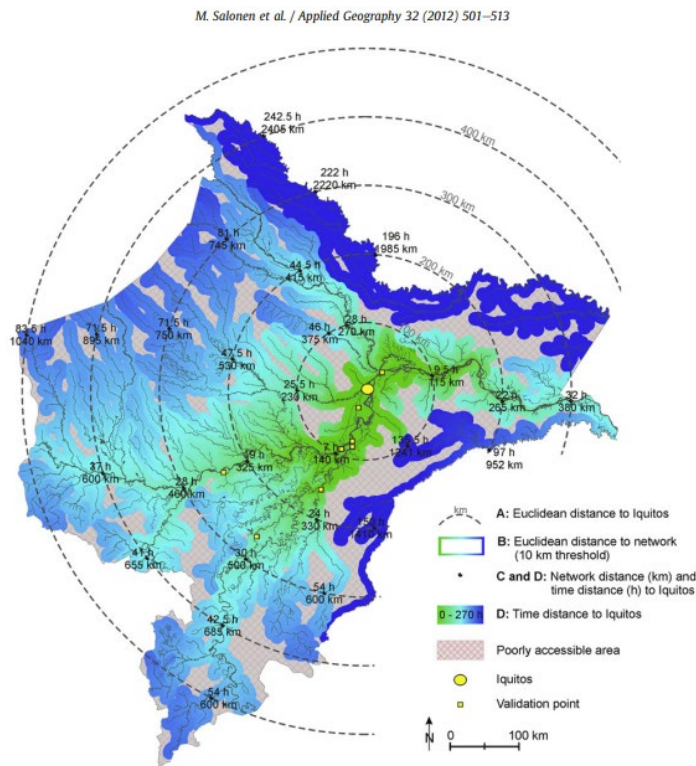
**In this section, we discuss the problems associated with each combination of route, modality of transportation, and cargo, analyzing their impacts.** In general, fluvial transportation between Iquitos and its main connections with the rest of the country – Pucallpa and Yurimaguas – is well developed in relative terms, with non-perishable goods being transported in cargo vessels and passengers in informal ferries. Air transport between Iquitos and the rest of the country is composed of frequent flights, which go to Lima and Cusco and have cargo capacity for merchandised goods. Transportation between Iquitos and the rest of Loreto has severe constraints due to the time required to navigate through the rivers, which severely limits the movement of people and merchandised goods. Air transport between Iquitos and the rest of Loreto is limited to flights in small planes to four destinations. These flights are subsidized by the government and have a restricted capacity for passengers and cargo.

#### 3.3.1 Fluvial transport

**Academic studies on mobility in Loreto have documented that the region's isolation is better expressed in terms of time needed for traveling than in monetary costs.** According to Maria Salonen et al (2012), decisions made by citizens of Loreto are mainly determined by navigation times and access to regions within the state. The authors highlight that 90% of cargo and passenger traffic occurs in the river system of Loreto and that fluvial transportation is way more dynamic than by land, even if it's subject to the ups-and-downs of the river's flows and volume, as well as its sinuous course. They describe the transportation system of Loreto as a series of concentric circles (see Figure 38) and make emphasis that the network distance – not the Euclidean distance – is the right measure to capture the distance between two points for the region. While the concentric circle closer to Iquitos is

characterized by a high traffic of vessels and the use of the *peque-peque* – a slow boat with little capacity for cargo – the external circles are characterized by bigger ships for longer trips.

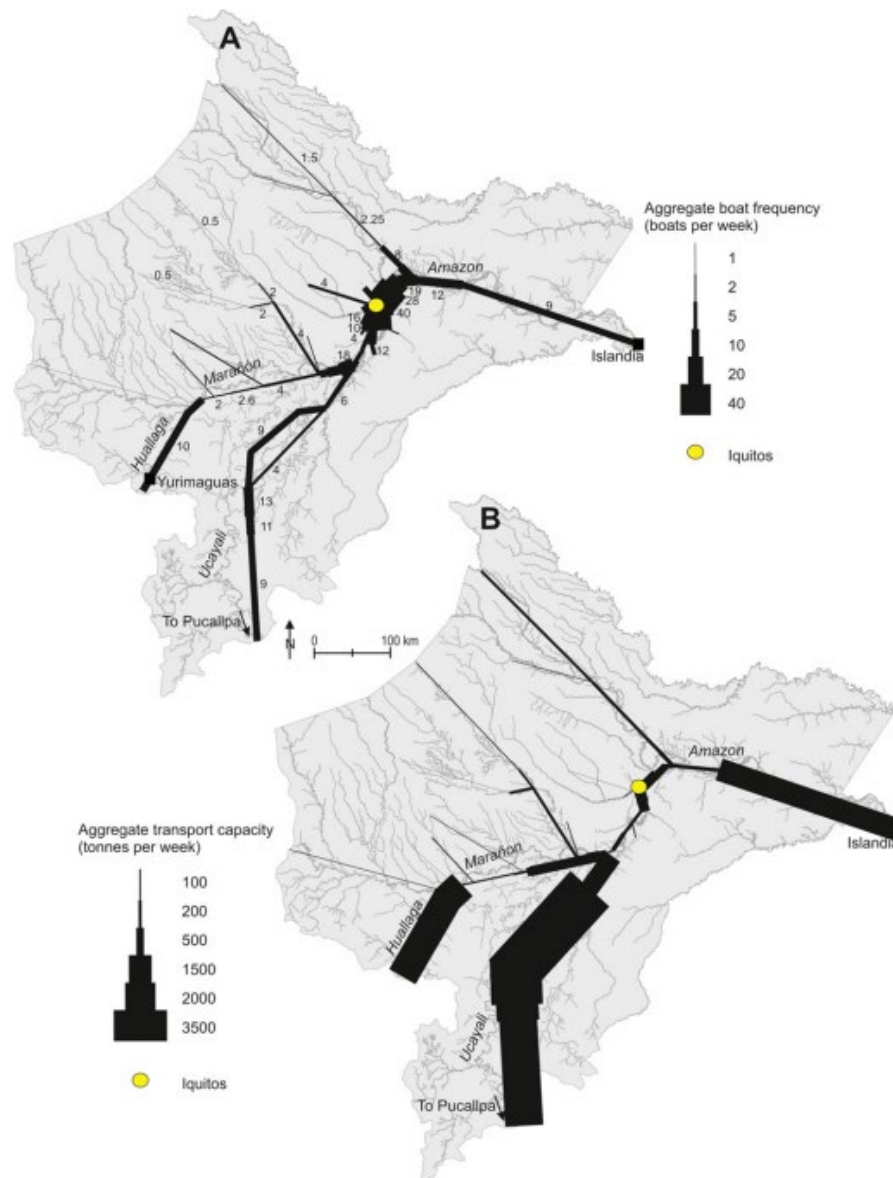
**Figure 38: Navigation times in concentric circles around Iquitos**



Source: Maria Salonen, Tuuli Toivonen, Jean-Michel Cohalan, Oliver T. Coomes (2012).

The authors' descriptions of the quantity of boats navigating in all those rivers and their different cargo capacities indicate that the route with higher cargo traffic is – by a significant margin – is Pucallpa-Nauta (from there cargo continues by road to Iquitos), followed by the route Yurimaguas-Nauta (see Figure 39). They highlighted that beyond these very frequented routes, the volume of commercial exchange is highly restricted, not only by distance but also by the unpredictable frequency of boats. From that study, we can derive two important conclusions for Loreto's sustainable development strategy: 1) accessibility to land is linked to the relative intensity of demand on its use, and 2) people in less isolated areas, with shorter transportation times, can produce a wider variety of goods.

Figure 39: Number of vessels and cargo capacity per trip



Source: Maria Salonen, Tuuli Toivonen, Jean-Michel Cohalan, Oliver T. Coomes (2012).

**The cost and time of transportation between Pucallpa and Iquitos varies with the stage and the direction of the river.** In his 2011 study, Francisco Luis Pereyra Reátegui documented that moving a metric ton from Iquitos to Pucallpa, navigating against the current in high season (high water levels), takes 130 hours and consumes 3,400 gallons of gas, while the same distance against the current in low season (low water levels) takes 150 hours and 3,900 gallons. From Pucallpa to Iquitos, navigating with the current, takes 72 hours and consumes 1,000 gallons of gas, whereas the other way around (Iquitos-Pucallpa) takes 96 hours and 1,400 gallons. Despite that, the trip Iquitos-Pucallpa costs significantly less, regardless of whether the navigation takes place with high (25% less) or low



(30% less) water levels. Thus, according to this study, taking a ton of cargo from Pucallpa to Iquitos is more expensive than taking it from Iquitos to Pucallpa, even if the first route takes significantly less time and less fuel. If this is true, it suggests there is an implicit cross-subsidy to those moving merchandise from Iquitos to Pucallpa (exporters), which is covered by those moving merchandise in the opposite direction (importers). This stylized fact is consistent with the anecdotes we heard in interviews and informal conversations in the region about cargo boats that arrive in Iquitos full of goods and leave empty. It is also consistent with a situation where the companies have market power and can discriminate prices, charging a premium where demand is more inelastic – in this case on importers.

**The price estimates we collected in interviews, also reported by other sources, indicate that moving a kilo of cargo between Lima and Iquitos (through Pucallpa) costs from ten to fifteen cents of US dollar (US¢/) per kilo. Compared to other transportation modes, the monetary cost of the fluvial transport of goods is relatively low.** A transport company we interviewed reported that a ton of cargo from Lima to Iquitos, with a time of 20 days, costs 15 cents (US¢). Another company offering the same trip for 10 US¢/kg, in 12 days (three on land and the rest in loading, unloading and navigation). These figures are consistent with reports from other sources, such as Mendoza and Gallardo (2012). In their study, the authors describe that a manufacturing company in Iquitos needed approximately 13 US¢/kg to move cargo in the same route.<sup>23</sup> These quotes are consistent with the statistics from the Bureau of Transportation Statistics of the United States, according to which transporting one kilo for 530 km (the linear distance between Pucallpa and Iquitos) would cost 9,8 US¢/kg at the average price. In general, the cost of fluvial transport is lower per kilo-kilometer than land transport (rail or truck) and way lower than the cost of air transport, which ranges from 12 to 16 times higher.<sup>24</sup>

**Between Iquitos and the rest of Loreto, particularly on less demanded routes, the transport market is dominated by informal providers and displays a significant price dispersion.** Alvarez Gomez (2009) collected information from 407 cargo shipments in 60 agricultural products in Loreto, where prices were quoted in measurements such as “bags, boxes, buckets.” To analyze them, one must homogenize the fares to a unique measure of soles per ton. It must be said that, by doing this conversion, the fare in soles per kilo shows a large dispersion in similar distances on the Ucayali River (see Figure 40), with shipments valued at a broad range going from 200 to 800 soles/ton. This volatility – in this market segment – is consistent with the irregularity of the conditions surrounding the shipment, as the availability of boats varies with the water levels of the river and other specific factors, which are difficult to predict.

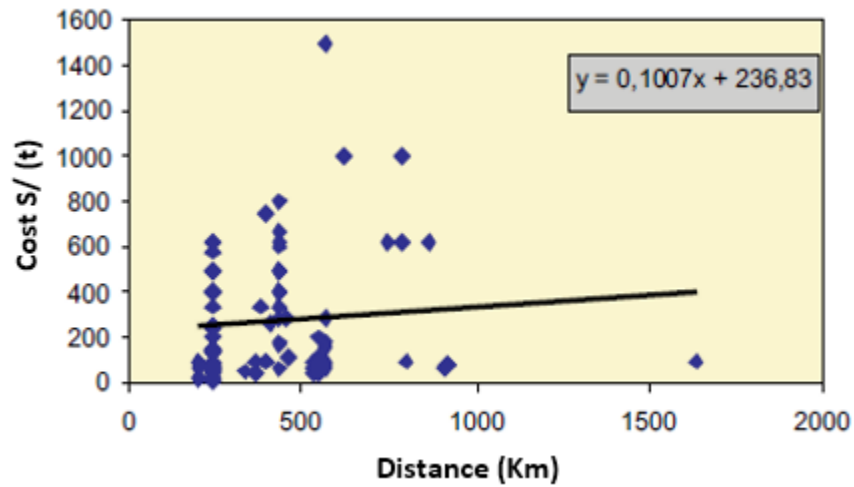
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<sup>23</sup> According to the authors, by 2012 a manufacturing company needed 7,700 soles to move a 40-feet container from China to Peru; 4,100 soles to move cargo from the Callao port to Pucallpa, and another 4,500 soles from Pucallpa to Iquitos. This approximately implies that a ton cost 366 soles from China to Callao, 195 soles from Callao to Pucallpa and 214 soles from Pucallpa to Iquitos, under the following assumptions: the standard 40-feet container (with a maximum cargo of 28 tons), traveling at 90% of capacity, calculated using the average exchange rate in 2012 (2.65 soles per dollar).

<sup>24</sup> “Air freight: a market study with implications for landlocked countries” (2009).



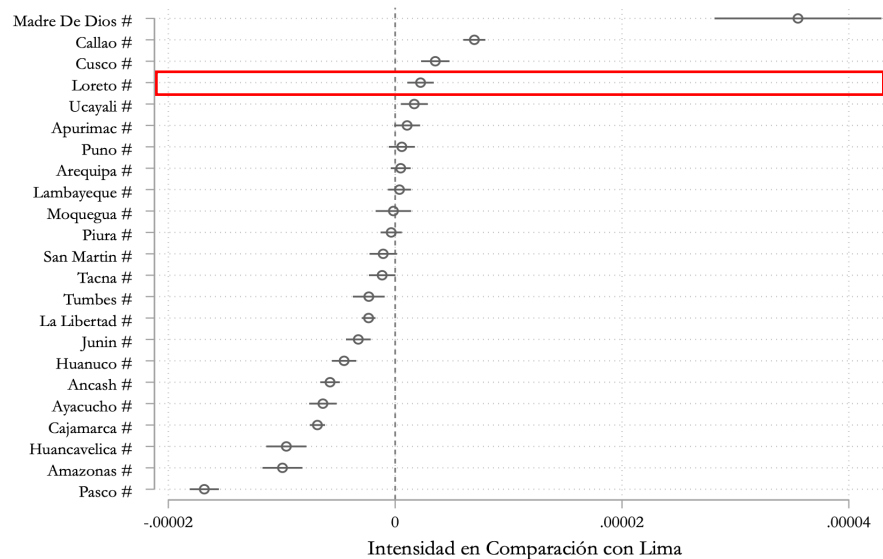
Figure 40: Cost per ton of transport in the Ucayali River



Source: Luis Álvarez Gómez (2009).

As expected, our analysis of input intensity concludes that Loreto is more intensive in fluvial transportation than the rest of Peru. As shown in Figure 41, Loreto is the third region in the country with the highest intensity in fluvial transport.<sup>25</sup>

Figure 41: Intensity in the use of fluvial transport in Peruvian Regions



Source: Dun and Bradstreet 2019, BEA 2012, ENAHO, prepared by the authors.

<sup>25</sup> See Appendix 1 for further detail on the intensity measures and the methodology used.

### 3.3.2 Air Transport

**Air tickets between Iquitos and Lima are not expensive in relative terms.** To measure the cost of air tickets, our team collected the prices in *Google Flights* for the flights from Lima to Iquitos, Arequipa, Cusco, Pucallpa, Trujillo, and Piura; six regional capitals with significant air traffic. More specifically, we considered the price of the cheaper ticket from each day from April to June 2020 for each route, acquired within three to four months in advance. The result is that the average price in dollars of the Lima-Iquitos flight is US\$ 24.3, lower than Lima-Trujillo (US\$ 29.8), Lima-Pucallpa (US\$ 28.4), and Lima-Arequipa (US\$ 25.6), but higher than Lima-Cusco (21.5).<sup>26</sup>

**Within Loreto, passenger air mobility is subsidized, with destinations reduced to four routes.** Since 2015, there have been flights between Iquitos and El Estrecho (to the North), Caballococha (to the East), and Gueppi (to the Northwest) and Colonia Angamos (to the Southeast), partially subsidized by the Ministry of Transport and Communications and operated by small planes with less than twenty seats.<sup>27</sup> The subsidy is granted under the Inclusion Program for the Amazon Law (Law N°. 29159) and the amount of this subsidy is determined based on studies made by the General Direction of Civil Aeronautics.<sup>28</sup> In 2019, 29,940 tickets were sold with the subsidy of up to 60% for transportation in those routes. As in Loreto, the Ministry subsidizes local flights in Amazonas, Ucayali, and San Martín.

**Moving cargo by plane from Loreto costs between 3-5 US dollars per kilogram and makes economic sense only for high-valued merchandise.** This price is within the standards of the air transportation industry, where the cost typically goes from 1.50 to 4.50 dollars per kilogram.<sup>29</sup> A factor reducing the price for air transport on of goods from Iquitos (e.g., for exporters) is the fact that passenger planes can bring perishable products (fruit and vegetables) and—as happens with the vessels—are used to leave Iquitos with significant spare capacity. Despite that, the cost of air transport is still too high for most products that could be exported in that way.

### 3.3.3 Conclusions

**Transport and logistics for goods and people are a significant challenge for the economy of Loreto, in particular for the production and consumption of perishable goods.** Transport times through the river – especially between Iquitos and Yurimaguas and Pucallpa – impose diverse costs for companies and households that produce (or might produce) perishable goods. Besides monetary and indirect costs, the time of transit can result in the partial or total destruction of the merchandise's value. For producers of agricultural goods in Loreto, the volatility of fluvial transportation is a main constraint, and poses a significant barrier to the possibilities of producing and exporting perishable goods. For the rest of companies that produce non-perishable goods, transport is also an obstacle,

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<sup>26</sup> We also verified that this conclusion is not restricted to reservations booked with greater anticipation. Average price of the ticket in US dollars to Lima within 0-20 days of anticipation is 81.1 flying from Iquitos, lower than the 84.0 fare from Piura, but higher than the 51.7 fare from Cusco, the 58.9 fare from Arequipa, the 65.8 fare from Trujillo, and the 73.8 fare from Pucallpa, so the tickets purchased without anticipation have also reasonable prices.

<sup>27</sup> “MTC iniciará en julio vuelos subsidiados” (2015).

<sup>28</sup> “MTC subsidió 29.940 pasajes aéreos” (2020).

<sup>29</sup> “Air freight: a market study with implications for landlocked countries” (2009).

although not as significant. On one hand, transportation times impose additional financial costs on the companies, such as higher inventory costs – both in transit and on land – and storage costs, besides higher financial costs (interests) on higher investment in working capital. On the other hand, fluvial transport is relatively cheap, compared to other transportation modalities.

**The costs associated with transport and logistics from Loreto might have acted as a sort of effective tariff that has protected certain local industries.** Local providers could handle the demand with less efficiency than their potential competitors out of the region. This could explain the fact that Loreto has a more complex productive ecosystem than one would expect given its income level. If that is the case, removing a significant part of those costs through the implementation of a more efficient, less expensive, predictable, regular and with a higher transportation capacity system might be one of the strategies that could allow the region's industries to achieve the efficiency they need to sell their goods outside Loreto's boundaries, tapping into foreign demand – including international markets and other regions of Peru.

### 3.4 Communications

**The quality of telecommunications in Loreto is amongst the worst in Peru. Both the mobile signal and internet services exhibit deficiencies in both coverage and speed, particularly in rural areas.** Figure 42 shows cell phone coverage for the four main telephone operators in Peru (Entel, Claro, Movistar and Bitel) in the areas close to Iquitos, evidencing the deficiencies in the network coverage. In Yurimaguas, only Movistar offers coverage. In Nauta, close to Iquitos, there is coverage by all operators except Entel, as happens in Requena (except Claro). The research team could confirm these limitations when it visited the owners of several touristic lodges around Iquitos, traveling upstream on the Amazon River. After some kilometers of traveling, the phone signal was severely restricted and soon after disappeared completely, until the next segment of the river where cell phone coverage is available, Tamshiyacu, a small town about 35 kilometers from the city in lineal distance.

Figure 42: Map of Cellphone Coverage in Iquitos for the Four Main Mobile Operators



Source: nPerf<sup>30</sup>

**Internet services also have great limitations in the region.** Even if internet broadband speed doubled in 2019,<sup>31</sup> Loreto is not connected to the national optic fiber network and operates with a microwave network, which results in low download speeds. With those standards, it is hardly surprising that the region has only 13.4 connections of land internet, which translates into 81 people per connection, lower than the median (25) of the rest of Peru. These limitations are also evident in Iquitos, where the main hotels scarcely have a dedicated service of 10 Mbps for all guests, the best option offered by the telecom companies. With this bandwidth, instant messaging and email applications do function with a certain speed but downloading videos or files of big size requires long waiting times.

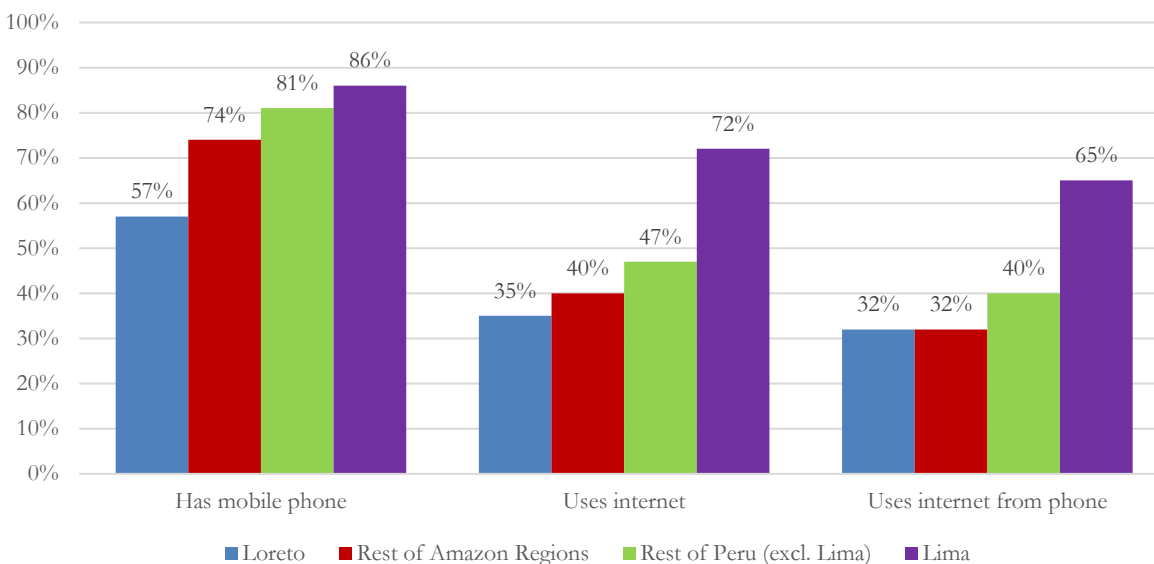
<sup>30</sup> Website: <https://www.nperf.com/en/map/PE/3696183.Iquitos/163659.Movistar-Movil/signal/?ll=-3.581954006425634&lg=-73.78280639648439&zoom=11>

<sup>31</sup> “Se duplica la velocidad de internet para telecomunicaciones en Iquitos” (2019).

**Authorities are aware of the dire state of telecommunications in Loreto and are implementing policies to address it.** At the time of writing this report, Ministry of Transports and Communications (MTC) was working with Proinversión to manage two new projects in Loreto. The first one of 306 million soles was part of an initiative to provide high-speed internet to the capitals of all provinces. This investment “will provide broadband internet to 319 public institutions in 274 places in the provinces of Alto Amazonas, Loreto, Maynas and Putumayo, benefiting 48 thousand people”.<sup>32</sup> The second project, 28.8 million soles, is related to the adjudication of a communications and internet network that would benefit 15,000 Loretanos in “43 places and 62 institutions”<sup>33</sup> in the district of Manseriche in the province Datem del Marañón. While these projects are completed, despite previous policy efforts, the telecommunications gap between Loreto and the rest of the country remains high.

**In line with these limitations, the use of internet and cell phones in Loreto is low compared to the rest of the country and other Amazonian states.** According to data from ENAHO in 2018, Loreto has one of the lowest rates of internet usage. Only 35.3% of Loretanos above the age of 15 use the internet at least once a month, compared to 39.9% of the population in the other Amazonian states, 47.4% in the rest of Peru excluding Lima, and 71.8% in Lima (see *Figure 43*). With respect to the use of mobile phones, 57.5% of Loretanos above the age of 15 own a cell phone, compared to 73.8% in the rest of the Peruvian Amazonia, 80.5% in the rest of Peru excluding Lima, and 86.3% in Lima.

**Figure 43: Digital communications use in Loreto and Peru**



Source: ENAHO (2018)

<sup>32</sup> “Región Loreto” (2019).

<sup>33</sup> Idem.

Despite the severe limitations for telecommunications in Loreto that we described, the research team did not find enough evidence to establish that internet and mobile services are among the main constraints for private investment in the region. During our meetings with companies in Loreto, all interviewees concurred in highlighting the low quality of the service, but in none of them, this condition was a significant obstacle for their growth plans. Improving the quality of this service would not necessarily greater relative investment, as in relative terms there may be other factors that are more binding which – if addressed – would have a bigger impact in the economy of Loreto. In the more remote areas, where the absence of coverage represents a great obstacle, the companies operating there – oil, lumber, and fluvial transport companies – have managed to overcome the lack of mobile signal by using radio systems, and satellite telephones, among other solutions.



## 4. LOW SOCIAL RETURNS: LACK OF HUMAN CAPITAL?

### 4.1 Level and Quality of Education

**Despite recent improvements in the quality of education in Peru, the country still ranks 67<sup>th</sup> among 79 countries in the OECD Program for International Student Assessment (PISA) exam, below Colombia, Mexico, Uruguay, and Chile, and all OECD countries.** Recent reforms in the national education system allowed Peru to improve its scores in PISA, a test that generates comparable information on education quality between several countries. Peru increased its scores from 2009 to 2018 in both reading and mathematics, going from 370 and 365 to 401 and 400, respectively. This is equivalent to an improvement of approximately 0.6 standard deviations. However, considering the average of the results in reading, math, and science for 2018, the country is still 86 points (or 1.6 standard deviations) below the average level of OECD countries.<sup>34</sup>

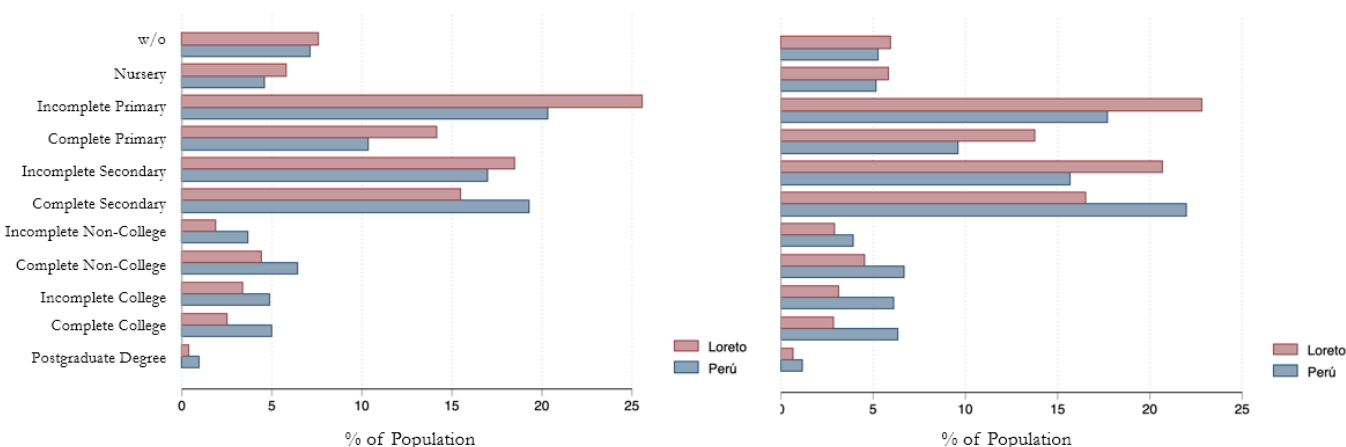
**Beyond improvements at the national level, there's still a large gap between Loreto and the rest of the country, both in terms of overall educational system and education level of its population.** Data obtained from the Statistics Unit for Educational Quality (ESCALE) of the Ministry of Education highlight the deficiencies of the education system in Loreto, especially from the middle school level and above. Attendance rates in early and primary education (79.0% and 91.7% respectively) are similar to national averages (80.1% and 90.8%), but from then onwards a significant gap shows up, with Loreto falling way behind the national median (68.7% versus 82.6%). The statistics also indicate that, compared to the national average, Loreto has gaps in underachievement (9.3% vs. 3.0% in primary; 11.4% vs. 5.1% in secondary) delay (18.1% vs. 6.5% in primary; 24.0% vs. 11.2% in secondary), and in the expenditure per student (in soles), which is lower than the national average in all levels (2,819 vs. 2,123 in primary; 3,673 vs. 2,963 in secondary).<sup>35</sup> In this context, it's not surprising that, on average, the population of Loreto has fewer years of education than the national average. Despite the guidelines of the Peruvian Constitution, according to which initial, primary, and secondary education are mandatory, in Loreto 32% of the economically active population (EAP) has no more than primary education, and only 46% has secondary or postsecondary education, which represents an important gap with the rest of the country, where only 24% of the EAP completed primary education or less, and 62% completed secondary or postsecondary education (Figure 44).

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<sup>34</sup> "Country Note: Peru" (2019).

<sup>35</sup> "Loreto: ¿Cómo vamos en educación?" (2017).

**Figure 44: Education levels – Loreto and Peru, 2010-2018**



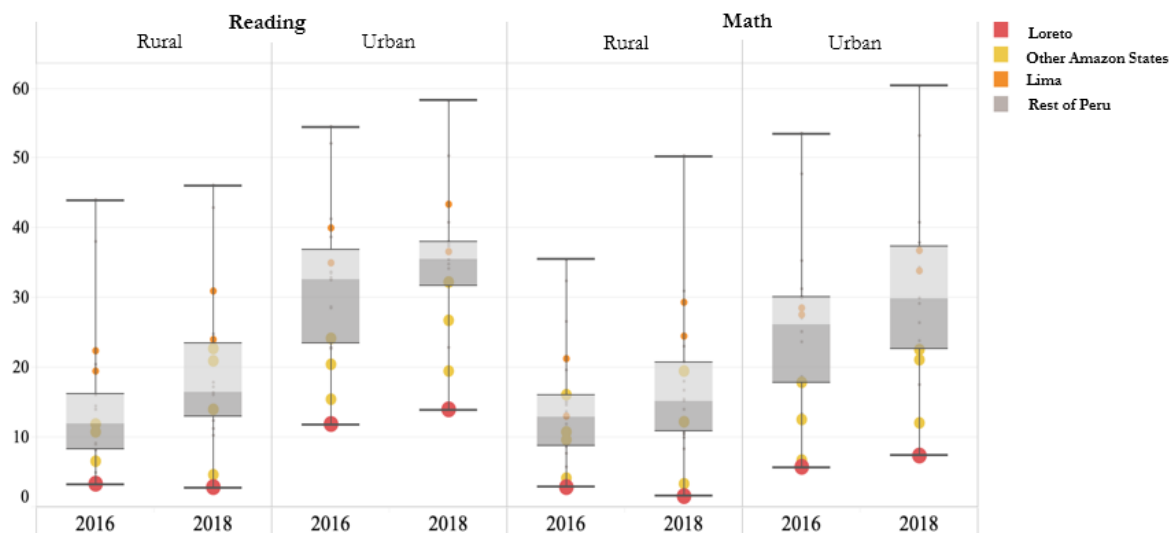
Source: ENAHO (2010, 2018).

**Together with the reported gap in years and levels of education, there is also a large gap with respect to the quality of education in Loreto.** Loreto is one of the states with the worst performance in the *Evaluación Censal de Estudiantes* that the Ministry of Education started in 2015 to assess the quality of education and knowledge of students nationwide. This exam measures the students of second and fourth grade in social sciences, math, science, and technology, and reading, classifying them into four categories, from the lowest (at the start of achievement) to the highest (satisfactory achievement). Loreto is within the lowest ten percent (amid the worst three) of all regions in terms of the proportion of students with satisfactory level in every one of the four tests, without distinguishing primary from secondary or rural from urban areas (see Figure 45).

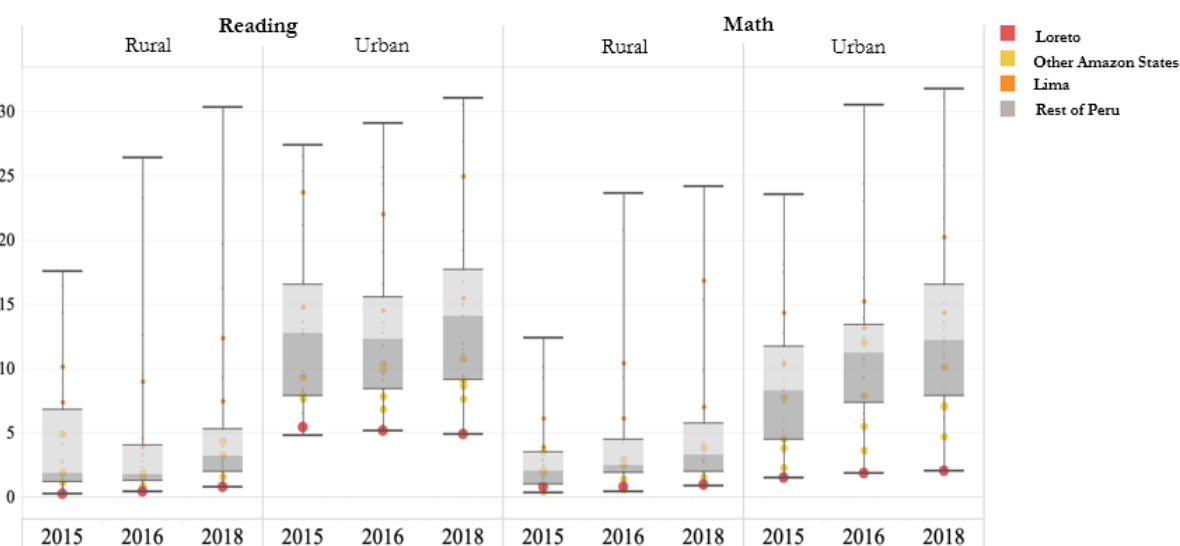


**Figure 45: Performance of census assessment of students**  
(% of students with a 'satisfactory' score)

### Primary Education



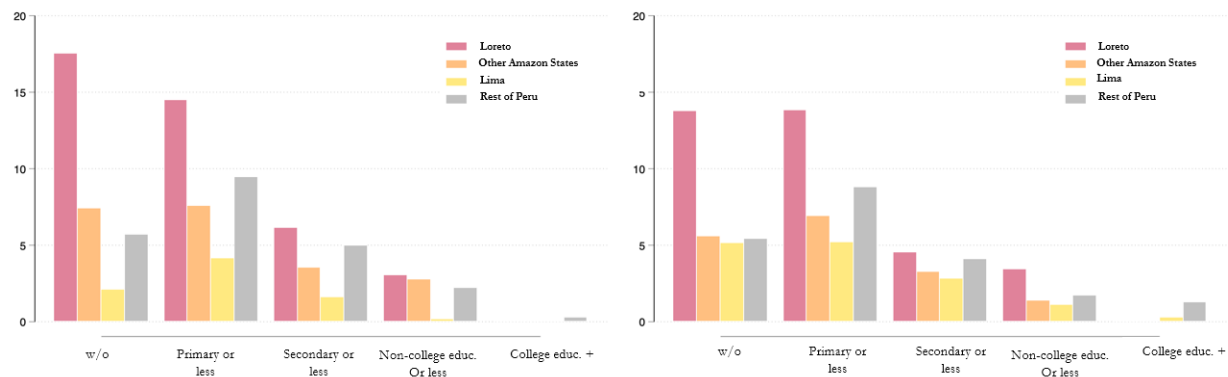
### Secondary Education



Source: Ministry of Education.

**Unemployment in Loreto is higher among citizens with lower education levels.** For citizens with no education, the unemployment rate is about 14%, in contrast with the 6% rate for the same group in the rest of the country. Additionally, Loretanos with primary education have an unemployment rate close to 14%, above the 8% registered in the rest of the country. These differences do not show up at secondary or higher education levels, where unemployment rates in Loreto are similar to those recorded in the rest of Peru (Figure 46).

**Figure 46: Unemployment by Level of Education, 2010-2018**

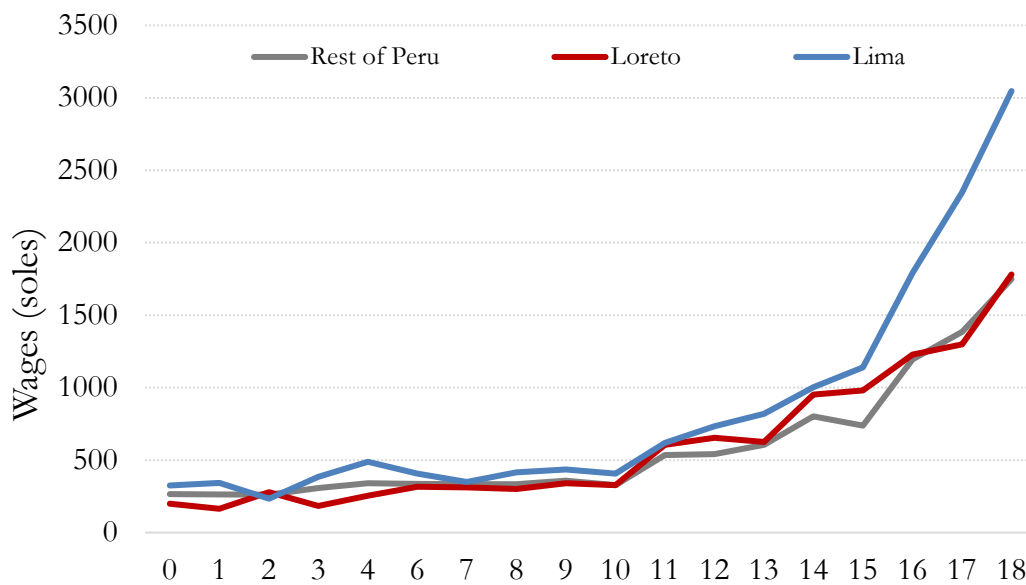


Source: ENAHO (2010, 2018).

## 4.2 Returns to Education

**Within the Peruvian job market, returns (wages) for post-secondary education are significantly higher than for primary and secondary.** Returns of education refer to the percentage increase in the net salary associated with each additional year of scholarship or education level in the job market. Figure 47 shows how the average wage increases with each year of primary and secondary education until the tenth year of education at an average of 5.2% per year. From then onwards, wage premiums per each additional year of postsecondary education accelerates at an average rate of 19.0%, going from 500-600 soles for ten years of schooling, to 1,500-3,000 soles for those with seventeen years. As expected, wages are higher in Lima than in Loreto and the rest of Peru, particularly when people reach the postgraduate level.

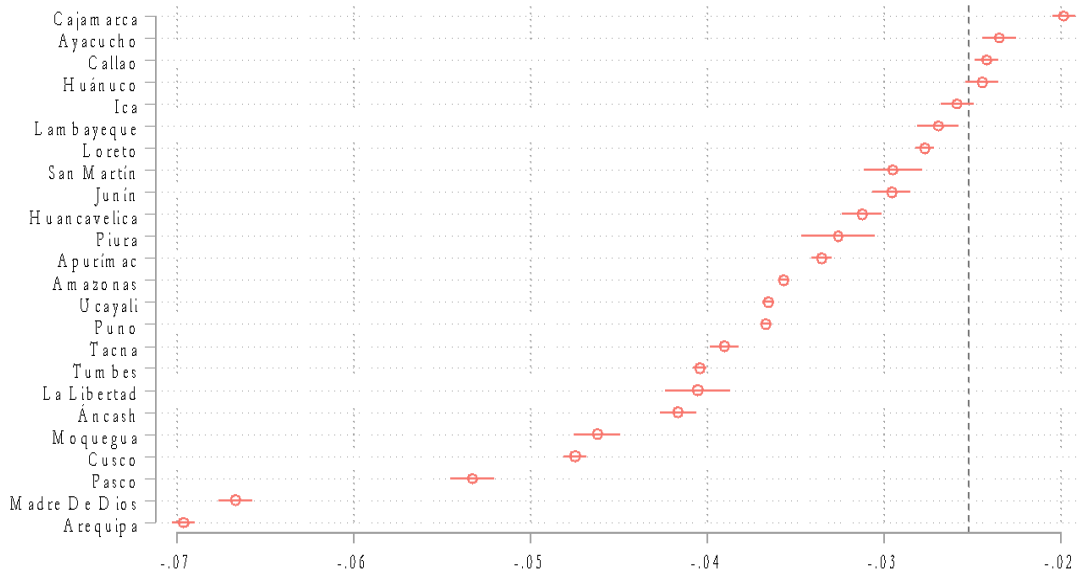
**Figure 47: Labor income per years of education, 2015-2018**



Source: ENAHO (2015-2018)

**Loreto displays average returns to schooling that are not significantly different from the rest of Peru when controlling for background and demographic characteristics, but there are remarkable variations between regions.** In Loreto, an additional year of education (at any level) is associated with a wage increase of 9.5%, controlling for work experience, gender, informality, and migratory status (whereas the individual works in the same place it was born). When fixed effects per region are included – which effectively control for all the other non-considered conditions that don't vary in the intra-state but vary between states – Loreto's coefficient (9.5%) is a bit higher than the average of the other Amazon states (8.7%), below the return of the rest of Peru (excluding the Amazon region, 10.1%), and lower than the average returns per year in Lima (12.9%). Figure 48 shows average returns to education per additional year of schooling for all Peruvian regions, controlling by all those factors and using Lima as a reference point. The fact most coefficients are negative indicates that few regions have average returns to education higher than Lima. The coefficient can also be interpreted as an indicator of qualified labor scarcity, which is expressed in each year of additional education of a worker. In that regard, Loreto is below the average, lower than the top seven regions (including Lima), and higher than the other seventeen regions of Peru.

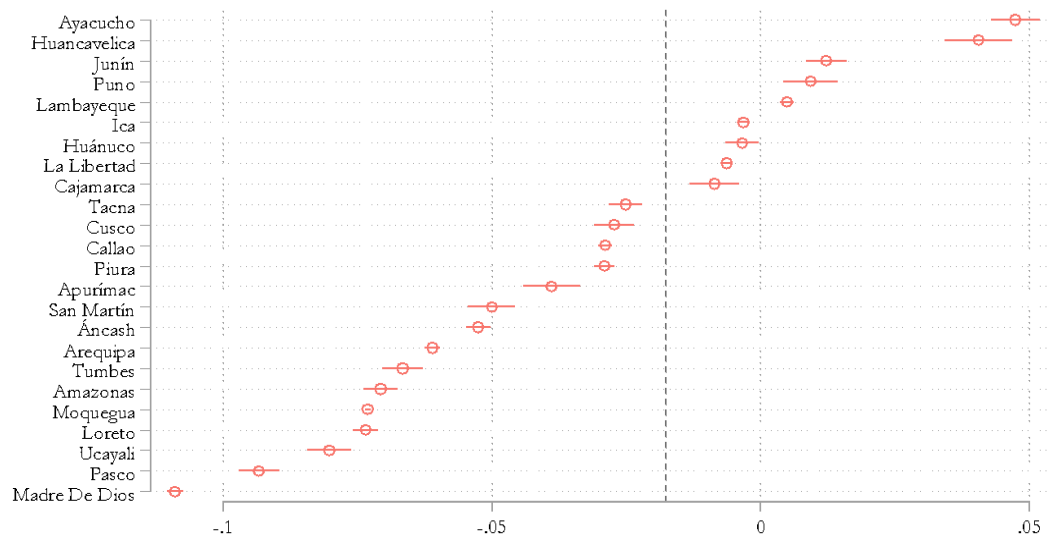
**Figure 48: Differential returns on schooling (with respect to Lima, 2015-2018)**



Source: ENAHO (2015-2018).

**Returns of each year of postsecondary education in Loreto are below the average of the rest of states in Peru.** Figure 49 shows the job remuneration associated with each additional year of postsecondary education for every state compared to Lima. A worker in Loreto earns a wage 16.1% higher, more than in the rest of the Amazon region (15.7%), but lower than the rest of Peru excepting Amazonas (17.7%) and way lower than in Lima (20.8%).

**Figure 49: Differential return for postsecondary education (with respect to Lima, 2015-2018)**

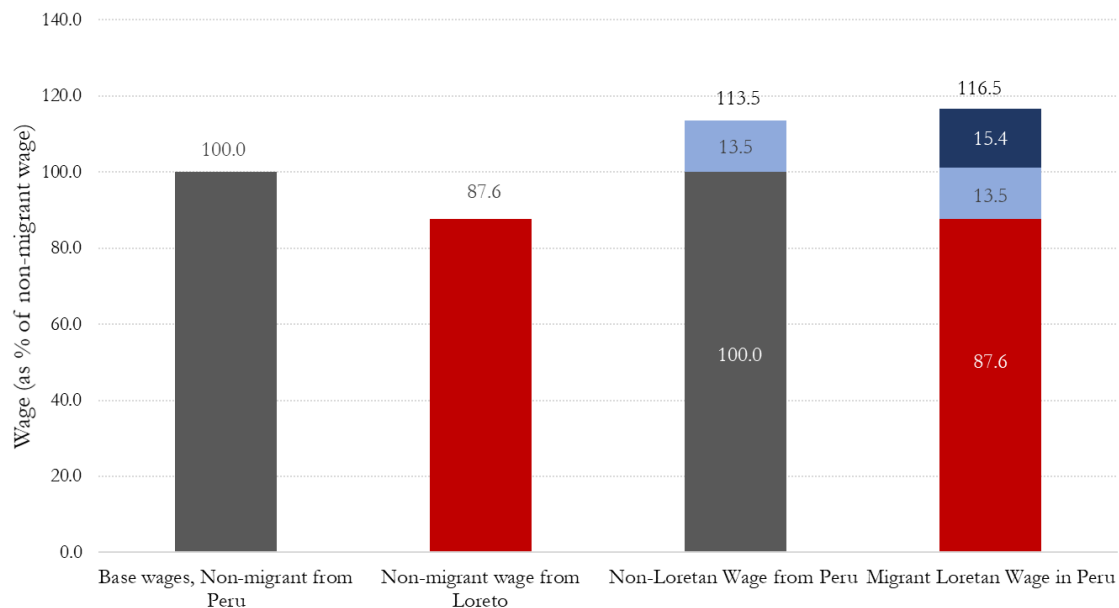


Source: ENAHO (2015-2018).

### 4.3 Human Capital in Migrant Loretanos

Workers with the same level of education which were born in Loreto but work in a different region earn more, on average, than workers who stayed in Loreto, suggesting that low wages in Loreto might be driven by place-specific conditions. When workers from Loreto migrate out of the state, they prove to be as productive (as measured by wages earned) as internal migrants from other regions.<sup>36</sup> As shown in Figure 50, migrants coming from Loreto tend to earn a premium above the wage they would earn back home (28.9%) which leaves them in a similar level – even slightly superior on average – to other domestic migrants’ with the same education years, experience, gender, and working condition (formal or informal), working in the same industry and the same occupation.

**Figure 50: Premium for migrant workers in Peru and Loreto, 2015-2018**



Source: ENAHO (2015-2018), own calculations.

### 4.4 Health in Loreto

**Health has important effects in households and workers, both in welfare and overall productivity.** It affects the educational performance of children, by impacting their ability to learn

<sup>36</sup> This phenomenon can be quantified with a regression that estimates how the salaries (in logarithms) of the respondents of ENAHO survey depend on their migratory status, controlling by scholarship years, work experience, gender, formality, industry, and occupation. See Statistical Appendix.

and accumulate knowledge, and thereby on the present and future productivity of workers. In this way, health acts as a complementary input to other forms of human capital.<sup>37</sup>

**Loreto is among the states with the worst health indicators in Peru.** According to data obtained from INEI, the region ranks high in mortality rate per 1,000 infants born alive, chronic malnourishment for five-year-old children or younger and reported cases of dengue fever and TB.<sup>38</sup> All this affects the citizens of Loreto through all the stages of life, reducing their performance at school<sup>39</sup> as well as their work productivity per fewer worked days, which impact their wages.<sup>40</sup>

**However, in the ranking of health infrastructure and doctors per capita, Loreto is closer to the national average and distant from the top places, which suggests problems of access or quality of health services.** The region's rankings on health indicators do not match its position in rankings of health infrastructure availability and medical attention. According to field interviews done by the Growth Lab team, the difficulties in access to health in Loreto are more associated by the limited geographical distribution of those resources and the difficulties of mobilizing patients to health centers.

#### 4.5 Conclusions

**Though health, and quality and quantity of education show lower levels in Loreto compared to the rest of Peru, it is unlikely that the lack of qualified labor is one of the most binding constraints to growth in the region.** Our empirical analysis has produced three fundamental pieces of evidence when it comes to diagnosing human capital as a potential binding constraint in Loreto. First, Loreto's workforce ranks among the lowest in education levels of all regions in Peru, in terms of years of schooling and quality. Second, though wages increase with the education level, premiums for postsecondary education are not higher in Loreto than in the rest of the country, which suggests that human capital is not relatively scarcer than in the other regions. Third, the education workers from Loreto receive – with all its deficiencies – enables them to get better paid jobs when they migrate out of Loreto, to the point that they tend to get paid slightly more than other domestic migrants with similar education, experience, gender, working condition (formal or informal), in the same industry and occupation. Considered together, these results suggest that the wage gap between Loreto and the rest of the country is not associated to individual factors (such as education, ability, or willingness to work), but rather that there is something in the region's productive ecosystem that prevents workers from being as productive (and therefore earn wages as good) as in other regions of Peru.

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<sup>37</sup> Bloom and Canning (2003).

<sup>38</sup> Source: INEI.

<sup>39</sup> Monge, A. et al. (2015).

<sup>40</sup> Bloom, D. et al. (2013).

## 5. LOW APPROPRIABILITY: GOVERNMENT FAILURE?

### 5.1 Taxes

**Loreto has a special fiscal regime, resulting in lower effective tax rates than in the rest of Peru.**

Loreto is exonerated from the general sales tax (IGV, 19% in the rest of the country), doesn't pay the selective consumption tax (ISC) for fuel (which is 0.30-0.39 soles a gallon for Diesel and 0.24 and 0.37 for industrial oil 6 and 500, respectively), and has a special rate of income tax for legal entities (IRPJ) of 5% for tourism, agriculture, forestry, fishery, and manufacturing companies involved in processing, transforming and commercializing Amazonian products (29.5% in the rest of the country and other activities in Loreto).<sup>41</sup> This special regime was created in 1999 to generate economic dynamism through public and private investment in the Peruvian Amazonia – also including to Madre de Dios, Ucayali, Amazonas and San Martin.<sup>42</sup>

**The fiscal regime stood unchanged until December 31<sup>st</sup> of 2019, when tributary refunds of IGV came to an end, as well as the exoneration of IGV for imports of consumer goods** (excepting products with tariff codes corresponding to machines, equipment and mechanical devises, machine parts, electric and electronic appliances, automobile, and car parts).<sup>43</sup> In exchange for eliminating those benefits, and following the policy implemented in San Martin in 2003 after the end of those same benefits, Loreto now gets an annual transfer of 200 million soles from the national government, for investment in infrastructure.

**Ending the refund increased the cost of imported supplies, which resulted in increased prices and had an incidence – depending on the demand elasticity in every case – on consumer's welfare and firms' profit margins.** The magnitude of the impact can be inferred from the data collected by SUNAT. In 2018 (the year before the change), 435 companies required tributary refunds for a total of 98.3 million soles, which represents approximately 1% of annual GVA in Loreto. The first 16 companies account for 50% of the total amount recognized by SUNAT; 75% if the first 57 companies are included. If the tributary incidence was absorbed in 100% by the consumers,<sup>44</sup> eliminating the refund represented a significant increase of the tax burden. However, the measure also opened fiscal space for executing public works, thanks to the annual transfer of 200 million soles, which indeed redistributed additional benefits compared to the previous regime (from consumers in general, to the recipients of public works contracts and the citizens potentially benefitted by the execution of those works). In any case, despite the impact of the modifications and their redistributing effects, Loreto still has a lower effective tax burden compared to the rest of Peru.

<sup>41</sup> "Recuadro 3" (n.d.).

<sup>42</sup> "Ley de Promoción de la Inversión en la Amazonía" (n.d.).

<sup>43</sup> "Ley que promueve la inversión y desarrollo de la región amazónica" (n.d.).

<sup>44</sup> This is an extreme assumption done with illustrative purposes, as it happens in cases where the demand curve is infinitely inelastic. The most likely is that tributary incidence is shared between the consumers (higher prices) and the producers (lower volumes).

The oil sector has generated, historically, from 10% to 35% of value-added in Loreto over the last decade, but only a fraction of those resources stays in the region through the oil canon. Oil companies operating in Loreto are registered and pay taxes in Lima, but 50% of the income tax and 18.75% of the production value goes back to Loreto through the oil Canon and Sobre canon, a mechanism used in Peru to grant direct benefits for the regions where extractive activities take place. The resources that go to the State must be destined to investment – not current expenditure – and are divided among the regional government (52% of the total), the local governments (42%), national universities (5%), and the research institute in the Amazon (3%).<sup>45</sup> The amount of transfers reached a historical maximum of 377 million soles in 2012 (see Figure 51), and shows a volatility consistent with that registered by oil prices and local production volumes.

**Figure 51: Oil Canon and Sobre canon Transfers (millions of current soles)**



Source: PeruPetro, prepared by the authors.

**Survey results and interviews with private sector companies suggest that taxes are not a differential constraint in Loreto.** The national enterprise survey from 2015 is prior to the elimination of the tributary benefits, thus must be interpreted with caution. From it, only 2.5% mentioned excessive tributary burden as a major obstacle for growth, while another 5.8% pointed at the excessive tributary regulation. In total, less than one out of ten companies mentioned issues related to taxes as the main obstacle for growth, a figure that suggests that there were other factors that were more binding for private activity in the context of Loreto. Similarly, from the 41 companies the Growth Lab interviewed over the course of this study (36 during the field visit and 5 through phone calls), only one (from the retail sector) mentioned the tax regime as an issue for sales growth.<sup>46</sup>

<sup>45</sup> “Transferencias por Tipo de Canon, Regalías, Participaciones y Otros” (2019).

<sup>46</sup> The company’s manager explained that eliminating the tributary refund brought a real increase in their costs. In this case, the sale price of the motorbikes is fixed by the headquarters for all Peru. That policy inhibits the transfer of



**It is not easy to determine to what extent Loreto is a net recipient of fiscal resources, but what is certain is that the non-oil economy gets more in fiscal transfers and expense from the national government than what it pays in taxes.** On one side, Loreto received 652 million soles for the local governments and the regional government in 2019 (without including the oil Canon and Sobrecanon, which added another 146 million soles). These amounts do not include transfers to other entities of Loreto (such as the EPS or the universities) or the indirect support the region receives via the budget of the ministries and other entities of the national government. Therefore, the 652 million soles represent the minimum benefit obtained by Loreto from the fiscal transfers coming from the national government. On the other hand, according to statistics from SUNAT, in 2019 Loreto only generated 301 million soles in non-oil taxes. The figure is also likely to be biased downwards, as some companies in Loreto are registered in Lima (or other fiscal jurisdictions) for reasons of convenience or cost, and the taxes they generate are accounted in the capital (not in Loreto). In any case, given the exemptions of IGV, ISC on fuel and the preferential rate on IRPJ, taxes paid by firms in Loreto are significantly lower than the resources it gets, which renders taxes an unlikely candidate for the most binding constraint.

**Overall, we have found no significant evidence suggesting that taxes – the tax burden or associated administrative procedures – are a binding constraint in Loreto.** Even with the end of the tributary refund, the tax burden in the state is low, thanks to the *Law to Promote Investment in the Amazon*.

## 5.2 Property Rights

**Property rights are the cornerstone of a market economy, and Loreto is not an exception.** When property rights are protected, economic agents have more certainty regarding their ability to appropriate the profits derived from their activities and have more incentives to continue investing. This is particularly true for the economic sectors that are intensive in the use of land or – more broadly – fixed assets.

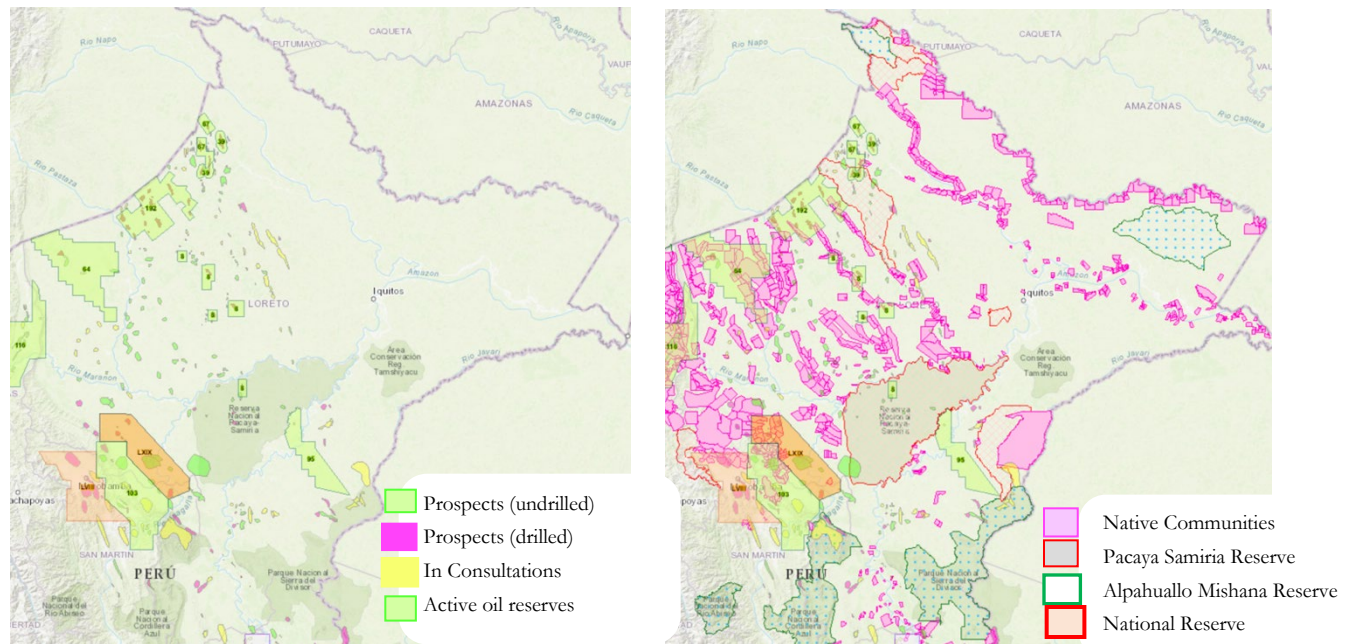
**Several studies show that the division of responsibilities among the local, regional, and national levels of government has been a significant issue when it comes to managing land in the Peruvian Amazonia.** While regional governments have the responsibility of recognizing the land of the native communities, the entity in charge of oil concessions at the central government level is Perupetro (Fernandini and Sousa, 2015). This division of responsibilities can result in coordination failures and overlaps in the granting of property rights. Even if public entities have been created to address public-private coordination issues, in practice, coordination is way harder (Kovacevic, 2014).

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incremental costs to consumers in Loreto, which had a significant impact on the profitability of the commercial operation in Iquitos.

In the following maps developed by Perupetro,<sup>47</sup> the overlap of oil plots and with the domains of native communities is evident.

**Figure 52: Oil lots and areas belonging to native communities in Loreto**



Source: PeruPetro.

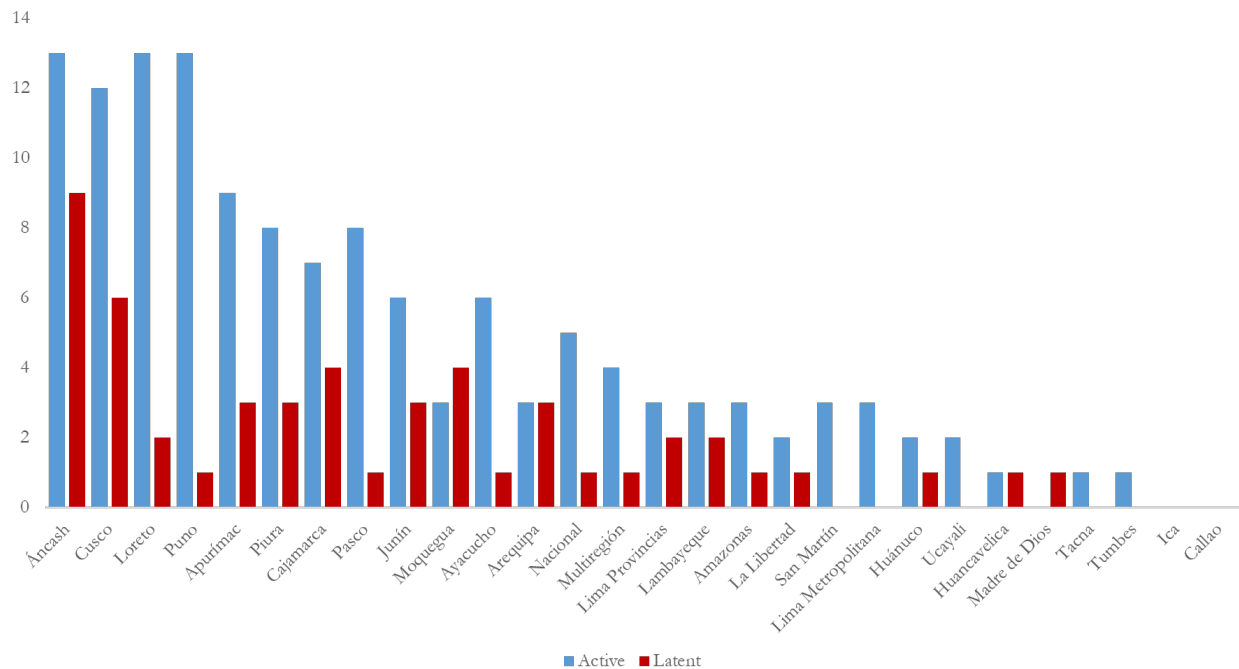
**The overlapping of native communities' territory, natural reserves and oil activities has contributed to increased social conflict, which has inhibited Loreto from realizing its full potential.** As shown in Figure 53, Loreto is one of the regions with highest levels of social conflict in Peru, with 13 active conflicts and two dormant by February 2020.<sup>48</sup> Eleven out of thirteen active conflicts have a social-environmental nature and are directly or indirectly related to the oil sector. Monterroso et. al (2019) stressed that conflicts around land permits and complaints about property right transfers are two of the main sources of tension between government officials and indigenous communities. Zamora and Monterroso (2019) provide testimonials from indigenous federations and NGOs that consider land concessions threaten the property rights of local communities. In addition, sabotages by third parties to oil pipelines in the native areas occurred during 2016 (Aguirre, 2019). The context around these episodes varies, but they also seem to be a mechanism to attract the attention of oil companies and the State to the problems in these areas and evidence how the distrust created by 40 years of oil exploitation without properly addressing the conflicts can become a significant constraint to the region's development.

<sup>47</sup> Access to the interactive map tool:

<https://perupetro.maps.arcgis.com/apps/webappviewer/index.html?id=6a830a470b934f0687c8ed84c2bacacc>

<sup>48</sup> "Reporte Mensual de Conflictos Sociales" (2020).

Figure 53: Number of Social Conflicts per state (November 2019)



Source: Defensoría del Pueblo, prepared by the authors.

**The government has implemented mechanisms aimed at addressing and mitigating conflict over the use of land, yet to show success.** After decades of conflict and distrust between communities and oil companies, the government introduced the process of ‘*Consulta Previa*’ in 2011 to allow the indigenous communities be consulted about the development of projects inside their established territories. This process includes making public the information about the project (30-60 days), a lapse for internal evaluation in the communities (30 days), and a dialog phase with the promoting governmental office (30 days), opening possibilities for negotiating modifications to the initial conditions and facilitating agreements to honor the rights of the communities. However, the results of these dialogs are not binding, and the State holds the right to decide how the project will be finally implemented (World Bank, 2016).

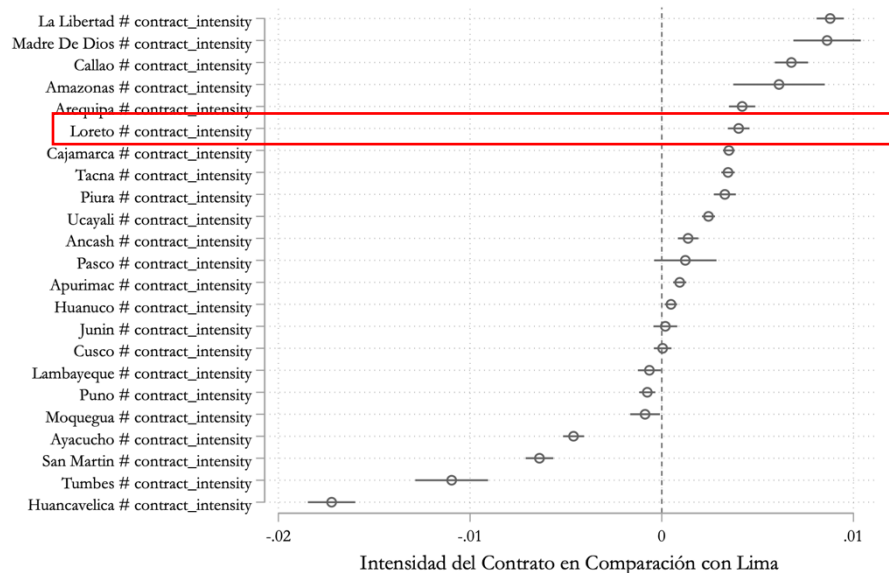
**Aside from issues with concessions granted in the jungle, there are also issues with property rights in urban areas and informal occupations – but they do not seem to be significantly more prevalent in Loreto when compared with the rest of Peru.** The large land lots surrounding Iquitos that were acquired at the beginning of the last century are semi-abandoned and under the informal possession of several settlements. Something similar happens in Yurimaguas, where there are also security and corruption issues associated to the commercialization of private land (Fachín Ruiz, 2019). As suggested by some authors (e.g., Salo et. al, 2011), illegal occupations might reduce demand for lumber concessions close to the urban areas of Loreto, compared to concessions located far from

them.<sup>49</sup> However, these troubles seem to affect very particularly the forestry and oil industries, and we have not found significant evidence that property rights issues are binding to the rest of economic activities in Loreto.

**Loreto's intensity in the use of contracts is higher than average, which is consistent with the fact that the institutional issues associated with property rights are an important constraint for certain industries in the region.** As shown in Figure 54 – which ranks Peruvian states ordered from more to less intensive in the use contracts – industries existing in Loreto are more contract intensive than the country's average, which suggests that companies use contracts as a tool to protect their interests from underlying conflicts, even if contract compliance isn't differentially more problematic.<sup>50</sup>

**In conclusion, property rights issues in Loreto seem to be particularly prevalent in the forestry and oil sectors, but we have not found evidence indicating that they are a differential constraint for the rest of the productive ecosystem.**

**Figure 54: Average intensity of Loreto in use of contracts in Peru**



Source: Nunn (2007), ENAHO, prepared by the authors.

<sup>49</sup> Salo et. al. speculate that another factor could make it more possible that lumber was exploited close to the cities. They found in their study that an “intermediate” distance of 500-700 km by river to the cities has bigger demand, because at that range companies can avoid problems but are still very close and can minimize the transportation costs of being too far from the cities.

<sup>50</sup> To define “intensity” in the use of contracts in an industry, we use the measure of Nathan Nunn (2007) (see Appendix 1 for further detail).

## 6. LOW APPROPRIABILITY: MARKET FAILURES?

The process of self-discovery— through which a place discovers which products and services can produce competitively — is one of the key drivers of productive diversification and structural transformation. Due to its nature, the process is usually subject to numerous failures that inhibit or delay the redeployment of existing productive capacities and knowhow into new industries with higher value added. The economic literature classifies them as either information failures, directly associated with lack of information in markets, and coordination failures between actors, mostly associated with governmental action (Hausmann and Rodrik, 2002).

**Information failures are related to the costs of discovering whether a new economic activity is profitable in a place.** A pioneer entrepreneur incurs in initial investment costs only to realize that in the process — in the case of success — he signals greater feasibility of the sector to potential competitors that then can enter the market by free riding on his initial investment. Given that its relatively easier to imitate a success after an initial discovery, pioneer entrepreneurs will tend to invest less than what would be socially optimal. Besides these failures of information and appropriability associated with private economic activity, there are also coordination failures that may inhibit the process of productive diversification. These failures tend to take place in the public sector (for instance, when there's no knowledge in the State about the public goods needed by new economic activities), between public sector institutions (when there is a need for consistency between regulations and supervision across different levels of the public administration, national, regional and municipal), or even between private firms (when there are several industries that depend on each other, but they are not able to coordinate their simultaneous investment to guarantee the provision of intermediate goods or other productive inputs).

**Self-discovery experiences are not unknown in Loreto's.** Though the region has depended, since its foundation, on primary commodities such as rubber, oil, and lumber, around those industries grew a productive ecosystem way more complex than one would expect given its remoteness. Cotton and *barbasco* in the beginning of the 20th century, or the goods derived from *camu-camu* and ornamental fish in recent years, are products of that productive ecosystem created outside more conventional natural resources (Mendoza and Gallardo, 2012). In the Economic Complexity Report of Loreto, the research team from the Growth Lab described, in more formal terms, Loreto's productive capacities vis-à-vis those of its Amazonian peers of Peru, Colombia, and Brazil.<sup>51</sup> The report proposes a location-specific route towards diversification and gradual sophistication of its productive matrix, that leverages on its agglomeration of productive capabilities and *knowhow*.

**Our empirical analysis suggests that Loreto has diversified comparatively less towards closer industries (in terms of productive capabilities) than the national average, which suggests that information and coordination failures associated with the process of self-discovery are more prevalent in the region.** This evidence is consistent with information collected in the field work

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<sup>51</sup> Hausmann, R., Santos, M.A., Tudela Pye, J., Li, Y., and Grisanti, A. (2020).



carried by the Growth Lab team, where we found several instances where significant costs of coordination and information were paid and where state capacity had to be mobilized to facilitate investment projects in new ventures. Additional indicators of the region's capacity to innovate, such as patents, are also registered in Loreto with a lower frequency than in the rest of the country.

### 6.1 Market Failures and State Failures in Loreto: Coordination and Information

**In the Latin American context, a proxy of assessing the prevalence of coordination failures is given by how much state intervention is needed to facilitate an investment in a new industry.** If self-discovery activities are restricted by the structure of existing incentives, it is common that the state steps in to support them (Sabel et. al., 2012). In general, the public sector responds to failures by establishing support mechanisms to facilitate the coordination between public and private actors.

**One of the flagship examples in Loreto is the case of AJE, where a combination of private knowhow, access to international markets, willingness to invest in the Amazonian region, and active state intervention, facilitated a competitive business venture that integrates Amazonian communities into global value chains.** The multinational company, dedicated to the production of non-alcoholic beverages and with presence in more than 20 countries, started to sustainably produce drinks made from camu-camu and aguaje, *super-fruits* with important natural properties<sup>52</sup> that flourish in the Peruvian Amazonia.<sup>53</sup> In partnership with the Ministry of Environment and its associated agencies (SERNAP and the Natural Reserve of Pacaya Samiria), Loreto's regional government, and the NGO Nature and Culture International (NCI), AJE managed to integrate Amazonian communities that extract the fruits in the natural reserve. NCI oversees the training and provides technical assistance in the first part of the process, SERNAP certifies the extraction, and AJE offers a fix purchase price per season to the communities – reducing the associated uncertainty that the producers face in case of oversupply, coordinating the transport for the product. Another private company, Frutama, processes the fruit in their plant in Iquitos, and the fruit pulp is taken to Lima by boat and truck for final transformation and commercialization.<sup>54</sup>

**There are also examples in Loreto of unsolved coordination failures that inhibit private investment and productive diversification.** This is the case for the tourism sector, where there is

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<sup>52</sup> Among other benefits, camu-camu has 16 times more Vitamin C than oranges and 60 more than lemons, which reinforces the immune system, while waterje has Vitamin A, Vitamin B, and Vitamin E, among others. Source: Agencia Andina. <https://andina.pe/agencia/noticia-loreto-se-prepara-para-dar-valor-agregado-a-produccion-camu-camu-y-waterje-746692.aspx>

<sup>53</sup> Loreto produced 11,764 metric tons of camu-camu in 2019 and 12,069 in 2018 (source: Loreto. Síntesis de actividad económica diciembre 2019, Banco Central de Reserva de Peru). There are around 900,000 hectares of productive waterje in Loreto (source: ITP. [https://www.itp.gob.pe/archivos/vtic/AGROINDUSTRIA\\_001-2018/files/assets/downloads/page0010.pdf](https://www.itp.gob.pe/archivos/vtic/AGROINDUSTRIA_001-2018/files/assets/downloads/page0010.pdf))

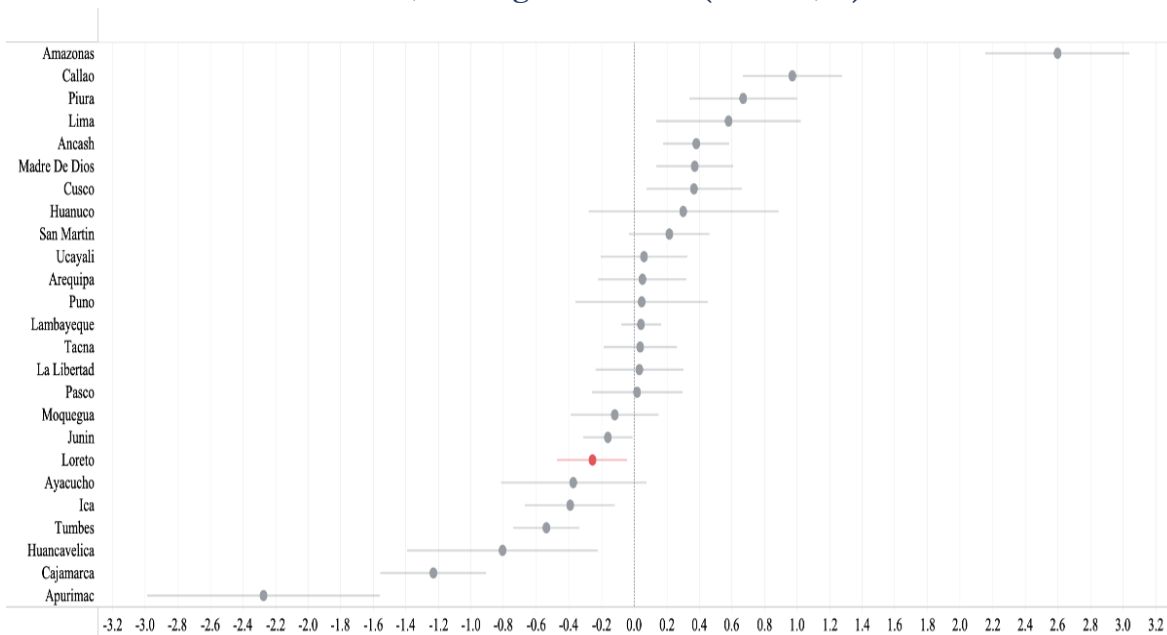
<sup>54</sup> Sources: research team interviews and <http://www.businessempresarial.com.pe/multinacional-lanza-bebidas-de-frutos-amazonicos-para-comercializacion-nacional-e-internacional/>

an absence of a touristic river port that creates negative impacts on tourism potential and investments in the region. During our visits and meetings with establishments and business executives from the tourism sector, their main obstacle for growth was the absence of a touristic fluvial port to properly embark visitors. Most jungle lodges embark their guests in private or informal ports with no adequate facilities, making the process chaotic and leaving an ill impression on tourists. Even if there is an industry committee where the main companies of the sector meet to coordinate actions, the high cost of investment, the uncertainty about appropriation, and the lack of adequate counterparts in the regional government, have inhibited the formulation and implementation of alternative arrangements that are attractive enough to facilitate a solution through private coordination. From the interviews carried, the team learned that previous administrations attempted to provide a touristic port, but they were unable to sort issues associated with construction licenses and land access, which resulted in a port constructed in a location close to a sewer that flowed into the river. Unfortunately, the port remains unused. The case is an example of the inability of public and private actors in the region to coordinate interventions and provide a relatively straightforward input that would enhance the experience of visitors and could spur the touristic potential of the region.

## 6.2 Diversification towards new products – quantitative analysis

Loreto diversified *differentially* less towards industries which are closer to its productive capabilities than the other regions in Peru, which suggests that its capacity to sort out coordination and information failures associated to self-discovery is weaker than the national average. We evaluated the marginal propensity of Loreto to diversify to industries that are closer in terms of productive capabilities, using employment data from the National Household Survey (ENAH). It's a well-documented fact – as reported in the Economic Complexity report of Loreto – that places tend to diversify to industries that require similar productive capabilities. This empirical regularity is confirmed by the data in Peru at the regional level, where the variable of density (an indicator of technological distance) is associated in a positive and significantly statistical way to the appearance of new industries within the country (see Appendix 2).

**Figure 55: Differential Effect of density on the probability of jumping into close industries, Loreto, and regions of Peru (VCR<0,25)**



Note: The graph shows the coefficient of the interaction between the variable of density and a dummy variable per region for jumps from industries with a revealed comparative advantage (RCA) lower than 0.25 to an RCA of 1 or more, in a period of 5 years.

In Loreto, the negative and statistically significant sign suggests that the region has a lower propensity to jump into closer industries (in terms of *knowhow*) than other regions of the country.<sup>55</sup> These results are consistent with the difficulties to solve the coordination and information failures described before. This incapacity to solve dilemmas around the process of self-discovery could

<sup>55</sup> Our results are robust regarding several definitions of jumps (see Appendix 2).



explain why Loreto has a significant levels of knowledge agglomeration but has been unable to translate them into the appearance of more sophisticated industries, able to sustain higher wages.

### 6.3 Patents and Technological Transfer

**Patents may also show outcomes of recent self-discovery.** Patents are important incentives for the development of new knowledge by allowing inventors to appropriate the returns associated with their discoveries over a period. Peru has several institutional arrangements to support technological transfers to regions, organized around what is called Centers of Technological Transfers (CITES). There are in 46 CITES in total, two of which are in Loreto —CITE Productivo Maynas, and CITE Forestal Maynas. The first one seeks to improve the region’s competitiveness through the generation of value added in the value chains of tropical fruit (camu-camu, aguaje) and fish (gamitana and paiche)<sup>56</sup>. In addition, CITE Forestal supports in training, technical assistance, and productive support to the forestry sector; for example, in some of the companies the research team interviewed obtained training from the CITEs for their workforce.

**According to the information on patents from the National Institute for the Defense of Competition and Protection of Intellectual Property (Indecopi), in Loreto six patents were registered from 2014 to 2018 (Figure 56).** Among Amazonian regions, Loreto was the only one that registered invention patents (3), besides utility models (2), and industrial designs (1). The total is above Ucayali (5), San Martín (2), and Madre de Dios (1).

**Figure 56: Patents by type and selected region (2014-2018)**

<i>Types of patent</i>	Loreto	San Martín	Ucayali	Madre de Dios	Median	Average	Lima and Callao
Utility models	2	2	3	1	6	41	686
Industrial designs	1		2		4	35	357
Invention patents	3				3	29	331

Source: Indecopi.

**Loreto and San Martín lead the number of patents of ‘collective knowledge’, which seek to protect the knowledge of native communities for the use, applications, and properties of biological resources.** From 2014 to 2018, 1,852 collective knowledge patents were registered in Loreto, more than in San Martín (1,137) and Madre de Dios (158). Even if these patents could be a base to develop products with commercial value – for example, pharmaceutical products and cosmetics – to this date they are yet to be leveraged at a high scale (Indecopi, 2016).

<sup>56</sup> Source: ITP. <https://www.itp.gob.pe/nuestros-cite/productivo/cite-productivo-maynas/>

**We have found significant evidence suggesting that information and coordination failures associated with the process of self-discovery are a significant binding constraint for sustainable development and diversification of Loreto.** The region has a higher agglomeration of knowhow and productive capabilities than its Amazonian peers in Peru and Colombia but has been unable to coordinate the action of the diverse public and private actors to leverage that knowledge. Our statistical analysis shows that Loreto has a differentially lower capacity to diversify towards new adjacent industries – in terms of productive capacities – of higher value added. The evidence from AJE indicates that it is possible to coordinate the action of different levels of government and several private actors to develop new products of higher sophistication, which capitalize not only the *knowhow* but the natural comparative advantages and collective knowledge of Loreto. But it is also true that in other cases the state has been unable to coordinate the provision of public input in thematic areas of great potential, such as tourism. The existence of some patent activity and the high number of collective knowledge patents suggest that Loreto has innovation capacity and a stock of important knowhow in its native communities but is yet to leverage it at a high scale. All these symptoms suggest that developing the institutional capacity to coordinate actions among different government levels and the private sector might be key to unleash the economic potential of the region.

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## Appendix

### 1. Intensity of states in the use of productive supplies

To estimate the intensity of the use of a productive input in a region, first we need to obtain an estimation of how intensive each industry is in its use. For that, we rely on two data sources. For the intensity in the use of contracts, we use the data from Nunn (2007), who constructs a database with an intensity measure of contracts at the industry level under the following assumption: the industries that use inputs purchased in competitive markets with a great number of buyers and sellers require less contracts, while the industries that require inputs from less competitive markets need more contracts, as every input needs a contract to fix a price. For a more detailed explanation, see the study published in *The Quarterly Journal of Economics* (2007). Data limitations include that it only considers goods (agriculture, manufacturing, and extraction) and not services, which is an important sector both in Peru and Loreto.

For the intensity in the use of electricity, water, transport, and finance, we use input-output tables published by the Bureau of Economic Analysis of the United States. Specifically, we use two different kinds of input-output tables: i) consumption tables, which maps the direct demand of each industry into the others (expressed in millions of US dollars), and ii) indirect consumption tables, which also consider the demand between two industries through intermediate industries (expressed in terms of the need of that input to produce a dollar of the final product).

We don't perform any further adjustments neither to the measurements of the indirect tables nor to the data from Nunn (2007), because they show, by definition, a proportion of the input in the final product. With the direct tables, we calculate an RCA of intensity, analog to the RCA shown in the Economic Complexity Report for Loreto. The RCA intensity of an input is the percentage of the total demand of an industry that comes from that input, divided by the percentage of the total demand in intermediate consumption of the economy that comes from the same input. The highest is this Intensity RCA is, the more intensive is the industry in that input.

In this way, we derive from these databases a measure of intensity in inputs for each industry, based on its relative expenditure with respect to total its intermediate consumption. Finally, we reclassified the industry classification of industries from BEA1997 or BEA2017 to the NAICS2017, which allowed us to run regressions using Dun & Bradstreet (2019), classified in NAICS2017.

Thereafter, we calculate the average intensity of an input in a particular region, weighted by the relative size of the industries operating in the region. We do this by running a regression where the dependent variable is the relative size of a sector in the economy of a region (the number of firms), where the independent variable of interest is an interaction term between the measure of intensity and a dummy variable per region, using location fixed effects

The resulting figures in every section show the coefficient of the variable of interest for every region, which is interpreted as the average degree of intensity in a input for that specific region. This regression is run by using both tables in the case of electricity, water, transport, and finance as robustness checks. In addition, for the electricity sector, the same regression is run only for the manufacturing economy. Formally:

$$x_{dp} = \beta_0 + \sum_d^D \beta_d \times id_d \times INT_p + \beta_1 id_d + \beta_2 id_p + \varepsilon_{dp}$$

where,

$d = region$

$p = product$

$x = proportion\ of\ firms$

$id = identifier$

$INT = measure\ of\ intensity$

$\beta_d = coefficient\ of\ interest$

$\varepsilon = margin\ of\ error$



## 2. Methodology for the Quantitative Analysis of Self-Discovery

To analyze whether Loreto depends differentially less or more on the variable density versus the other regions of Peru, we run the following specification, using the National Homes Survey (ENAH) for employment:

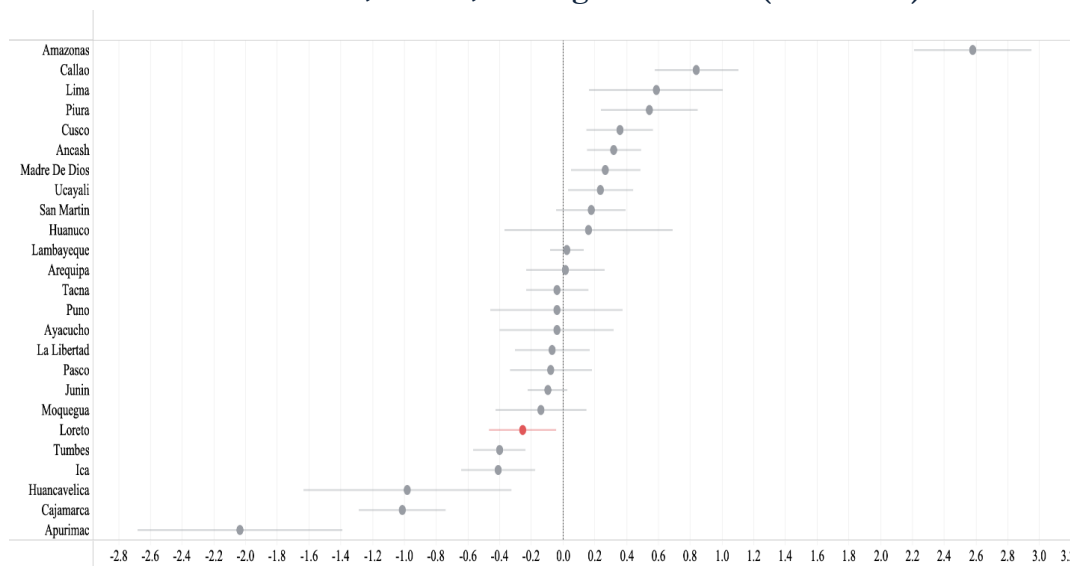
$$jump_{ij} = f(density_{ij}, rca_{ij}, dpto, dpto * density_j)$$

Where  $jump_{ij}$  is a dichotomous variable with value 1 if in a period of 5 years (using ENAH) the revealed comparative advantage (RCA) of the industry  $i$  in the region  $j$  went from the extensive margin ( $RCA < 0.25$  or  $RCA < 0.75$ ) to the intensive margin ( $RCA \geq 1$ ), 0 if it didn't;  $density_{ij}$  is density of the industry  $i$  in the region  $j$ ;  $rca_{ij}$  is the revealed comparative advantage of the industry  $i$  in the region  $j$ ;  $dpto$  is a variable that takes the value 1 for every region, and  $dpto * density_j$  is the interaction between these two last variables, our variable of interest.

Given that the objective is to know the relationship between the jumps Loreto has done towards intensive industries and the initial proximity of its industries, controlling by the level of initial intensity between regions and industries, we use the Poisson probabilistic specification, which controls for multiple fixed effects, developed by Correia et al (2020)<sup>57</sup>, and reported the coefficient of the marginal effect (average).

The results for these jumps with an RCA lower than 0.75 to 1 or higher are the following:

**Figure 57: Differential Effect of density on the probability of jumping towards close industries, Loreto, and regions of Peru ( $RCA < 0.75$ )**



<sup>57</sup> See Correia et al, 2020