



Programa de Doctorado en Ciencias Económicas y Jurídicas

***Regional Competitiveness in Latin America: A Comparative
Study of the Key Elements for Regional Performance***

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Camilo José Cela**

Thesis

**Regional Competitiveness in Latin America: A Comparative Study of the Key Elements for
Regional Performance**

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Abstract

The place of settlement has a big influence in the performance of a company and in the wellbeing of a person. Thus, for citizens, workers, and companies some regions are more attractive than others. Companies and people have few barriers to move within a country, and nowadays, less barriers to move across countries. Because of this, cross-country comparison is critical to understand the success of some regions and the stagnation of others in Latin America.

This research measures regional competitiveness using a set of comparable regional indicators for Chile, Colombia, and Mexico in the 2008-2017 period and through a model that separates input competitiveness from results competitiveness. The measurement allows comparison and ranking of regional competitiveness across countries. Results show that regions with high levels of Input Competitiveness yield higher progress in Results Competitiveness for the studied period. Thus, input competitiveness factors may play a major role well-being and company performance.

There are regions in Latin America that consistently show high levels economic, social, and environmental indicators. The research results show that most of the differences in performance are explained by the initial levels of input competitiveness, country effects, by the condition of holding a capital city, and by specific competitiveness factors such as health and social system.

Policy implications regarding regional competitiveness are important, since promoting competitiveness capabilities in less advantaged regions would be crucial to increase economic performance, social wellbeing, and environmental sustainability for the population and companies that settle in those regions.

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1. Introduction

1.1. Using Cross-Country Comparison to Understand Regional Performance

Cross-country comparison is critical to understand the economic success of some regions and the stagnation of others. The place where companies settle can have a great influence on their level of productivity; certain regions or countries can grant companies a competitive advantage over others. Because of this, some regions will compete for the attraction of foreign investment, by offering advantages for companies to arrive and do business in their territory.

For instance, the Metropolitan region in Chile competes with other regions to attract foreign investment investments from high-tech companies like Amazon web services. In 2018, Amazon announced that they were going to install a data center in Latin America, that would allow them to manage data and computing for companies and that they were looking at several alternative places including Chile and Argentina. However, Amazon was not assessing a random location in Chile; they were evaluating a specific location in the Metropolitan region, which had the necessary telecommunication infrastructure, connectivity, and skilled workers. In this case, multiple interests need to be accounted. For instance, Amazon is weighing the level of support from the federal government in the event of such an investment.

Furthermore, Huawei installed in August 2019 a data center in the metropolitan region in Chile after assessing different locations in Latin America, including locations in Argentina and Brazil. The data center offers cloud services for Chile and other countries in the Latin American region. Huawei made this investment in the middle of trade negotiations with the United States, and right when the nature of their investment and security vulnerability is being questioned. According to Huawei CEO in Chile, David Dou Yong, they choose Chile due to its political stability, economic freedom, solid legal system and because Chilean President Sebastián Piñera announced that Chile would become a digital hub and announced an artificial intelligence development plan towards 2022. The Chilean government is committed to promote Chile as a technological and innovation hub within the Latin American region, welcoming all sources of foreign investment in technology services

Likewise, regions, and specifically the companies and clusters placed in them, compete for product placement in international markets, with others country's companies and clusters. For example, table grapes produced the *Copiapó* valley from *Atacama* region in Chile compete with table grapes produced in Peru in the United States market. In Chile, table grape production and harvest does not overlap between Chilean regions, but it overlaps with the production and harvest of other southern hemisphere countries as Peru. In fact, table grapes from *Copiapó* valley are harvested in November and December in Chile, and exported to the United States, where they arrive around January. Thus, they do not compete with table grapes produced in the Central regions from Chile, which are harvested in January and February and arrive to the United States only in February and March. But they do compete with the table grapes produced in the Ica valley in Peru. Thus, when evaluating the competitiveness of the table grape industry from the *Atacama* region, it would make much more sense to compare the performance with its competitors in *Ica*, Peru, and not necessarily with the table grape industry from other regions in Chile, such as *Valparaíso* or *O'Higgins* which do not compete with *Atacama* in export markets.

The two types of regional competition described above take place between countries; they are not limited to in-country competition. Therefore, understanding regional competitiveness requires an international approach that compares regions between countries.

There are several rankings of regional competitiveness for Latin American countries (Argentina, Mexico, Chile, Colombia, and Peru). However, the set of key factors that promote regional competitiveness and that favor regional performance in Latin America are not clearly identified and there is still debate on which characteristics are the most important to boost competitiveness. Comparative studies of regional competitiveness between European countries such as the Regional Competitiveness Index (RCI) developed by the European Commission (Dijkstra *et al*, 2011) allows identifying common characteristics among competitive regions. There are no equivalent studies comparing the competitiveness of regions between Latin American countries. However, there is a regional development index called "IDERE LATAM" that compares Latin American regions across 8 countries using a comparable set of indicators that are based on the human development index from Amartya Sen (Rodríguez and Vial, 2020). The use comparative studies would allow to

identify common patterns and characteristics that favor competitiveness in Latin American regions.

In consequence, this thesis aims to identify common patterns and characteristics that promote regional competitiveness among Latin American regions through cross-country contrast and comparability.

Chapter 1 introduces the problem of regional inequalities and differences in performance of regions in Latin America, presents research questions, hypothesis, and objectives of this thesis.

Chapter 2 reviews the existing literature on regional competitiveness and its applications in Latin America. This chapter also presents a comparative analysis of available measurements of regional competitiveness within countries in Argentina, Colombia, Chile, Mexico, and Peru which allows to identify some common factors in competitive regions and helps to further understand the critical factors that influence competitiveness in Latin American regions.

Chapter 3 present the methodology and the data used to measure regional competitiveness for 71 regions from three countries in Latin America: Chile, Colombia, and Mexico. Regional competitiveness is measured using a set of comparable regional indicators in the 2008-2017 period and through a model that separates input competitiveness from results competitiveness (Aiginger and Firgo, 2017). The measurement allows cross-country comparison of regional competitiveness and performance.

Chapter 4 presents the results and the empirical analysis of the regional competitiveness measurement for the 71 regions. Regional competitiveness is compared across the three countries and regions are ranked according to an Input Competitiveness Index and to a Results Competitiveness Index.

Chapter 5 presents the conclusions of the thesis and proposes further areas of research.

1.2. Latin America and Regional Inequalities

Latin America has a diversity of regions, some of them have had success and have been able to further their development, while others are lagging (ECLAC, 2015a; ECLAC, 2017). In general, successful Latin-American regions are the ones that allocate an important city (usually capital city) or the ones that have based their economic development on the extraction of natural resources (ECLAC, 2015a). The preponderating factors that promote regional performance in Latin America are not as clear as in comparative studies for regions within the European Union (EU), which have already identified key factors that boost regional competitiveness such as ensuring basic education, improving institutions in middle-developed regions, and innovation in developed regions (Annoni and Dijkstra, 2017). Innovation has been widely discussed as a competitiveness boost factor for Latin American regions, but there is little evidence of its relative importance compared to other competitiveness factors. Similarly, Aiginger and Firgo (2017) identify education and innovation, and high institutional quality factors as solid drivers of regional competitiveness in the EU.

According to Figueroa (2013), in the 1950s, social scientists believed that the main reason for underdevelopment in Latin American countries was the economic dependency they had with developed economies, in what they called a center-periphery model. Since then, economic growth became the core of development policy in Latin America, setting the basis for development policies in the second half of the XX century. As a result, countries shifted towards industrialization strategies through import-substitution policies, which would allow reducing that dependency. However, results were not satisfactory, and by the late 60s, industrialization policies were in a crisis. Inequalities grew, dependency from developed countries was not reduced, and business stagnated. Countries shifted towards free trade policies, which liberalized trade, reduced government size, and promoted economic development based in export development. This free trade model was developed in the 80s, carrying negative political, economic, and social consequences for a vast sector of the population. However, the free trade model improved in the 90s and has prevailed towards the XXI century taking basis in the idea that economic development will have spillover effects, which will improve social wellbeing.

In the 1980s because of the debt crisis in Latin America, several policies were applied based in the Washington Consensus. As a result, economic progress derived in the 80s and 90s, but

performance was poor compared to other developing economies such as South Korea and developed economies such as the United States or Germany (Cornick, 2016). Despite having similar institutions and policies as in other developing countries, the main causes behind the poor economic performance in Latin America are the low levels of labor productivity and total factor productivity. There is a consensus that Latin America has a productivity gap with developed economies and that this is the main reason behind slow economic growth and not the lack of investment (Cornick, 2016; Fernandez-Arias and Rodriguez, 2016; OECD, 2019). Consequently, there is a renewed interest in productivity growth policy and its role in promoting development in Latin American countries.

Convergence implies closing productivity gaps between Latin American countries and the developed economies, but also closing structural inequalities within the countries (ECLAC, 2010). Inequalities within the country, or regional inequalities, can influence the level of potential wellbeing in a certain location, that is why the reduction of regional inequalities is crucial for development in Latin America (ILPES, 2009; ECLAC, 2010).

Social indicators in Latin America improved from 2002 to 2014, poverty was reduced from 45,5% in 2002 to 27,8% in 2018 (ECLAC, 2019). However, poverty increased to 30,8% in 2018, because of higher poverty in Brazil and Venezuela, and a lower decrease rate in the rest of Latin American countries. Inequalities measured by the Gini index decreased from 0,538 in 2002 to 0,465 in 2018. However, inequality reduction was much slower between 2014 and 2018.

Despite having reduced poverty and income inequality, economic growth in Latin America has not been enough to converge to well-being levels of developed economies (OECD, 2019).

Additionally, regional inequalities within the countries in Latin America have not decreased significantly between 1970 – 2018, and this situation is also linked to high levels of concentration of population and economic production (Llungo, 2018).

According to 2017 data from the United Nations Economic Commission for Latin America and the Caribbean demographic and economic concentration in are relatively high compared to OECD economies, with one region concentrating most of the population or GDP. The Metropolitan

region in Chile concentrated 46% of the country's GDP and 42% of the population, the City and State of Mexico concentrated 26,2 % of Mexico's GDP and 21 % of the population, while Bogota and Cundinamarca concentrated 30,8 % of Colombia's GDP and 23% of the population (ECLAC, 2017). The high levels of demographic and economic concentration have been accompanied by high regional inequalities measured through regional GDP per capita differences. Empirical evidence suggests that the high levels of concentration and primacy have become an obstacle for economic growth in a number of countries in Latin America, including Argentina, Chile, Peru, Uruguay, Paraguay, and most countries in Central America (Atienza and Aroca, 2013). Additionally, economic primacy has also been linked to higher regional disparities in Argentina, Perú and Brazil and during specific periods in Bolivia, Colombia, Chile, and Mexico (Cuervo, LM. and Cuervo N., 2013).

GDP regional inequalities are much larger in Latin American countries such as Chile, Colombia, Mexico, Peru, Brazil, and Panama, compared to OECD economies such as the United States and Spain. However, despite regional inequalities being high, in Chile, Colombia, Mexico, Peru and Brazil and there has been a regional inequality reduction trend between 2000 and 2010. There is evidence that these regional inequalities had a negative effect in national economic growth for Argentina, Bolivia, Brazil, Chile, Colombia, Mexico, Panama, and Peru (Cuadrado-Roura and Gonzalez, 2013). In the specific case of Chile, inequality has been a serious problem for decades, and the concentration of income has been gained predominantly by the Metropolitan region, despite the production growth in other regions has been higher (Aroca, 2013). Similar issues have been observed by Quintana and Asuad (2013) in Mexico, where the process of economic concentration has limited social development of Mexican regions. Similarly, Galvin and Meisel (2013) point out that primacy and the highest concentration of companies around Bogotá and other areas with relatively high wealth seem to have increased regional disparities in Colombia.

Competitiveness has not been in the public policy agenda in Latin America countries in the past decade. However, in light of the high levels of regional inequality and centralization, there has been a shift in this matter recently, and promoting economic performance of regions has regained importance for the Latin American economies.

1.3. Research Questions

1. What is the definition a competitive region? What specific characteristics does a competitive region have? Are there competitive regions in Latin America? Are there common elements among competitive regions in Latin America?
2. What enhances regional economic performance, social wellbeing, and environmental sustainability? How do you measure these aspects?
3. Which factors promote regional competitiveness? Are these factors external or endogenous to the region? Do competitiveness boosting factors vary between regions?
4. Innovation and technology are known to be critical factors in promoting regional competitiveness; does this also apply to regional competitiveness in Latin America? What type of innovation factors have been successful?

1.4. Hypothesis

1. There are competitive regions in Latin America, which have outstanding economic, social, and environmental performance. These regions possess factors such as skilled human capital, communication and technology infrastructure, high innovation capacity by companies at various points of the production chain and allocate networks or clusters of high-tech companies.
2. Cross-country comparison is critical to understand the success of some regions and the stagnation of others. Therefore, understanding regional competitiveness requires an international approach that compares regions between countries.

1.5. Research Goals

The main research goal of this thesis is to identify the factors that promote regional competitiveness in Latin American countries (Mexico, Chile, Colombia) for the 2008 – 2017 period.

Specific research goals:

- Elaborate a methodology to measure competitiveness and its core components.
- Identify highly competitive regions using robust definition and a comparable set of indicators for regional competitiveness for the 2008 - 2017 period.
- Identify the main success factors and framework of application.
- Establish a typology of regional competitiveness factors based on their common elements and areas of application.
- Identify policy recommendations that would enhance economic performance in less competitive regions.

2. Regional Competitiveness: Concepts and Applications in Latin America

2.1. What is Competitiveness? Competitiveness Framework and Concepts

Competitiveness is a widely used term, both in formal and informal research by academics, press politicians and stakeholders. Many times, competitiveness is applied indistinctly to firms, regions, or countries. Although there are areas of agreement in competitiveness definitions, several researchers point out that different definitions and interpretations of the concept coexist, thus there is no unique definition and interpretation of competitiveness to this date (Borozan and Strossmayer, 2008; Aiginger and Firgo, 2017; Ketels, 2016; Huggins and Thompson, 2017; Annoni y Dijkstra, 2017).

The concept of competitiveness first appeared implicitly in international trade theories that were meant to explain the economic performance of a country and the composition of its international trade. Adam Smith in the book *The Wealth of Nations* (1776) introduces the concept of absolute advantages. The absolute advantage of a country occurs when a country has a lower production cost for a certain good, compared to another country. The country with the absolute advantage will be more competitive in the global market because it is "more efficient" in the production of that good.

After Adam Smith, David Ricardo (1817) introduced the concept of comparative advantage, which results from specialization. Countries can specialize in the production of a certain good and import the ones they do not produce. The specialization will lead to a lower tradeoff than producing a wider range of products and it explains why countries that do not have an absolute advantage in the production of any good may still export and have trade with other countries.

Both types of advantages, absolute and comparative, are currently considered competitiveness advantages by modern authors. In example, low costs are considered a form of "low road" competitiveness advantage by Aiginger *et al* (2013), Aiginger & Vogel (2015) or Malecki (2017).

Michael Porter formally addressed the definition of competitiveness in the 1980s to explain the economic performance of companies by taking basis on the concepts of absolute and comparative advantages. Porter (1985, 1990) introduces the concept of "competitive advantage" of nations,

which is a type of advantage that is created and sustained locally and that allows a country to have the lead in certain industries where the setting, the institutions, and competition are favorable to them.

Krugman (1994) questions the very existence and use of the concept of country competitiveness, which would be much more complex than firm competitiveness. He argues that countries do not compete in the same way companies do, since their objectives and the very nature of competition in countries and companies are different. Krugman points to the fact that noncompetitive firms are not sustainable and eventually go out of business, but countries that have a poor economic performance do not go out of business. Additionally, Krugman establishes that the success of a country is not a zero-sum game; the success of a country is not at the expense of another, unlike what happens with companies, which compete for market share. When a company increases market share, it does so at the expense of another company.

According to Atkinson (2013), “the true definition of competitiveness is the ability of a country to export more in value added terms than its imports”. The problem with this definition is that it limits competitiveness to those countries that have positive trade balances because of successful export sectors, low barriers to trade or low support to exporters (subsidies). In other words, productivity would be a critical factor of competitiveness but only if it links to export sectors. Under this framework, if the productive sectors do not export, relative wages would increase along with the capacity to generate wellbeing, but it would not be a competitive economy, which contrasts with the current views of competitiveness, which give productivity and the capacity to generate wellbeing more relevance than the ability to export.

In this context, exports are drivers of income, employment, and development. In order to export, local businesses must have a competitive advantage. This type of advantage develops from cumulative processes, agglomeration, cooperation, and synergies and the sustainability of this advantage relies in the facts the fact that it needs to be dynamic and in constant innovation. Additionally, positive externalities generated by local and national governments and territorial culture reinforce the competitive advantage (Camagni, 2005).

However, Krugman (1994) establishes that, in general, living standards of a country are related more to domestic productivity than to international competition. In a country with low levels of trade, like the United States, productivity would be the main factor behind increasing wellbeing. When a country specializes in a productive sector but that does not have international trade it can still be considered competitive in the sense that it has the capacity to allow for high living standards for its citizens.

Despite the differences in approaching competitiveness, Porter (1990; 2003) and Krugman (1994) both agree that productivity ultimately defines to the capacity of a nation to generate a high and rising standard of living for its citizens. Moreover, the capacity to export is not a requirement *per se* to achieve high standards of living. Krugman establishes that, in general, living standards of a country relate to domestic productivity and not to international competition. It is productivity and domestic factors, and not international trade, which influences the level of wages and living standards of a country.

2.2. Defining a Region

Before reviewing regional competitiveness theory, it is necessary to review the concept of region itself. In fact, one of the difficulties of defining regional competitiveness is that concept of region itself is also ambiguous and can be interpreted in different ways (Borozan, D. and Strossmayer, 2008). For example, the word region may refer to a subnational administrative unit within a country (for example a department in Colombia or a State in Mexico) or it may also refer to a group of countries (for example, Latin American region, North American region, or European region). It is important to state, that the subject of study in this thesis is the region acknowledged as the subnational unit within a country.

The OECD (2016) defines two types of regions: TL2 (*territorial level 2*), which are macro-regions that correspond to the first subnational level (*regiones* in Chile, *estados* in Mexico) and TL3 (*territorial level 3*) which are micro-regions corresponding to the second subnational level of a country (*municipios* in Chile). This definition is set by following the official administrative divisions of each country; thus, it is inherently used as a framework for implementing policies. For the same reason, there is a broader range of official data for these regions.

Alternatively, the definition of region that social science uses to study human development is much more complex, because it involves social and economic interactions that do not follow the country's administrative borders and frontiers.

To illustrate this distinction, Klapka, Halás and Tonev (2013) indicate that in geography, there are two types of regions: formal regions and functional regions. Formal regions are those that arise from vertical relationships or scalar definitions and where the object of study is the place itself. Functional regions are defined by horizontal flows that occur in and between them. Those flows may correspond to people, information, goods, or any other type of factor that is the object of study. The measurement or description of these flows will define the limits of the functional regions and will allow distinguishing them from each other.

OCDE (2016) defines functional regions based on economic or social interactions that occur and that may exceed the administrative limits. One characteristic that functional regions have is that

they are relatively self-contained, that is, the economic or social interactions used to define them exist within the limits of the functional region.

For example, Annoni and Dijkstra (2017) measured a Regional Competitiveness Index (RCI) for functional economic regions of the European Union using the OECD definition of functional region. The analysis of functional regions allows studying characteristics of the labor market, which in many cases exceeds the limits of the European administrative units (NUTS 2).

CEPAL (2017) makes a similar distinction based on the formal or functional boundaries of regions by defining the concept of scale and level. Scale is the geographical scope of deployment of a certain process, function, or problem while level is the political, juridical, or administrative division, such as a state or county.

Additionally, CEPAL (2017) defines "territory" that is based on the idea of appropriation by which "a group culturally appropriates a physical space". This appropriation may take form as a sense of belonging or commitment to the physical space or it may be appropriation by legal or political means.

For the purpose of theoretical discussion on regional competitiveness, this research defines region as a subnational geographical scale that has a common social, economic, or cultural characteristic. This region may or may not match a country's administrative division. However, for the measurement of regional competitiveness, regions are limited to the political-administrative divisions since the vast majority of quantitative data and statistics available correspond to such division. This distinction needs to be reflected to understand the limitations of the data and for the correct interpretation of the results arising from regional competitiveness measurements.

2.3. The Concept of Regional Competitiveness

Having a clear definition and framework for what is understood as “region”, we now need to define regional competitiveness, its main characteristics, and what differentiates it from country competitiveness and firm competitiveness.

These concepts generate theoretical debate to this day, because of the nature and scope of the concept and especially when defining who are the ones that compete. Competitiveness of regions and nations is only competitive in the sense that it presents a platform for companies to compete in local, national, or international markets (Huggins and Thompson, 2017).

Porter (2003) acknowledges that much research on competitiveness has focused on the national scale, without recognizing the internal differences between regions, which exist in all countries. He suggests that the major components that promote economic performance are regional components, such as specialized inputs, infrastructure, education of the labor force, institutions which will encourage agglomeration of firms in the form of clusters. The existence of clusters defines the way in which companies interact and compete, the type and speed of innovation and the incentives for company creation. The local business environment establishes how sophisticated competition is.

Storper (1997) defines regional competitiveness as the capability of a region to attract and maintain firms with stable or rising market shares in an activity, while maintaining or increasing standards of living for the population. Aiginger (2006) defines competitiveness as “the ability of a country or location to create welfare”.

Camagni (2002) indicates that when facing the globalization process, regions, cities, and territories compete for goods, investment, and for the attraction of workers. Additionally, regions and countries enable companies to compete in local, national, or international markets (Huggins and Thompson, 2017). Thus, competition exists and “some places are more competitive than others” (Malecki, 2017).

Furthermore, Camagni (2002, 2005) distinguishes national competitiveness from regional competitiveness using international trade theories. One of the main differences arises from the

existence in countries (or inexistence in the case of regions) of borders and barriers that prevent movement of production factors and financial adjustments. Camagni infers that the stakeholders compare absolute prices between countries (price of a good in common currency), and these prices are governed by factors such as wage and the exchange rate. Real wages align with the country's average productivity level; thus, an inefficient country will have low wages, which will give an absolute advantage over another country. When a country loses an absolute advantage there are two possible adjustment mechanisms that take place: first, the reduction of wages and prices, and second, devaluation of its currency.

In contrast, in regions, real wages do not adjust to the level of average productivity since the factors of production (capital and labor) move freely between regions because there are no barriers or borders to prevent such displacements. As a result, in regions, adjustments by means of migration occur faster than financial adjustments. Moreover, there are no regional currencies or specific exchange rates, thus, if a region has absolute disadvantages, it cannot devalue its currency.

As a result, Camagni concludes that regions may have absolute advantages (based in their level of productivity) but may not have comparative advantages due to the lack of barriers that countries have. This distinction is relevant not only because it differentiates country and regional competitiveness, but also because productivity will have leading role in achieving regional competitiveness.

Regions that have low levels of productivity and offer lower real wages will likely have higher levels of unemployment, emigration, and eventually depopulation (Camagni, 2005). For these types of regions, there would be three possible strategies to avoid the depopulation trend:

1. Obtaining public resources or transfers, which would be a short-term solution, not sustainable in the long-term.
2. Attracting investment from other regions or from abroad.
3. Improving competitiveness of the local production network, creating synergies between regional stakeholders, and incorporating companies that innovate and generate increasing returns of scale

In this context, any action that encourage the development of the local productive networks and the attraction of investments is relevant.

Borozan and Strossmayer (2008) place the concept of regional competitiveness between microeconomic and macroeconomic competitiveness. Micro-economic competitiveness refers to the ability of a firm to compete in a market successfully. Macro-economic competitiveness refers to country competitiveness and is link to the idea that the environment that enables firms and companies to compete successfully.

The concept of regional competitiveness is much more complex because it is not the aggregation of microeconomic competitiveness nor of the productivity of the firms within the region (Borozan and Strossmayer, 2008). This vision neglects to consider the factors outside the region, which are not controllable, as well as spillovers and network effect. Additionally, companies and regions have different goals, companies seek profitability or productive, while regions seek for higher living standards, better jobs, or minimization of corruption. Regional competitiveness is also not a derivative of national competitiveness, because of the differences between macro-economic factors and regional economic factors. National competitiveness is also much more heterogeneous that regional competitiveness. Finally, national governments have a wider range of macroeconomic adjustment mechanisms and much more influence over the public, private, and non-profit sectors than the regional governments have.

Competitiveness for firms or companies and regional competitiveness are also different concepts which relate to each other in a non-linear manner. Company success does not always translate into regional or national success; the way they connect is complex. For instance, firms that search outside knowledge sources by externalizing services, as part of their strategy, may facilitate knowledge-based investment or capabilities within their region, which will translate into higher productivity for both the firm and the region (Huggins *et al*, 2014). This will increase competitiveness for the firm and for the region, but it is not always the case.

Boschma (2010) points out similarities between competitiveness of firms and regional competitiveness. First, despite that regions do not compete for market share as firms do, regions that economically grow faster will gain a higher share of the national economic at the expense of

slower growing regions. Secondly, regions that specialize in similar sectors will compete in the attraction of work talent and investments. On the other hand, one basic distinction is that companies enter or exit the market as they succeed or go bankrupt, while regions do not go out of business or disappear. Companies also compete to attract work talent, but the nature of regional goals is much more complex than the goals that companies have.

Modern definitions of competitiveness by the World Economic Forum and IMD World Competitiveness Center implicitly distinguish the competitiveness of firms from country competitiveness by recognizing a link between company performance and the capacity of a country to produce wellbeing for its population.

The World Economic Forum (WEF) defines country competitiveness as the “*set of institutions, policies and factors that determine a country’s level of productivity*” and recognizes that the ultimate goal is to improve human wellbeing (Schwab, 2017).

For the IMD World Competitiveness Center, country competitiveness is “*ability of a nation to create and maintain an environment that sustains more value creation for its enterprises and more prosperity for its people*” (IMD, 2017).

According to Ibarra-Armenta and Trejo-Nieto (2014), competitive regions have high and sustained levels of economic growth, along with high standards of wellbeing. In addition, competitive regions can attract productive investment in a context of economic openness and globalization, allowing them to achieve high levels of productivity.

Borozan, D. and Strossmayer (2008) and Aiginger and Vogel (2015) distinguish between input competitiveness (costs, productivity, economic structure, and capabilities) and outcome competitiveness (wellbeing). Malecki (2004), Aiginger and Vogel (2015), and Aiginger and Firgo (2017) consider a narrow and an enlightened version of cost competitiveness. The narrow version of cost competitiveness is based only on reduction of cost components such as taxes, wages, and energy, labor or raw materials costs. The enlightened version of cost competitiveness incorporates productivity in addition to cost; if the costs are higher, an economy can still be competitive by increasing productivity.

Ketels (2016) distinguishes competitiveness definitions by those that are centered in costs and those that are centered in productivity. Cost competitiveness depends on unit production costs in a specific place; low unit production costs allow companies to be competitive in global markets. By contrast, productivity competitiveness relies in the capacity of a place to add value based on production factors, in other words how productive that place is. Productive factors, such as labor and capital, move between regions and there are spillovers and synergies between regions, thus, the subnational economic structure differs from the national economic structure. In other words, regions do not correspond to smaller versions of national economies, because they are structurally different.

Contemporary views of regional competitiveness highlight the importance of increasing productivity, but not at the expense of the population's quality of life. For example, an increase in productivity through the means of wage reduction will not increase people's quality of life. Even though it may generate a positive trade balance, it would not be sustainable in the long term (Huggins and Thompson, 2017). Michael Peneder (2017) defines competitiveness as the "ability of an economic system to develop" according to the goals of society, in a sustainable manner and allowing for long-term increase in living standards. Malecki (2017) points out that the concept of regional competitiveness has value when it focuses on the bases and dynamics of long-term wellbeing and not on restrictive views that only focus on market share or resource competition.

2.4. Regional Competitiveness Drivers

The advancement of free trade, globalization, and having a quick and efficient transport and communication services would lead us to believe that location is less important. On the contrary, the place of establishment of companies remains a very relevant variable. Competitive advantages develop from local factors, such as knowledge, cooperation, competition, and concentration (Porter, 1998).

To maintain that competitive advantage companies must constantly innovate, otherwise a more dynamic competitor will leave that advantage obsolete. A country's competitiveness relies on the capacity of its industries to innovate and upgrade (Porter, 1990). Countries can facilitate innovation processes through 4 conditions that constitute the diamond of national advantage: factor conditions (nation's position in production factors, cost and quality of inputs), demand conditions (demand for a good or service in the domestic market), related and supporting industries (the existence of competitive suppliers and other related companies), and firm strategy, structure and rivalry (national conditions on how companies are created, organized and managed, and the intensity of domestic rivalry).

Comparative studies of regions in OECD countries (OECD, 2009) have identified the following critical factors to promote regional performance: human capital, regional infrastructure, innovation agglomeration and accessibility to markets.

In this section, regional competitiveness drivers are discussed and presented in three groups. The first group of drivers are those related to the local environment which include factors such as infrastructure, institutions, market access and social capital. The second group of drivers are sorted under innovation and human capital and include factors such as workers skills and educational features of the regional population. The third group of drivers are those related to specialization and clusters, including agglomeration and the region's economic structure.

2.4.1. The Environment and the "Milieu"

Both Porter (1998) and Camagni (2003) recognize the local environment or *milieu* as a key determinant of competitive advantages. The place of settlement or location will be an important

factor in determining a company's performance at all geographical levels. The regional context will influence the behavior and performance of companies and, consequently, will be relevant in determining their competitiveness (Bochma, 2010). Regions compete, therefore, in providing the best platform to reach high levels of productivity (Huggins and Thompson, 2017).

Mario Polesse (2020) studied cities across the world, focusing and comparing cities within the United States or in Latin America. He states that for cities and regions to succeed and grow, there has to be a functional national state first, which means, there needs to be a set of values, norms and institutions that make economic development possible. A city alone, cannot succeed in an unfavorable context.

Esser *et al* (1996) point out to the creation of a favorable environment in achieving competitiveness, together with a collective effort from firms, associations, State, and other stakeholders. The absence of a favorable environment reduces the capacity of a company to sustainably achieve competitiveness.

Local environment is structured by factors that arise from different scales or levels, for instance, macroeconomic policy from the federal government as well as local institutions, public infrastructure, or networks will influence the local environment.

Institutions are considered an important factor in economic performance and economic growth volatility at a national level, and even a more important factor than poor macroeconomic policies, which may also be underlying institutional problems (Acemoglu *et al*, 2003). At a sub-national level, Balaguer-Coll *et al* (2020) find evidence of a positive relation between the effectiveness of government and economic growth for 1,820 municipalities in Spain between 2008–2015.

The systemic competitiveness model (Esser *et al*, 1996) systematizes these factors in four different levels: Micro, Macro, Meso and Meta.

The Micro level includes factors linked to companies or firm networks. It contains elements such as human capital, business management, business strategies, innovation management, production cycle improvements, business logistics, and producer-supplier interactions.

The Meso level consists of environmental factors such as geography, location, security, proximity to urban centers, and public infrastructure, institutions, public services, social capital, networks, innovation environment, and competition.

The Macro level in the systemic competitiveness model includes elements of the macroeconomic context that influence the efficiency of markets and growth, such as the exchange rate, commodity prices, economic cycles, external shocks, and demographic trends.

The Meta level consists of structural and basic elements such as the political, economic, and legal organization, values, the vision of the future, and cultural elements.

An important mention about social capital is necessary. Social capital, defined as norms and values that shape the type of relationships between people, will favor competitiveness (Camagni, 2003). Social capital embodied in the rules, habits and relationships that favor exchange and innovation, institutions, behavior that reduces transaction costs, good reputation, sense of belonging, and trust are factors that increase regional competitiveness.

Social capital has Macro and Microelements, both formal and informal. Institutions, rules, and norms are formal macroelements. On the other hand, general conventions, codes of conduct and values are informal macroelements. Formal microelements of social capital are social networks, associations, and individual relationships. Informal microelements of social capital are trust, reputation, and participation. Formal elements reduce costs, transaction times and increase information flow, while informal elements strengthen existing relationships and the effectiveness of networks (Camagni, 2003).

2.4.2. Innovation and Human Capital

One of the most relevant competitiveness factors is the endogenous capacity to innovate. Early research by Porter (1990) highlighted productivity and innovation as key factors of competitiveness. Knight *et al* (2020) argue that the fields of economic geography and strategic management have both used innovation to explain competitiveness advantages, and address the concept of increasing productivity, value added and efficiency.

Innovation capacity is dynamic, in the sense that it requires constant renewal, and provides a relevant advantage for competitiveness compared to static aspects of production such as costs or natural advantages (Fratesi, 2017). In the study of economic growth Aghion *et al* (2021) point out that the accumulation of innovation is a primary source of economic growth. Innovation will push economic growth by the means of “creative destruction”, which will constantly push for new products, services, and technologies and by the arrival of new companies and firms.

Cuervo (2017) when reviewing the history of development theories points that competitiveness was initially linked to the success of firm theory in the 1970s, a time in which the concept of competitiveness was very successful and led to the use theories of competitiveness of the firm to explain the economic performance of nations and regions. The shifting of competitiveness theories from firms to countries (and regions) implied changing the focus from the firm's success towards productivity and well-being. This subsequently led to the inclusion of new factors coupled with competitiveness of countries and regions such as innovation, human capital, and income distribution. These factors were previously unrelated to the theory of the firm's competitiveness but were common in development theories.

The positive externalities generated by the creation of knowledge and its dissemination are also factors that contribute to the success of a region (Camagni, 2005). Coordination, leadership, and public-private partnerships towards the construction of a local vision represent forms of governance that open way to a bottom-up development model, constructed through participative planning tools.

Malecki (2017) states that knowledge and innovation are the core of regional competitiveness, creativity and innovation occurs in some places, and not in others. Global innovation networks, which are the fundamental pillar of competitiveness, settle in places that are attractive to them. Therefore, regional competitiveness is a dynamic process, constantly changing and adapting through the learning process. This process is common in high-tech industries, which identify opportunities and threats through research and development processes.

Boix and Soler (2017) compared 250 regions from 24 countries from the European Union and found that creative service industries increased the region's innovation capacity which ultimately

boosted the region's labor productivity. Creative service industries are the following economic activities: retail sale of second-hand goods in stores, publishing, audiovisual, programming and broadcasting, computer programming, architecture and engineering, R&D, advertising, design, photography, arts, entertainment, and recreation.

Endogenous growth models place investments on human capital, innovation, and knowledge as key drivers of growth (Huggins and Thompson, 2017). Competitiveness models are implicitly based on endogenous growth model; thus, some authors define regional competitiveness as the capacity to achieve economic growth relative to other regions at a similar stage of development (Huggins *et al*, 2014; Huggins and Thompson, 2017). In this type of models, economic output is determined by labor technological changes that come from investment in research and human capital in addition to labor and capital.

In Latin America, education, skills and human capital and its relation to economic activity was overlooked for several decades, and the focus was put on to macroeconomic stability and trade liberalization. Today human capital is well known as a key factor promoting economic performance. In Latin America, Mendoza *et al* (2013) showed that increasing coverage of secondary education boosted short-term economic growth and increasing coverage of tertiary education promoted long-term economic growth for 18 countries from Latin American, including Colombia, Chile, and Mexico.

2.4.3. Specialization and Clusters

A key factor promoting regional economic growth and performance is the existence of clusters, which correspond to geographical groupings of companies, suppliers, service providers or institutions of an economic sector which are interconnected by externalities of different types (Porter 1998; 2003). The existence of clusters shapes the way in which companies interact and compete, the type and speed of innovation and the incentives for company creation. The local business environment outlines how sophisticated competition is. In developing economies, it relates to basic infrastructures, education of the labor force, institutions and other factors that are common to all economic sectors. In developed economies, local business environment relates to specific factors of the cluster, such as the existence of specific regulations that benefit that cluster.

Porter (2003) studied the economic performance of regions in the United States, the composition of regional economies and the role of clusters in the economy. He classifies industries into three types: local, resource-dependent, and traded industries.

Local industries provide goods and services in the local market and do not trade with other industries in other regions. Examples of local industries are health services, retail, and construction. Resource-dependent industries compete with domestic and international industries. Forestry industry, mining or agricultural activities are examples of resource-dependent industries. Traded industries trade goods and services with other regions and countries and choose their location based on competitive considerations and not on the available natural resources. Examples of traded industries are aircraft and engine manufacturers, motion picture production, and automobile assembly.

Local industries account for the largest share of employment in the United States. Resource-dependent industries employ only 1% of the workers and trade industries have the highest wages and productivity. The presence of trade industries increases local industry average wages because they boost demand for goods and services from local industries (Porter, 2003).

Through a case study in Sweden, Osarenkhoe, A. & Fjellström, D. (2017) state that clusters and networks of SMEs are vital to gain a competitive advantage and promote regional growth. However, the way that cluster interactions occur is complex and the degree of cooperation within the cluster influences the overall competitiveness (Jankowska et al, 2017).

In Mexico, Mendoza (2021) shows evidence that trade liberalization shaped networks and areas of influence in Mexican regions (Entidades Federativas) between 1980 and 2018, generating positive and negative externalities in their area of influence, especially in key regions such as Distrito Federal and Estado de Mexico.

Camagni (2005) indicates that specialization is not a requirement for the development of clusters and high economic performance. Proximity is necessary, but not enough, for synergistic processes to arise. There must be, in addition to proximity, a way of coordinating efforts toward a common goal, through the creation of relational capital. Cooperation between companies is fundamental for

the development of competitiveness, but it must go beyond customer-supplier relationships. It needs to move towards joint action and commitment to local development.

Productive specialization is also recognized as one of the major factors influencing regional economic growth in the European Union (Maroto and Cuadrado-Roura, 2013). Regions from the European Union that were specialized in dynamic sectors, such as services, had a higher economic growth than the country average and also higher productivity between 1980 - 2008. An additional characteristic is that dynamic regions were concentrated in various large capital cities and European financial centers.

Garcilazo *et al* (2013) show that OECD countries have specialized in the service industry, mainly in financial and business services, over other economic activities such as agriculture and manufacturing. However, this structural change has been geographically dispersed due to differences in local labor markets and the dependency that services gave on those local market conditions. In OECD countries, between 1995 and 2008 the service-related activities became more geographically concentrated than other economic sectors. Moreover, higher productivity growth in service sectors was linked to overall performance of OECD regions. Critical factors to boost productivity in the service sector are improving human capital, density, and innovation.

In the European Union, knowledge intensive business services tend to be more concentrated regionally than other economic activities. Housing a capital city, availability of high skilled human resources in the areas of science and technology, technological capital, geographical proximity, and accessibility are factors that favor the location of these type of services in a region (Delgado-Márquez & García-Veloso, 2013; Cuadrado-Roura, 2013).

Regional specialization in service industries may be key to both boosting economic performance as to attracting skilled workers to the region. Gomez-Tello, Murgui and Sanchis (2020) studied regional productivity in 13 European countries over the period 2000–2015 and found that the richest regions have specialized in manufacturing and service industries such as information and communication technology, finance, professional services, and retail services.

Garrido and Mancha (2010) studied productivity and specialization patterns in Spanish regions from 1986 to 2007 and show that the Spanish tertiarization process was followed by a reduction of productivity gaps between regions and that the inter-sectoral structural change was a key determinant in regional productivity gains, specifically in shifts of employment in the service and industrial sectors.

Alamá-Sabater *et al* (2020) find evidence in the Valencian Region in Spain to support that the service sector is particularly important in regional development in terms of holding the population via employment, especially in rural areas.

In Latin America, Márquez *et al* (2013) find that specialization plays an important role in regional economic growth. In the case of Chile and Colombia, the regional specialization patterns seem to follow natural resources available in the region, except for the regions that contain the capitals, Metropolitana and Bogotá, which show an industrialized specialization pattern. In these countries, regional exports, and specialization, better than export diversification, seem to enhance regional growth.

In Costa Rica, Araya *et al* (2020) studied data from 81 counties between 2010 -2016 and found that the creation in business services increases with higher county competitiveness or with a higher size of the manufacturing industry. These results suggest that business services seek those counties that offer a critical mass of manufacturing companies and a favorable local environment to operate.

2.5. Measuring Competitiveness

This section describes the features and characteristics of the most well-known comparable measurements of country competitiveness from the World Economic Forum (WEF) and the IMD World Competitiveness Center. Additionally, regional competitiveness measurements in the European Union are presented in order to review previous experiences of cross-country comparisons of regional competitiveness.

2.5.1. Measuring Country Competitiveness

There are two well-known institutions that measure and compare country competitiveness: The World Economic Forum (WEF) and the IMD World Competitiveness Center. The WEF publishes annually a World Competitiveness Report that measures competitiveness for 140 countries, while the IMD World Competitiveness Center publishes a world competitiveness yearbook that ranks 63 countries. Both reports measure competitiveness through complex series of indicators grouped in pillars and factors that are synthesized in an index.

The countries with higher competitiveness are the ones that obtain higher scores for the index and allow a country benchmark and ranking. Both indexes are frequently quoted by academics, press, politicians, and stakeholders.

The 2017/18 WEF Global Competitiveness Report groups 114 indicators into 12 pillars (Schwab, 2017). The 12 pillars are:

1. Institutions
2. Infrastructure
3. Macroeconomic environment
4. Health and primary education
5. Higher education and training
6. Goods market efficiency
7. Labor market efficiency
8. Financial market development
9. Technological readiness

10. Market size
11. Business sophistication
12. Innovation

The GCI takes the stages of development into account by attributing higher relative weights to those pillars that are more relevant for an economy given its particular stage of development. To implement this concept, the pillars are organized into three subindexes, each critical to a particular stage of development.

Pillars 1 to 4 have a higher weight in *factor-driven* economies, which are those countries that compete based on their factor endowments: unskilled labor and natural resources. Pillars 5 to 10 are more important in *efficiency-driven* economies, which base competitiveness in efficient production processes and product quality because wages have risen, and they cannot increase prices. Pillars 11 and 12 are more important in *innovation-driven* economies, where wages are high, and they are able to sustain those higher wages and the associated standard of living only if their businesses are able to compete using the most sophisticated production processes and by innovating new ones (Schwab, 2017).

The criteria used to classify countries in each stage of development is based on GDP per capita and share of exports from mineral goods over total exports. The countries are classified into 5 stages of development, which are the factor, efficiency, and innovation driven ones, plus two transition stages. In 2017, Honduras, Nicaragua and Venezuela were classified as in transition from factor to efficiency-driven. Colombia, Mexico and Peru were classified as efficiency-driven. Argentina, Chile, Costa Rica, Panamá and Uruguay were classified as countries in transition from efficiency to innovation-driven. The leading countries in the global competitiveness index were Switzerland, the United States, Singapore, the Netherlands, and Germany. The highest ranked country in Latin America was Chile, in place 33.

The WEF Global Competitiveness Report uses a Global Competitiveness Index 4.0 and measures competitiveness for 140 countries. The index uses new pillars for the features that a competitive economy requires and responds to the 2008 economic crisis, which demonstrated that prolonged periods of recession have impacts on productivity. Additionally, it considers the fourth industrial

revolution, which has accelerated the innovation cycle making companies obsolete at a faster rate (Schwab, 2018). Under this new scenario, competitive economies require:

- resilience to economic crisis and external shocks
- agility in order to adapt to constant changes, and to take advantage of opportunities
- building and innovation ecosystem where innovation receives incentives from all sectors to produce new goods and services
- adopting a human-centric approach from economic development, recognizing that the main progress comes from human capital

The 12 pillars of the Global Competitiveness Index 4.0 are:

1. Institutions
2. Infrastructure
3. ICT adoption (information and communication technologies)
4. Macroeconomic stability
5. Health
6. Skills
7. Product market
8. Labor market
9. Financial system
10. Market size
11. Business dynamism
12. Innovation capability

An important change that the Global Competitiveness Index 4.0 introduces is that it does not differentiate according to the stage of development anymore and computes the index in the same way for all 140 countries, by averaging the value of each of the 12 pillars. This logic follows the basis that “as the fourth industrial revolution proceeds, all competitiveness factors will have a similar bearing on countries competitiveness, regardless of their income levels”. Automation will possibly reduce the feasibility of countries relying on low labor costs in manufacturing (Schwab, 2018). The Global Competitiveness Index 4.0 methodology was also used in the Global

Competitiveness Report 2019 (Schwab, 2019), but rankings were paused in 2020 due to the COVID pandemic. For 2020, the WEF launched a Special Edition of the Global Competitiveness Report: How Countries are Performing on the Road to Recovery (Schwab, 2020) that focuses on the core country issues that will promote the recovery of economies.

The highest-ranking economy according to the Global Competitiveness Index in 2018 was the United States, followed by Singapore, Germany, Switzerland, and Japan. The highest-ranking economies in Latin America are Chile (33), México (46), Uruguay (53), Costa Rica (55) and Colombia (60).

In 2019, the highest-ranking economy according to the Global Competitiveness Index was Singapore, followed by the United States, Hong Kong, Netherlands, Switzerland, and Japan. The highest-ranking economies in Latin America are Chile (33), México (48), Uruguay (54), Colombia (57), and Costa Rica (62).

Likewise, the Institute for Management Development (IMD) World Competitiveness Center measures competitiveness for 63 countries using 341 indicators. The IMD competitiveness index bases 66% of its results in statistical data and does not use as much survey information as the WEF Global Competitiveness Index (Institute for Management Development, 2017)

The IMD competitiveness index groups the 341 indicators in the following pillars and areas of competitiveness:

1. Economic performance
 - a. Domestic economy
 - b. International trade
 - c. International investment
 - d. Employment
 - e. Prices

2. Government efficiency
 - a. Public finance

- b. Tax policy
 - c. Institutional framework
 - d. Business legislation
 - e. Societal framework
3. Business Efficiency
- a. Productivity and efficiency
 - b. Labor market
 - c. Finance
 - d. Management practice
 - e. Attitudes and values
4. Infrastructure
- a. Basic infrastructure
 - b. Technological infrastructure
 - c. Scientific infrastructure
 - d. Health and environment
 - e. Education

In 2019, 63 countries were ranked by the IMD (Institute for Management Development, 2019). The competitiveness ranking was led by Singapore, followed by Hong Kong and the United States. Country rankings from Latin America were Chile (42), México (50), Colombia (52), Peru (55), Brazil (59), and Argentina (61).

In 2020, the IMD World Competitiveness Ranking was led by Singapore, followed by Denmark, Switzerland, Hong Kong, and Sweden (Institute for Management Development, 2020). The United States was ranked 10. From Latin America, top ranking countries were Chile (38), Peru (52), Mexico (53) and Colombia (54).

2.5.2. *Measuring Regional Competitiveness: Experiences in the European Union*

There is a great diversity of approaches in the current measurements of regional competitiveness. This diversity follows the diversity in interpretation of current regional competitiveness conceptual frameworks.

According to Annoni y Dijkstra (2017) one of the biggest problems of identifying regional competitiveness indicators is the lack of a clear economic, political, or conceptual framework. This absence of a clear definition does not allow the construction of an index based on robust theoretical frameworks.

The European Commission developed a Regional Competitiveness Index (RCI) that was published in 2010, 2013, 2016 and 2019. The RCI measurements allow comparing regional attractiveness for companies and individuals within countries as well as between countries. To measure the RCI, regional competitiveness is defined as “the ability to offer an attractive and sustainable environment for firms and residents to live and work” (Dijkstra *et al*, 2011; Annoni and Dijkstra, 2017).

The RCI considers 11 pillars divided into 3 groups: basic, efficiency and innovation.

- Basic group: ((1) Institutions; (2) Macroeconomic Stability; (3) Infrastructures; (4) Health; and (5) Quality of Primary and Secondary Education.
- Efficiency group: 6) Higher Education, Training and Lifelong Learning; (7) Labor Market Efficiency; and (8) Market Size.
- Innovation group: (9) Technological Readiness; (10) Business Sophistication; and (11) Innovation.

Factor and determinants of competitiveness will vary along with the development of the region. Factors such as qualified and efficient workforce and the ability to innovate will have a higher weight in developed regions, than in regions that do not have the basic group factors covered.

Regions are classified into five stages of development, according to the level of regional GDP per capita in purchasing power parity. In regions with lower GDP per capita, the pillars from the basic

group have a greater weight in the RCI than the pillars from the innovation group. On the other hand, in regions with higher GDP per capita, pillars from the innovation group have a greater weight. The results of Annoni and Dijkstra (2017) show that in the European Union highest RCI regions are those that host capital cities.

Alternatively, Aiginger and Firgo (2017) agree with Annoni and Dijkstra (2017) in the definition of regional competitiveness but differ in the application of the definition to measure it. Aiginger and Firgo's main criticisms of regional competitiveness indexes point to the fact that they do not distinguish between the competitiveness of “inputs” and competitiveness of “outcomes” and those measurements rarely incorporate environmental indicators.

Aiginger and Firgo (2017) establish that to measure competitiveness there must be an assessment of both inputs and outputs. Input competitiveness is related to efficiency and capabilities of regions, and input competitiveness factors are costs, productivity, economic structure, and capabilities.

On the other hand, regional outcome competitiveness is “the ability of a region to deliver Beyond GDP goals”, thus including social and environmental results in the assessment, in addition to economic results.

Using 54 variables, Aiginger and Firgo measure competitiveness in 229 regions (NUTS 2) in 16 European countries. Cost competitiveness is assessed through wages and labor costs for the whole economy and for manufacture. Capabilities dimensions are infrastructure, education and innovation, social and institutional quality, and environmental capabilities. Outcome competitiveness is the aggregation of income, social and ecological pillar into a New Perspectives Outcomes Composite variable (NPO).

To measure regional competitiveness (Aiginger y Firgo, 2017) variables are classified in the following components:

1. Outcomes:

- a. Income Pillar: GDP per capita and household income.

- b. Social Pillar: unemployment rate, employment gender gap, Youth unemployment rate, Long- term unemployment as share of total unemployment, people at risk of poverty or social exclusion.
 - c. Ecological pillar: Co2 intensity (CO2 emissions/GDP), Population exposed to air pollution and composite index of environmental and natural assets and emission of air pollutants.
2. Costs: wages, compensation per person employed in total economy and manufacturing sector.
3. Structure: Financial and business services share in employment, share of employment in knowledge- intensive services, Share of employment in high technology sectors, manufacturing and high- tech knowledge- intensive services, and Entropy of sectoral employment.
4. Capabilities:
 - a. Education and innovation: Share of active population in science and technology, share of population with tertiary education, Participation rate in education and training, Share of young people neither in employment, education or training, R&D expenditures, and Patent applications.
 - b. Social System: infant mortality rate, life expectancy at birth, and age dependency ratio.
 - c. Institutions: Share of voters in general elections, quality of regional government, Distance to markets or city.
 - d. Infrastructure (intangible) and equipment: population density, ability of landscapes to provide shelter and safe transportation, Landscape services from landscapes with touristic or recreational value, regional capital city.
 - e. Ecological capabilities: Share of employment in industries with high-energy purchases in total industrial employment, Number of green patents, Influence of land cover and biologically mediated processes, and Suitable living space and reproduction habitat for wild plants and animals to maintain biological and genetic diversity.

Furthermore, Huggins *et al* (2014) developed a World Regional Competitiveness Index (WCIR) for 546 regions using 19 indicators and following the Global Competitiveness Index measurement methodology by the World Economic Forum. Countries are categorized according to their development status (factor, efficiency, and innovation driven) to determine the weights of the

indicators in the WCIR. The WCIR includes Latin American countries of Colombia and Brazil in the assessment.

Before the WCIR, Huggins (2003) also developed a regional competitiveness index for the United Kingdom that allows comparisons of regions and localities. Similarly, to Aiginger and Firgo, Huggins acknowledges that the measurement of regional competitiveness is complex and cannot be limited to GDP and productivity indicators, it must also include political, social, and cultural factors. Moreover, the author measures factors that linked to regional inputs, outputs, and outcomes through a 3-factor model:

1. Inputs:

- Business density (firms per capita)
- Knowledge based businesses (% of all businesses). Based in OECD definition, which includes technology manufacturing and knowledge-based services.
- Economic participation (activity rates)

2. Output:

- Productivity (GDP per capita)

3. Outcomes:

- Earnings (full time wages)
- Unemployment (unemployment rate)

In Spain, the General Council of Spanish Economists (CGE, 2018) defines regional competitiveness as "*the ability to provide a favorable environment for companies, either through factors specific to the territory or through the achievement or expansion of others, tangible or intangible, which reinforce and consolidate their competitive base, with the ultimate objective of improving the welfare of their population*". The CGE developed a Regional Competitiveness Index (ICREG) for the 17 Autonomous Communities of Spain. The ICREG consists of 53 variables divided into seven areas of competitiveness: economic environment, labor market,

human capital, institutional environment, basic infrastructures, business environment and innovation.

An important theoretical premise is that to measure the ICREG the CGE presumes that regional competitiveness is not directly measurable, because the definition of the concept is "abstract and multidimensional, with factors not determined exhaustively and without a well-known functional form" (CGE, 2018). However, the CGE recognizes that competitiveness of two regions, despite not being directly measurable, may be compared using a set of performance indicators that act as proxies of regional competitiveness. In consequence, to overcome the problem of not having a well-known functional form of competitiveness, and still be able estimate and compare regional competitiveness, ICREG measures variables that are assumed to be correlated with regional competitiveness.

2.6. Regional Competitiveness Measurement in Latin America

There are several measurements of regional competitiveness in Latin America. In general, regional competitiveness measurements in Latin America cover the largest scale of the country's administrative division, equivalent to TL2 under the OCDE definition.

One of the main advantages of using the country's political-administrative division is the larger availability of statistical information and that public policy targets that same division. On the other hand, the problem of using that division is that economic and social occurrences and trends do not follow the boundaries of administrative divisions, and many times these occurrences transcend them (OCDE, 2016).

Another characteristic of the existing regional competitiveness measurements in Latin America is that all of them rank regions within the country. Thus, there is no research comparing regional competitiveness between countries that could allow establishing common factors that arise from different research and competitiveness indexes, such as the research previously described for the European Union. There is, however, a regional development index called "IDERE LATAM" that compares 182 Latin American regions across 8 countries (Argentina, Brazil, Colombia, Chile, El Salvador, México, Paraguay, and Uruguay) using a comparable set of indicators that are based on the human development index from Amartya Sen (Rodriguez and Vial, 2020). The comparative analysis of this index shows that there are high regional inequalities in Latin America, that the highest levels of development are in urban centers and national capitals, and that Chile and Uruguay show higher levels, in general, of development.

In order to identify common patterns between the already available rankings, this section reviews the existing competitiveness measurements from three perspectives:

1. Institutions and supporting theories of the regional competitiveness index
2. Ranking results of the regions
3. Measurement techniques used in each regional competitiveness

2.6.1. Institutions and Supporting Theories

Table 1 summarizes available regional competitiveness measurements for Argentina, Colombia, Chile, Mexico, and Peru. One of the first characteristics of competitiveness measurements in Latin America is the fact that most countries have more than one institution measuring it simultaneously. Argentina is the only country where there is only one available measurement for regional competitiveness.

The multiple measurements of competitiveness in Latin America are evident from at least two perspectives: institutions and supporting theories. Institutions measuring regional competitiveness differ in the very nature of their existence, in their objectives, mission and vision, or in their purpose for measuring regional competitiveness, which explains why sometimes two different measurements of competitiveness are available for the same regions at the same time.

For example, in Colombia, there are two regional competitiveness indexes. The Private Council for Competitiveness together with Rosario University publish the Department Competitiveness Index (*Indice Departamental de Competitividad-IDC*). On the other hand, the Economic Commission for Latin America and the Caribbean (ECLAC) produced an index called *Escalafon de Competitividad Departamental*. The two institutions have different missions, objectives and purposes which reflect on their regional competitiveness measurements. The Department Competitiveness Index takes basis in the WEF approach, centering in productivity, performance, efficiency, innovation and market sophistication, while ECLAC has a multidimensional approach that incorporates economic growth, innovation, connectivity, the welfare of its population and the governance of the territory. This reflects on the institutions, United Nations focusing much more on development and the Private Council for Competitiveness/Rosario University focusing on economic performance.

Similarly, in Peru, three institutions measure regional competitiveness: The National Council for Competitiveness (*Consejo Nacional de Competitividad*), the Peruvian Institute for Economics (*Instituto Peruano de Economía*) and the Competitiveness Center (Centrum) from the Catholic

University of Peru (*Universidad Católica del Perú*). The first two institutions support their competitiveness measurement in the WEF approach, centered in productivity. The National Council for Competitiveness is a government institution within the Peruvian Ministry of Economy and Finance, and the Peruvian Institute for Economics is a private institution. Both institutions have as objectives improving economic policy and promoting economic growth. On the other hand, Centrum, a research institute from a Peruvian University, uses an approach that incorporates both productivity and population wellbeing: “*regional competitiveness is defined as management of resources and capacities to sustainably increase business productivity and wellbeing of the region's population*”.

2.6.2. Ranking Results

In Chile, Colombia and Peru, results of highest and least competitive regions are similar, despite major differences in methodologies, supporting theories and set of indicators used in each index.

For example, in Chile the Economics and Business Studies Center from the *Universidad del Desarrollo* produced the Regional Competitiveness Index (ICORE). This index measured competitiveness in the 15 existing regions (Echeverría and Arce, 2013). On the other hand, the Chilean Institute of Municipal Studies from the Universidad Autónoma of Chile (Instituto Chileno de Estudios Municipales, 2017) created a Regional Development Index - IDERE. This index does not measure of regional competitiveness; it measures regional development from a multidimensional perspective, but factors and construction are very similar to other competitiveness indexes.

Despite having large differences in methodology and indicators, for both indexes in Chile, the Metropolitana region leads the results, followed by the Magallanes region. The Metropolitana region has the high levels for the almost all the dimensions including social development, economic, infrastructure and innovation. Magallanes region records high values of indicators related to infrastructure and socioeconomic wellbeing. Specifically, Magallanes has low levels of poverty, above average income, and good housing quality indicators.

The fact that different competitiveness measurements yield similar results in Chile, Colombia and Peru supports the idea that competitiveness can be indirectly assessed by measuring a set of competitiveness-related indicators (CGE, 2018) and that results from different indexes will yield similar results.

The similar rankings between different measurements are also consistent to what has been observed in the European studies. For example, Huggins *et al* (2019) measure competitiveness in the United Kingdom regions in 2019 comparing only 10 indicators, which are input, output, and outcome factors. According to the authors, the factors interact in a complex manner and include economic, social, political, and cultural factors, but not all of them are measurable. Thus, they selected the indicators considering their value and their relative effectiveness as performance measures. Additionally, they assume that factors, such as culture, will have an identifiable effect on the key economic factors, since competitiveness comparisons take place within the UK.

Aiginger and Firgo (2017), assemble a set of 54 indicators of input, output, and outcome factors to compare competitiveness across regions in the European Union. Principal components analysis (PCA) and factor analysis (FA) allow the authors to group indicators and drop 10 of them that do not fit well into their groups. Additionally, PCA and FA reduce the complexity and dimensionality to investigating the relation between input, output, and outcome factors.

These results suggest that adding large sets of indicators will not necessarily yield different results from previous measurements, thus, competitiveness measures should focus in obtaining a minimum set of indicators that relate to the core factors of regional competitiveness.

Table 1: Competitiveness Indexes in Latin America: Supporting Theories and Main Results

Country	Index Name	Author/Institution	Supporting Theory	Highest ranked regions	Lowest ranked regions
Argentina	Índice de Competitividad Provincial	Bolsa de Comercio de Córdoba	Regional competitiveness is based on the definition from the Chilean Department for Regional Development (SUBDERE): "Capacity or potential of the economic system of a certain region to achieve higher levels of per capita income in a sustained manner".	1. Ciudad Autónoma de Buenos Aires 2. Tierra del Fuego 3. La Pampa 4. San Luis	21. Catamarca 22. Chaco 23. Corrientes 24. Jujuy
Colombia	Escalafón de competitividad	CEPAL (ECLAC)	The index is based on an implicit definition of competitiveness that gathers structures, dynamics and achievements of a region that link economic growth, innovation, connectivity, the welfare of its population and the governance of the territory. This definition is part of a multidimensional vision, beyond GDP (Krugman, 1994, Stiglitz <i>et al.</i> , 2009), and provides a panoramic and comprehensive view of the relative development of each department.	1. Cundinamarca/Bogotá 2. Antioquia 3. Santander 4. Caldas 5. Atlántico (2019)	30. Vichada 31. Guainía 32. Vaupés (201)
Colombia	Índice de Competitividad departamental (IDC)	Consejo privado de Competitividad – Universidad de Rosario	Based on the competitiveness definition from the World Economic Forum: " <i>set of institutions, policies and factors that determine a country's level of productivity</i> ".	1. Bogotá 2. Antioquia 3. Valle del Cauca 4. Santander 5. Risaralda (2020)	25. Chocó 26. Guainía 27. Vichada (2020)
Chile	Índice de Desarrollo Regional - IDERE	El Instituto Chileno de Estudios Municipales de la Universidad Autónoma de Chile	Measures regional development using a multidimensional perspective, similar to the Human Development Index (HDI) from the United Nations Development Program (UNDP).	1. Metropolitana 2. Magallanes 3. Valparaíso 4. Antofagasta (2017)	15. Araucanía 14. Maule 13. Aysén 12. Arica y Parinacota
Chile	Índice de Competitividad Regional-ICORE	Centro de Estudios en Economía y Negocios de la Universidad del Desarrollo	It is a measure of the competitive capacity of regions and accounts for the factors that enable systematically higher levels of productivity compared to other regions. The ICORE reflects the relative differences in the structural conditions of the regions that can significantly influence their productivity and, at the same time, influence the competitiveness of the companies that are located in them. The regional conditions given by public and private sector can enable higher standards of living.	1. Metropolitana 2. Magallanes 3. Valparaíso 4. Aysén (2015)	15. Arica y Parinacota 14. Los Ríos 13. Araucanía 12. Atacama

Mexico	Índice de Competitividad Estatal	IMCO	Competitiveness is defined as the capacity of cities, states, or countries to generate, attract, and retain talent and investments. Both talent and investment tend to allocate in places that offer higher economic and social returns. Thus, in regions that attract talent and investment, high level of productivity is expected for companies and individuals, as well as high levels of prosperity and well-being. The latest Competitiveness index by IMCO (2020) does not have a general ranking for the regions, and only ranks them by sub-index.	1. Ciudad de Mexico 2. Querétaro 3. Nuevo León 4. Aguascalientes (2018)	29. Michoacán 30. Oaxaca 31. Guerrero 32. Chiapas
Mexico	Índice de Competitividad Urbana	IMCO	The index measures the ability of Mexican cities to attract and retain investment and talent. In cities, as in countries and in states, the level of productivity of companies and individuals, as well as their prosperity and well-being, are linked to the local stock of physical and human capital. In addition, both talent and investment tend to gravitate towards places where they can obtain the best economic and social returns. Therefore, a competitive city - consistently appealing to talent and investment - is a city that maximizes the productivity and welfare of its inhabitants.		
Perú	Índice de Competitividad Regional	Consejo Nacional de Competitividad	Based on the competitiveness definition from the World Economic Forum: "set of institutions, policies and factors that determine a country's level of productivity".	1. Lima 2. Moquegua 3. Ica 4. Arequipa (2013/14)	24. Huancavelica 23. Loreto 22. Huánuco
Perú	Índice de Competitividad Regional INCORE	Instituto Peruano de Economía	Based on the competitiveness definition from the World Economic Forum: "set of institutions, policies and factors that determine a country's level of productivity".	1. Lima 2. Arequipa 3. Moquegua 4. Ica (2018)	19. Ayacucho 18. ICA 17. Ucayali
Perú	Índice de Competitividad Regional	CENTRUM - Universidad Católica del Perú	Regional competitiveness is defined as management of resources and capacities to sustainably increase business productivity and wellbeing of the region's population.	1. Lima metropolitana 2. Moquegua 3. Tacna 4. Arequipa (2018)	26. Huancavelica 25. Amazonas 24. Ayacucho

Source: author based in official data

2.6.3. Measurement Techniques

Table 2 presents indicators, factors, pillars, and methods used to compose regional competitiveness indexes in Latin America. The comparative analysis of these indexes allows identifying the following set of common competitiveness factors or pillars: company efficiency and productivity, regional infrastructure, human capital, technological capacity, and innovation.

Another common feature among these measurements is that all competitiveness rankings use sets of normalized indicators. The normalization method varies slightly between indexes. The majority of normalization procedures uses the “min-max” scaling method. The *Indice de Competitividad Regional* (Consejo Nacional de Competitividad, 2013) for Peru, uses historical minimum and maximum values to normalize each indicator, this allows to compare normalized values between years for each indicator because the changes in the normalized indicator reflect changes of the actual value of the indicator. Centrum (2017) uses the standard value method to normalize. The INCORE (*Instituto Peruano de Economía*, 2018) scales values for each indicator from 0 and 10 to the minimal and maximum value of each indicator, respectively. Afterwards, the intermediate values are extrapolated.

A major difference between scaling and normalization is that scaling values does not change the distribution of the variable that it scales, unlike normalization, which may change the distribution of the normalized variable.

After normalizing or scaling, values are aggregated using different weighting techniques to create a single indexed value for each region. There are four main techniques for aggregating values:

1. Averaging values of all the indicators or pillars (INCORE-Peru, *Indice Competitividad Regional-Peru*) giving the same weight, and thus importance, to all indicators.
2. Assigning different weights to each indicator by using Principal Components Analysis (PCA) or Factor Analysis (FA).

3. Using different weightings based on the degree of development of the region. This technique is based on the WEF Global Competitiveness Index (Schwab, 2017) which classifies countries into factor-driven, efficiency-driven or innovation-driven based on their GDP per capita levels and share of exports dependent on raw materials. This technique was dropped in the 2018 WEF Global Competitiveness Report under the rationale that under the fourth industrial revolution “all competitiveness factors will have a similar bearing on countries’ competitiveness, regardless of their income level” (Schwab, 2018).

4. Consulting with a panel of experts or making surveys and assigning different weights to each component based on the opinions of the experts or results from the surveys.

A major problem of comparing regions in Latin America is the availability of comparable indicators, as few of them are constructed using similar sources and methodology. Additionally, the variability in the size of administrative regions is enormous; there are regions in Latin America, such as Sao Paulo, Rio de Janeiro or Mexico’s Federal District that have larger populations than entire countries (ECLAC, 2015). Furthermore, when comparing different countries there are a number of factors such as institutional set-ups, patterns of trade and innovation, industrial specialization, cultural factors, that differ between countries and regions, and that may be a distorting factor when comparing performance (Smith, 2001). To reduce this problem, best practice would be to use different performance measures, instead of a single indicator or measure.

Considering source and methodology consistency, only few indicators are comparable, these include indicators that come from population census, household surveys, employment surveys, and national accounts. These indicators are usually constructed by National Statistics Institutes in each country, which use the same standards and methodologies. In the case on national accounts, most countries in Latin America measures them through their National Statistical Institute, but in Chile and Ecuador, the Central Banks is responsible for this data (Buitelaar *et al*, 2015). All these institutions follow international standardization methods and rely on similar sources.

These results suggest that to obtain a measure of regional competitiveness the effort should be focalized in obtaining a limited set of comparable indicators that maximize their effectiveness as performance measures. PCA and FA allow reducing the number of indicators by dropping indicators that do not add explanatory power to the dependent variables. Additionally, these techniques allow maximizing the value and effectiveness by reducing the dimensionality of the data set.

To obtain comparable indicators it is necessary to adopt a normalization approach. From previous results, the most frequently used approach is the “min-max” scaling method. Other normalization techniques have not shown any superior results or benefits. Additionally, the use of historical minimum and maximum values will allow comparisons of normalized values and their evolution in time-series.

Table 2: Competitiveness Indexes in Latin America: Indicators, Normalization, and Aggregation Methods

Country	Index Name	Time frame	Scale/number of regions	Indicators	Number of pillars	Pillar description	Normalization Method	Variable/Pillar aggregation method
Argentina	Índice de Competitividad Provincial	2007-2012	24 regions (23 Provincias and Ciudad Autónoma de Buenos Aires)	72 indicators (variables). 16 of them are from survey data.	7 factors	People, business, government, natural resources and environment, infrastructure, innovation, science and technology, and economic results.	Normalized by “min-max” also known as feature scaling method: $(X - \text{Min}) / (\text{Máx} - \text{Mín})$	The weighting of the variables within each factor is obtained from a “consensual analysis of all the members of the working group and consultation of qualified professionals in the subject” (Bolsa de Comercio de Córdoba, 2013). The 7 factors have the same weight in the index.
Colombia	Escalafón de Competitividad	2000-2019	32 departments		5 factors	<p>a) Economic strength: size of the market, productive structure, associations and entrepreneurship, trade and financial services.</p> <p>b) Infrastructure and logistics: roads, ports, airports, and digital networks.</p> <p>c) Wellbeing and human capital: education, health, social structure, and housing services.</p> <p>d) Science, technology, and innovation: investment on science and technology, scientific production, and superior education.</p> <p>e) Institutions and public management: public management, government finances, security, and transparency.</p>	Normalized by “min-max” also known as feature scaling method: $(X - \text{Min}) / (\text{Máx} - \text{Mín})$	The weighting system is determined through Principal Component Analysis (ACP). Therefore, the weight of each factor varies with each new version of the index.

Colombia	Índice de Competitividad departamental	2013-2020 (8 versions)	Complete index for Bogota and 32 departamentos.	102 variables	13 pillars grouped in the following factors: Basic conditions, Human Capital, market efficiency and innovation ecosystem	<ul style="list-style-type: none"> A) Basic conditions: <ul style="list-style-type: none"> 1. Institutions 2. Infrastructure 3. Adoption of Information technology 4. Sustainability B) Human Capital <ul style="list-style-type: none"> 5. Health 6. Tertiary education and training C) Market efficiency <ul style="list-style-type: none"> 7. Business environment 8. Labor market 9. Financial system 10. Market size D) Innovation ecosystem: <ul style="list-style-type: none"> 11. Sophistication and diversification 12. Innovation and firm dynamics 	The score assigned to each indicator results of the application of a max-min transformation, which not only normalizes the data, but maintains the ordering of the departments and the relative distance $(X - \min) / (\max - \min)$. The scores vary between 0 and 10.	For the 2020 index: Simple averages of the normalized variables in each pillar. Equal weighting for each of the 13 pillars. For the 2018 and before: the departments are classified according to their development status in four categories taking into account GDP per capita, excluding mining and energy activities, and degree of complexity of production. The less developed departments have a greater weighting of the basic factors and the most developed have a greater weighting of efficiency and innovation factors.
Chile	Índice de Desarrollo Regional - IDERE	2016-2019 (3 versions)	15 regions	33 indicators	7 dimensions	Education, health, socioeconomic well-being, economic activity, connectivity, safety, and sustainability and the environment.	Normalized by “min-max” also known as feature scaling method: $(X - \text{Min}) / (\text{Mín-Máx})$	The weights of each dimension were calculated through the responses of a second consultation with experts through an online survey. Thus, the weighting of each dimension is: Education, 17.5%; Health, 17.5%; Socioeconomic Wellbeing, 17.5%; Economic Activity, 17.5%; Connectivity, 10%; Security, 10%; Sustainability and Environment, 10%.
Chile	Índice de Competitividad Regional- ICORE	1999-2015 (12 versions)	15 regions	65 indicators	7 dimensions	<ul style="list-style-type: none"> 1. Person: 10 health and education variables 2. Business management and quality of employment: 10 variables in the areas of business management, quality of employment and capacity of workers. 3. Innovation, science, and technology: seven variables in the areas of resources for innovation, science, and technology. 4. Infrastructure and Capacity: This dimension divides into two areas: basic services and infrastructure, and capacity. 5. Economic and Financial Environment: This dimension covers the areas of financial system, economic development and activities and prices. 6. Public Investment and Security: Eight variables that cover aspects of national and regional public investment, and security. 	Normalized by “min-max” also known as feature scaling method: $(X - \text{Min}) / (\text{Mín-Máx})$	Simple averages of the normalized variables in each dimension. Equal weighting for each dimension.

7. Trade: Eight variables that cover the areas of external trade (with other countries) and internal trade (within the country).

Mexico	Indice de Competitividad Estatal	2006 - 2020 (8 versions)	32 regions (Estados)	97 indicators	10 sub-indexes	I. Reliable and objective legislations, II. Sustainable management of the environment, III. Inclusive, prepared and healthy society, IV. Stable and functional political system, V. Efficient and effective governments, VI. Factor market, VII. Stable economy, VIII. Precursor sectors, IX. International relations and X. Innovation.	The variables selected for each state were standardized on a scale of zero to 100 based on the values they present with respect to the rest of the sample. Thus, the lowest value of the sample takes the value of zero, while the highest value takes the value of 100. The other values take a rating between zero and 100 in proportion to the scale used.	The basis of the index are investment and talent indicators. The rest of the indicators from the ten sub-indexes are compared against the first ones in order to establish relationships that allow orienting the design of public policies. All the indicators have the same weight within the database. The weight of the sub-indexes is calculated using Principal Components Analysis. The ratings obtained in each indicator grouped by sub-index are taken as independent variables and the average of the investment and talent variables is taken as the dependent variable. This technique helps to identify how much variance of anchor variables is explained by the variables that make up each sub-index.
Mexico	Indice de Competitividad Urbana	2007 - 2018 (6 versions)	73 cities	120 indicators	10 sub-indexes	I. Reliable and objective legislations, II. Sustainable management of the environment, III. Inclusive, prepared and healthy society, IV. Stable and functional political system, V. Efficient and effective governments, VI. Factor market, VII. Stable economy, VIII. Precursor sectors, IX. International relations and X. Innovation.	The variables selected for each city were standardized on a scale of zero to 100 based on the values they present with respect to the rest of the sample. Thus, the lowest value of the sample takes the value of zero, while the highest value takes the value of 100. The other values take a rating between zero and 100 in proportion to the scale used.	The allocation of the weights per indicator follows two stages. First, 50% of the weight of the rating is calculated through a budget allocation process. For this, IMCO experts were consulted in each subject to assign to all indicator values of 0.1, 0.5 or 1.0, depending on their level of influence on competitiveness. Second, 50% of the weight is assigned based on the variance of each indicator. Variables with steady behavior are rewarded to avoid over-reactions in the ranking caused by abrupt movements of the indicators. The sub-indices are weighted by Regression by Principal Components, using talent and investment as dependent variables.

Peru	Índice de Competitividad Regional	2007/2008 - 2013/14 (7 versions)	24 regions	58 indicators	8 pillars	Productivity or input pillars (institutions, infrastructure, health, education, innovation, and environment) and competitiveness or output pillars (sectoral evolution and economic performance).	Standardized by the historical minimum and maximum method (X-Max historical) / (Historical Min-Max historical). This allows that changes in the normalized indicator to reflect changes in the absolute indicator.	The weight of the indicators in the construction of the index varies according to the level of development of each region, which is measured through GDP per capita.
Peru	Índice de Competitividad Regional INCORE	2018 (6 versions)	25 regions (Includes Lima and Lima Provinces. Callao province is included in Lima)	45 indicators	6 pillars	Economic, Labor, Education, Health, Infrastructure, Institutions	For each indicator regional scores are calculated. A value of ten is assigned to the best performing region, a value of zero to that worst performing region and the corresponding value is interpolated for the other regions.	Pillars are assigned the average of the scores obtained for each indicator. Competitiveness index for each region is the average value of the six pillars (equal weighting for each pillar).
Peru	Índice de Competitividad Regional	2010-2016 (5 versions)	26 regions (Includes Lima Metropolitan area and Lima region)	90 variables	5 pillars	Economic, companies, government, infrastructure, and people.	First, the standard result is calculated and afterwards is scaled to facilitate interpretation. The standard result is the number of standard deviations below or above the mean = $(X - \text{Mean}) / \text{SD}$	Index is the average value of the six pillars (equal weighting for each pillar).

Source: author based in official data

2.7. Measuring Regional Competitiveness : The Theoretical Framework

Modern definitions of regional competitiveness have advanced from economic-centered principles that prevailed in the 1980 and 1990s, towards a holistic concept that recognizes that the goal of regional competitiveness is to increase wellbeing through productivity. This aspect of regional competitiveness is what makes it a comprehensive framework to address regional performance. The goal of increasing well-being through the means of productivity is also what separates regional competitiveness from other purely economic approaches and also what separates regional competitiveness from social development concepts that focus almost entirely on wellbeing, leaving economic issues behind.

From a practical perspective, the regional competitiveness conceptual framework allows a broad understanding of the differences in regional performance. In the past, differences in regional performance have been addressed by endogenous growth models (Romer, 1994), which place investments on human capital, innovation, and knowledge as key drivers of growth, in addition to the traditional factors of capital and labor (Huggins, *et al* 2014; Huggins and Thompson, 2017).

According to Huggins and Thompson (2017), a major difference between endogenous growth models and competitiveness models is that endogenous growth models seek to explain past growth. By contrast, competitiveness models are also seeking to measure the potential for future growth, incorporating the explanatory factors adopted by growth theorists such as labor, capital, technology, or investment in human capital, as well as current rates of output and productivity. Hence, competitiveness models are implicitly based on endogenous growth models and seek to predict potential outcomes.

As presented before, there is a great diversity of approaches in the existing Latin American regional competitiveness measurements. This diversity mirrors the diversity in interpretations of the regional competitiveness conceptual frameworks (Annoni y Dijkstra, 2017).

Amongst the various definitions of regional competitiveness, a modern and comprehensive definition is “*the ability of a region to deliver beyond GDP goals for its citizens today and tomorrow*” (Aiginger *et al*, 2013; Aiginger and Vogel, 2015; Aiginger and Firgo, 2017). Similarly,

Annoni and Dijstra (2017) define regional competitiveness as the “*ability to offer an attractive and sustainable environment for firms and residents to live and work*”. Both of these definitions address wellbeing and economic objectives while also incorporating the idea of a regional environment that enables the achievement of those objectives.

From to these definitions, the following qualities and characteristics of competitive regions are derived and listed below.

The first characteristic is the idea that the region offers an “environment” for companies to achieve a certain level of performance. In other words, competitive regions offer an environment or *milieu* that boosts company productivity.

Secondly, sustainability is a basic condition to achieve competitiveness, in the sense that it allows a sustained high performance for the companies. This implies that the environment or *milieu* cannot be composed of short-term factors or time-specific conditions and, on the contrary, must include enduring and sustainable conditions.

Third, a competitive region needs to offer attractive conditions for both companies and residents; the region needs to be attractive so that workers will live in that region. Regions in Latin America specialized in the mining sector, like the Antofagasta region in Chile, which specializes in copper extraction, are often considered competitive only because of company performance and without considering any aspects of the resident’s wellbeing. In the particular case of the Antofagasta region, it offers a good environment for mining companies to have a high performance, but many workers travel from other regions and have no interest in residing within the region, because they may get better access to services, like education or health services, in other regions. These types of regions are not competitive under the definitions stated before.

Forth, this definition implies that competitive regions need to offer certain conditions that attract companies and people, which can allow a high productivity for companies and a high level of wellbeing for people, but also that they need to show positive results in both of these factors. This implies that competitiveness has certain conditions (environment) that will allow a potential

outcome, and also that these regions are achieving the actual outcome (productivity and wellbeing). Additionally, wellbeing is an outcome of social, economic and environmental results.

In consequence, for the purpose and objectives of this thesis, regional competitiveness is defined as “*the ability of a region to sustainable deliver economic, social, and environmental goals to its citizens and workers*” (Aiginger et al, 2013; Aiginger and Vogel, 2015; Aiginger and Firgo, 2017; Annoni and Dijkstra, 2017).

3. Methodology. Measuring Regional Competitiveness Across Countries

3.1. Definitions and Methodology

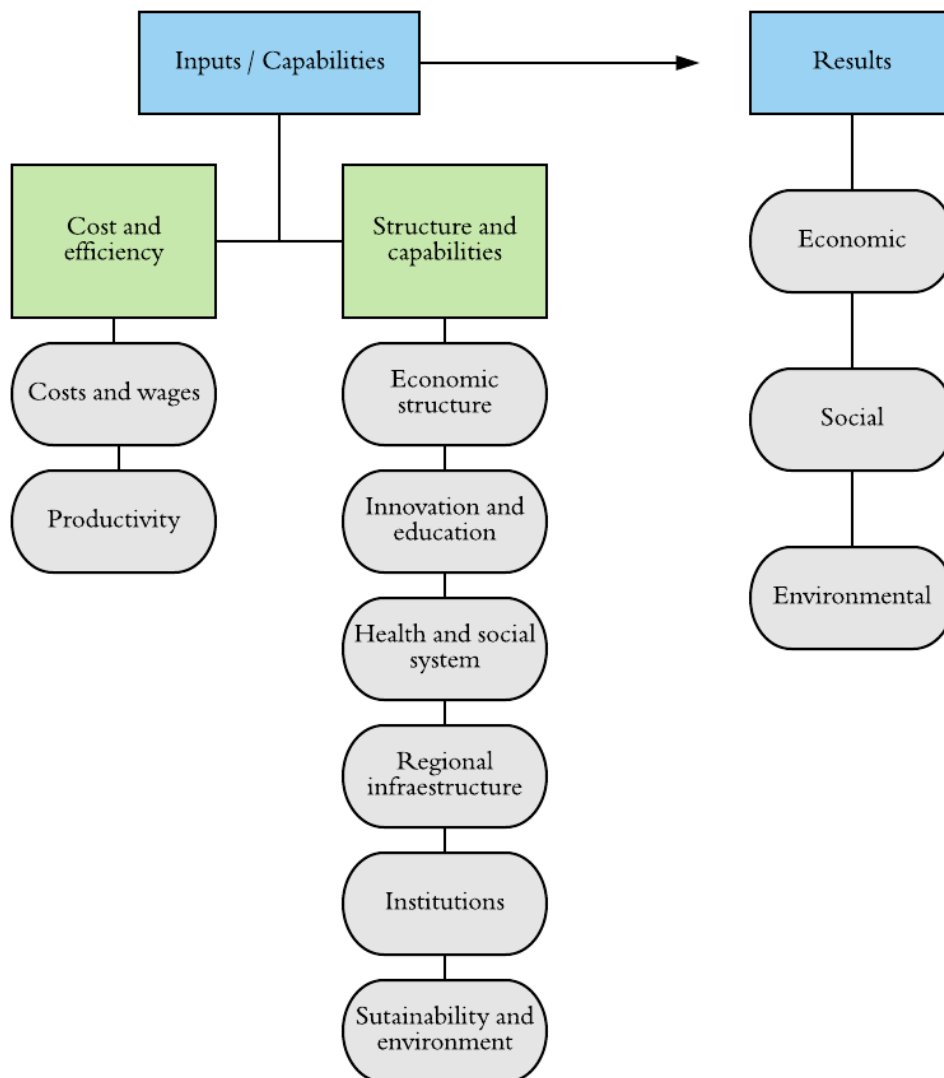
Regional competitiveness is defined *as the ability of a region to sustainable deliver economic, social, and environmental goals to its citizens and workers* (Aiginger *et al*, 2013; Aiginger & Vogel, 2015; Aiginger & Firgo, 2017, Annoni & Dijkstra, 2017).

A set of regional indicators is constructed to measure regional competitiveness in Chile, Colombia, and Mexico. The set of indicators was selected in a way that allows comparison of regional competitiveness and performance across countries. Variables are normalized using the “min-max” scaling method using historical minimum and maximums for all regions and years to consider the evolution in the indicators across time (OECD, 2008).

The reason for choosing to study and compare these three countries is that these countries show similar levels of competitiveness scores in the World Economic Forum’s Global Competitiveness Report (Schwab, 2018). Moreover, Mexico and Chile are the only two OECD countries in Latin America and Colombia is likely to be soon incorporated into the OECD economies. From a practical perspective, these three countries have enough statistical data to measure and compare regional competitiveness indicators.

Figure 1 shows the regional competitiveness model. This regional competitiveness model distinguishes inputs from results mirroring the work of Aiginger and Firgo (2017) and Huggins and Thompson (2017).

Figure 1. Regional Competitiveness Model



Source: based in Aiginger and Firgo (2017) and Huggins and Thompson (2017)

Inputs are those elements that allow for an attractive and sustainable environment for firms and residents and that constitute a potential capacity of yielding a result. Inputs are factors that allow the region to provide attractiveness for both people and companies to settle in.

There are two types of inputs. The first type of inputs corresponds to the ones that lead to “low road” competitiveness: cost and efficiency (Aiginger *et al*, 2013; Aiginger & Vogel, 2015,

Malecki, 2017). The second type of inputs are complex factors that lead to “high road” competitiveness (Aiginger & Vogel, 2015; Malecki, 2017). These types of elements are related to the economic structure of the region and its capabilities, including physical characteristics of the region as well as the social grid, institutions, networks, innovation, and clusters (Aiginger & Firgo, 2017; Huggins & Thompson, 2017)

On the other hand, results competitiveness components are actual levels performance and wellbeing that the region achieves. Following a comprehensive definition of wellbeing, the result encompasses the economic, social, and environmental performance of the region.

Input competitiveness is measured through the following factors: cost and efficiency, regional structure, economic structure, innovation and education, health and social system, and institutions. Inputs (or capabilities) competitiveness is measured through the average of the six factors (equation 1). No regional variables that were comparable between countries were identified for sustainability and environment input factors.

$$(1) \text{Input Index}_i = \frac{1}{6} \text{Eff}_i + \frac{1}{6} \text{Infras}_i + \frac{1}{6} \text{Ec Struct}_i + \frac{1}{6} \text{Educ}_i + \frac{1}{6} \text{Health}_i + \frac{1}{6} \text{Instit}_i$$

Where:

Input Index = Inputs/capabilities competitiveness index for region i

Eff = Efficiency and cost factor

Infras = Regional infrastructure factor

Ec Struct = Economic structure factor

Educ = Innovation and education factor

Health = Health and social system factor

Instit = Institutions factor

Results competitiveness is measured through the geometric mean of social, economic, and environmental results factors as presented in equation 2. Since environmental, social, and economic factors are necessary and equally important to achieve a competitiveness results the geometric mean is used to account and give the same importance to all factors related to results.

Additionally, it allows to overcome the possibility of compensation of one factor for the other. If one of the factors drifts to 0 then the overall index will drift to 0. This differs from the arithmetic mean, which allows to compensate the average value when one of the components leans to 0 by increasing the values of the other components.

$$(2) \text{ Results Index}_i = \sqrt[3]{\text{Economic}_i * \text{Social}_i * \text{Environmental}_i}$$

Where:

Results Index = Results Competitiveness Index for region i

Economic = Economic results component

Social = Social results component

Environmental = Environmental results component

Following OECD (2008) recommendations for composite indicators, the variables used to measure regional competitiveness are weighed through Principal Components Analysis (PCA) for each factor and each component. PCA gives higher weight to those variables that explain most of the variability of the dataset. Additionally, PCA allows to identify hidden patterns in the dataset and which variables are correlated (Kassambara, 2017). PCA was processed using the “R” statistical software. Figure 2 shows the weight obtained through PCA for each variable within each Input Competitiveness factor. Figure 3 shows the weight obtained through PCA for each variable within each Results Competitiveness component. Figure 4 summarizes the methodology steps to construct the Input Competitiveness Index and Results Competitiveness Index.

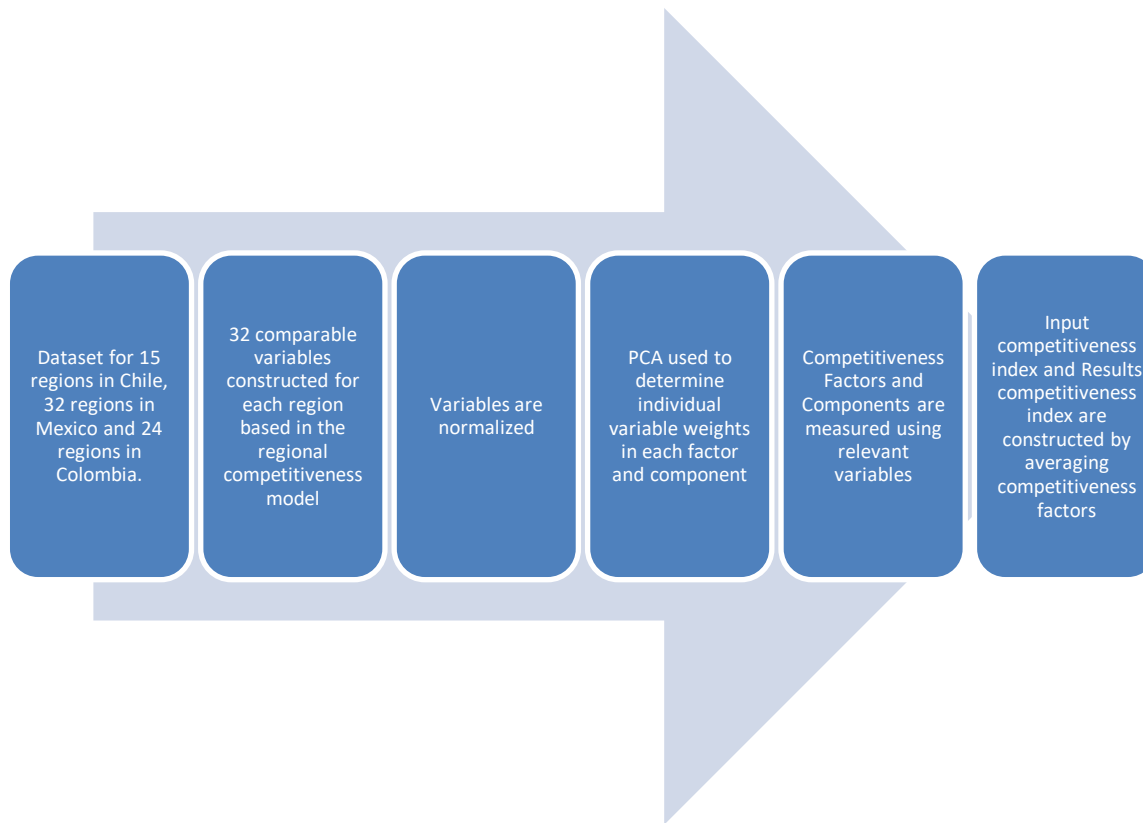
Figure 2: Variables and Weight within each Input Competitiveness Factor

Efficiency	Regional infrastructure	Economic structure	Innovation and education	Health and Social System	Institutions
<ul style="list-style-type: none"> •0,100 * Productivity (Regional GDP per worker) •0,445 * Real Minimum wages (country level only) •0,455 * Median minimum relative to average wages of full-time workers (country level only) 	<ul style="list-style-type: none"> •0,5 * Density (Number of inhabitants per square kilometer) •0,5 * Internet broadband access (% of households with access) 	<ul style="list-style-type: none"> •0,06* GDP per area (dollars world bank) •0,25 * Specialization index •0,07* Manufacturing Industry (share of GDP) •0,14 * Financial services (share of GDP) •0,13 * Real state and household services (share of GDP) •0,19* Personal services (Education and health) and professional services (share of GDP) •0,16 * Public administration (share of GDP) 	<ul style="list-style-type: none"> •0,18 * Illiteracy rate (%) •0,2 * Years of education (years) •0,15 * PCT patent applications per million inhabitants •0,25* Tertiary education assistance rate •0,11* Secondary education assistance rate •0,11 * Primary education assistance rate 	<ul style="list-style-type: none"> •0,412 * Life Expectancy at Birth (years) •0,343 * Infant Mortality Rate (Number of less than 1 year deaths for 1,000 live births) •0,245 * % 65+ over population 15-64 	<ul style="list-style-type: none"> •0,41 * Intentional homicide rate (Number of homicides for 100,000 population) •0,31 * Corruption Perception Index (country level only) •0,18 * Social Capital Index (country level only)

Figure 3: Variables and Weight within each Results Competitiveness Component

Economic Results	Social Results	Environmental Results
<ul style="list-style-type: none"> •0,5 * GDP per capita dollars current prices (current GDP in PPP per inhabitants) •0,5 * GDP Growth rate 5 years 	<ul style="list-style-type: none"> •0,16 * Poverty (% of people under the poverty line) •0,42 * Employment Gap (difference male-female participation rate) •0,25 * Labor participation rate (% of workers employed or actively seeking employment divided by the total working-age population) •0,17 * Unemployment rate (% of unemployed workers in the total labor force) 	<ul style="list-style-type: none"> •0,5 * Air Pollution in PM2.5 (Average level in $\mu\text{g}/\text{m}^3$ experienced by the population) •0,5 * Renewable energy consumption (% of total energy consumption)

Figure 4: Methodology Steps to Construct Competitiveness Capabilities Index and Results Competitiveness Index



Source: author

To test for consistency in the rankings and results, the Input Competitiveness Index was contrasted with calculations giving each variable within each factor the same weight. Similarly, Results Competitiveness Index was calculated using arithmetic means. Convergence trends for Results Competitiveness are observed following Royuela, & García (2015), who test convergence not only for economic variables but also for social variables in Colombian regions.

Once input and results competitiveness index are measured for years 2008 and 2017, an econometric model is used to find evidence of which factors have the highest influence on regional competitiveness results index changes for the 2008-2017 period. Since regional data is clustered by countries, the model coefficients are estimated using a mixed linear model fitted by maximum likelihood in order to control for country effects. In this model, fixed effects correspond to the dependent variables in each estimation and random effects are assigned to the country intercept as shown in equation (3) and equation (4).

Equation (3) shows the relation between changes in results competitiveness index for region i from country j between 2017 and 2008 and its determining factors. The random intercept value varies for each country α_{ij} according to a random error term ε_{ij} shown in equation (4). β_{ij} and γ_{ij} are fixed coefficients with a random error term μ_{ij} . *Results Index_{ij}* corresponds to the 2008 value of the competitiveness results index is included to test β -convergence between regions for results competitiveness (Barro & Sala-i- Martin, 1992). *Inputs Index_{ij}* corresponds to 2008 values of the competitiveness inputs index, which is composed of six factors that are included in the model both as an index and as individual explanatory factors to test for the overall. Additionally, a dummy variable *Capital_{ij}* for capital city is included to test for its influence in results competitiveness.

$$(3) \quad \Delta Results\ index_{ij} = \alpha_{ij} + \beta_{ij} Results\ Index_{ij} + \gamma_{ij} Inputs\ Index_{ij} + \delta_{ij} Capital_{ij} + \mu_{ij}$$

$$(4) \quad \alpha_{ij} = \alpha_{0j} + \varepsilon_{ij}$$

3.2. Data and Sources

The data sources and the variables used to construct the regional competitiveness indexes are presented in table 3. The dataset includes 32 variables for 15 regions in Chile, 32 regions in Mexico and 24 regions in Colombia for year 2008 and year 2017. Out of the 33 regions from Colombia, 9 lack the information to be processed through PCA (Amazonas, Arauca, Casanare, Guainía, Guaviare, Putumayo, San Andres y Providencia, Vaupes, and Vichada). Thus, research results are presented for a total of 71 regions.

Table 3. Variables and Sources

Variable Number	Variable Name	Unit of measure	Source		
			Chile	Mexico	Colombia
Inputs					
Inputs - Cost and Efficiency					
1	GDP per worker dollars current prices	Dollars PPP	Estimation based in World Bank data, Banco Central de Chile and INE (1)	Estimation based in World Bank data (1)	Estimation based in World Bank data (1)
2	Real minimum wages	In 2018 constant prices at 2018 USD PPPs (country level)	OECD	OECD	OECD
3	Median minimum wage relative to average wages of full-time workers	Ratio (country level)	OECD	OECD	OECD
Inputs - Regional Structure					
4	Internet broadband access	% of households	OECD	OECD	DANE
5	Density	Number of People per square kilometer	Based in Population and Area	Based in Population and Area	Based in Population and Area
Inputs - Economic Structure					
6	GDP per area (dollars world bank)	dollars PPP	Estimation based in World Bank data	Estimation based in World Bank data	Estimation based in World Bank data
7	Specialization index	Index 0-1	Based in GDP data	Based in GDP data	Based in GDP data
8	Manufacturing industry	% of the sector in Regional GDP	Banco Central de Chile	INEGI	DANE
9	Financial services	% of the sector in Regional GDP	Banco Central de Chile	INEGI	DANE
10	Real state and household services	% of the sector in Regional GDP	Banco Central de Chile	INEGI	DANE
11	Personal services (Education and health) and professional services	% of the sector in Regional GDP	Banco Central de Chile	INEGI	DANE
12	Public administration	% of the sector in Regional GDP	Banco Central de Chile	INEGI	DANE
Inputs- Capabilities: innovation and education					
13	Illiteracy rate	%	CASEN Survey	INEGI	Terridata DANE

14	Years of education	years	CASEN Survey	INEGI	DANE
15	Tertiary education assistance rate	%	CASEN Survey	INEGI	Terridata DANE
16	Secondary education assistance rate	%	CASEN Survey	INEGI	Terridata DANE
17	Primary education assistance rate	%	CASEN Survey	INEGI	Terridata DANE
18	PCT patent applications per million inhabitants	Fractional count; by inventor and priority year	OECD	OECD	World bank (country level only)
Inputs- Capabilities: Health and Social System					
19	Life Expectancy at Birth	Years	OECD	OECD	OECD
20	Infant Mortality Rate	Number of less than 1-year deaths for 1,000 live births	OECD	OECD	OECD
21	Dependency Ratio, Elderly	% 65+ over population 15-64	OECD	OECD	OECD
Inputs- Capabilities: Institutions					
22	Intentional Homicide Rate	Number of homicides for 100,000 population	OECD	OECD	OECD
23	Social Capital Index	Index 0-1 (country level)	Prosperity index - Legatum Institute	Prosperity index - Legatum Institute	Prosperity index - Legatum Institute
24	Corruption perception index	Index 0-1 (country level)	Transparency international	Transparency international	Transparency international
Results - Economic					
25	Regional GDP per capita dollars current prices (world bank)	dollars PPP	Estimation based in World Bank data	Estimation based in World Bank data	Estimation based in World Bank data
26	Regional GDP Growth rate 5 years	%	Banco Central de Chile / INE	INEGI	DANE
Results - Environmental					
27	Air Pollution in PM2.5	Average level in µg/m ³ experienced by the population	OECD	OECD	OECD
28	Renewable energy consumption	% of total final energy consumption (country level)	World Bank	World Bank	World Bank
Results- Social					
29	Poverty	%	CASEN (Chilean Socioeconomic Characterization Survey)	CONEVAL (National Council for the Evaluation of Social Development Policy)	Terridata DANE
30	Employment Gap (difference male-female)	% points	CASEN Survey	INEGI	Terridata DANE
31	Labor participation rate	%	CASEN Survey	INEGI	Terridata DANE
32	Unemployment rate	%	CASEN Survey	OECD	Terridata DANE

Source: Author

1: Regional GDP was estimated using Country GDP in current dollars in PPP from World Bank and assigning values of regional distribution of Gross Value Added within countries using official country data.

4. Results

4.1. Regional Input Competitiveness and Results Competitiveness Indexes

Table 4 shows regional Inputs Competitiveness Index and Results Competitiveness Index rankings for year 2017, respectively.

The top ranking regions for Input Competitiveness Index correspond to each of the regions that allocate each country's capital: Bogota (Colombia), Distrito Federal (Mexico) and Metropolitana (Chile). The remaining top-ranking regions for the Input Competitiveness Index correspond to Chile.

For the Results Competitiveness Index, the top-ranking regions are Aysén (Chile), Magallanes (Chile) and Bogotá (Colombia). Results competitiveness rankings are mixed among regions from Chile and Colombia, while regions from Mexico show, in general, lower levels of the Results Competitiveness Index.

These general trends for Input and Results competitiveness suggest that there are country effects taking place and that competitiveness may be heavily influenced by country factors.

Table 4. Input and Results Competitiveness Ranking For 2017

Ranking Input	Ranking Results	Country	Region	Ranking Input	Ranking Results	Country	Region
1	3	Colombia	Bogota	37	53	Mexico	Tamaulipas
2	49	Mexico	Distrito Federal	38	43	Mexico	Yucatan
3	7	Chile	Metropolitana	39	25	Colombia	Quindío
4	5	Chile	Antofagasta	40	66	Mexico	Tabasco
5	8	Chile	Tarapacá	41	39	Colombia	Magdalena
6	18	Chile	Arica y Parinacota	42	71	Mexico	Morelos
7	2	Chile	Magallanes	43	11	Colombia	Boyacá
8	9	Chile	Valparaíso	44	45	Mexico	Nayarit
9	26	Chile	Biobío	45	46	Mexico	Campeche
10	32	Chile	Coquimbo	46	62	Mexico	Hidalgo
11	19	Chile	Atacama	47	65	Mexico	Puebla
12	12	Chile	Los Lagos	48	54	Mexico	San Luis Potosí
13	22	Chile	Araucanía	49	35	Colombia	Cesar
14	13	Chile	Los Ríos	50	29	Colombia	Bolívar
15	28	Chile	Maule	51	38	Colombia	Norte Santander
16	16	Chile	O'Higgins	52	50	Mexico	Sinaloa
17	1	Chile	Aysén	53	58	Mexico	Guanajuato
18	24	Colombia	Atlántico	54	40	Colombia	Huila
19	6	Colombia	Santander	55	37	Colombia	Sucre
20	42	Mexico	Nuevo Leon	56	20	Colombia	Tolima
21	10	Colombia	Antioquia	57	21	Colombia	Meta
22	48	Mexico	Aguascalientes	58	57	Mexico	Zacatecas
23	44	Mexico	Coahuila de Zaragoza	59	68	Mexico	Veracruz de Ignacio de la Llave
24	30	Mexico	Quintana Roo	60	41	Mexico	Chihuahua
25	69	Mexico	Queretaro	61	51	Colombia	Cordoba
26	17	Colombia	Risaralda	62	52	Mexico	Colima
27	36	Mexico	Sonora	63	61	Mexico	Michoacán de Ocampo
28	14	Colombia	Valle	64	70	Mexico	Chiapas
29	4	Colombia	Cundinamarca	65	15	Colombia	Nariño
30	63	Mexico	Mexico	66	23	Colombia	Cauca
31	59	Mexico	Tlaxcala	67	67	Mexico	Oaxaca
32	55	Mexico	Jalisco	68	47	Colombia	Caquetá
33	27	Mexico	Baja California Sur	69	33	Colombia	La Guajira
34	56	Mexico	Durango	70	64	Mexico	Guerrero
35	34	Mexico	Baja California	71	60	Colombia	Choco
36	31	Colombia	Caldas				

Source: Author

Maps 1 to 3 show results for Inputs Competitiveness Index and Results Competitiveness Index rankings for Chile, Colombia, and Mexico in the year 2017, the color pallet varies in five categories according to the value of the Input and Results Index, and values are fixed for the three countries.

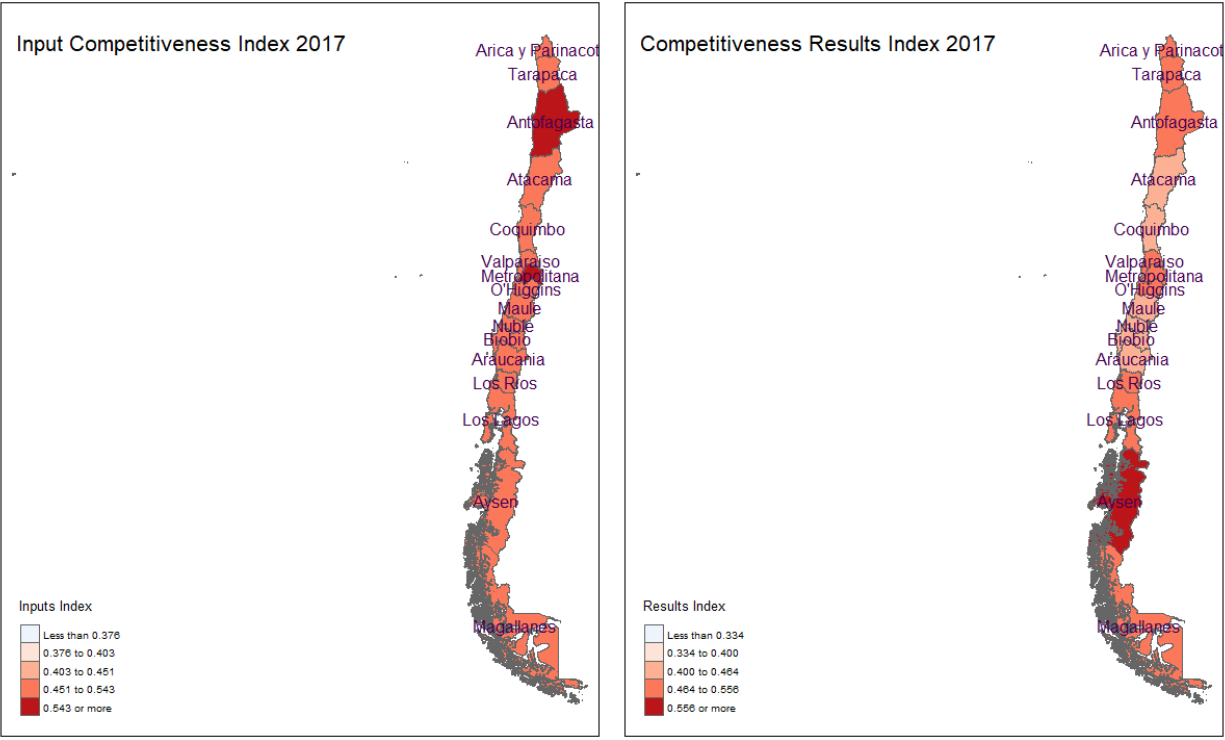
Chilean regions present higher scores, in general, for both indexes (map 1) compared to Colombia and Mexico, since there are no regions falling in the lower categories. Thus, the general situation of regions in Chile seems to follow the requirements to be considered competitive regions under this thesis definition of regional competitiveness, since both Input Competitiveness and Results Competitiveness scores are high.

Many regions in Colombia fall under the lowest category values of competitiveness, and this situation is much more sever for the Input Competitiveness Index than for the Results Competitiveness Index (map 2). Apparently, regions in Colombia seem to have good competitive results in 2017, despite not having the highest competitiveness capabilities. This could be a result of highly competitive Input Competitiveness in the past.

Regions in Mexico also fall under the lowest category values of competitiveness, but this is much more sever for the Results Competitiveness Index than the Input Competitiveness Index (map 3). Hence, regions have the capabilities and potential to reach a positive performance but are not able to achieve those competitive results.

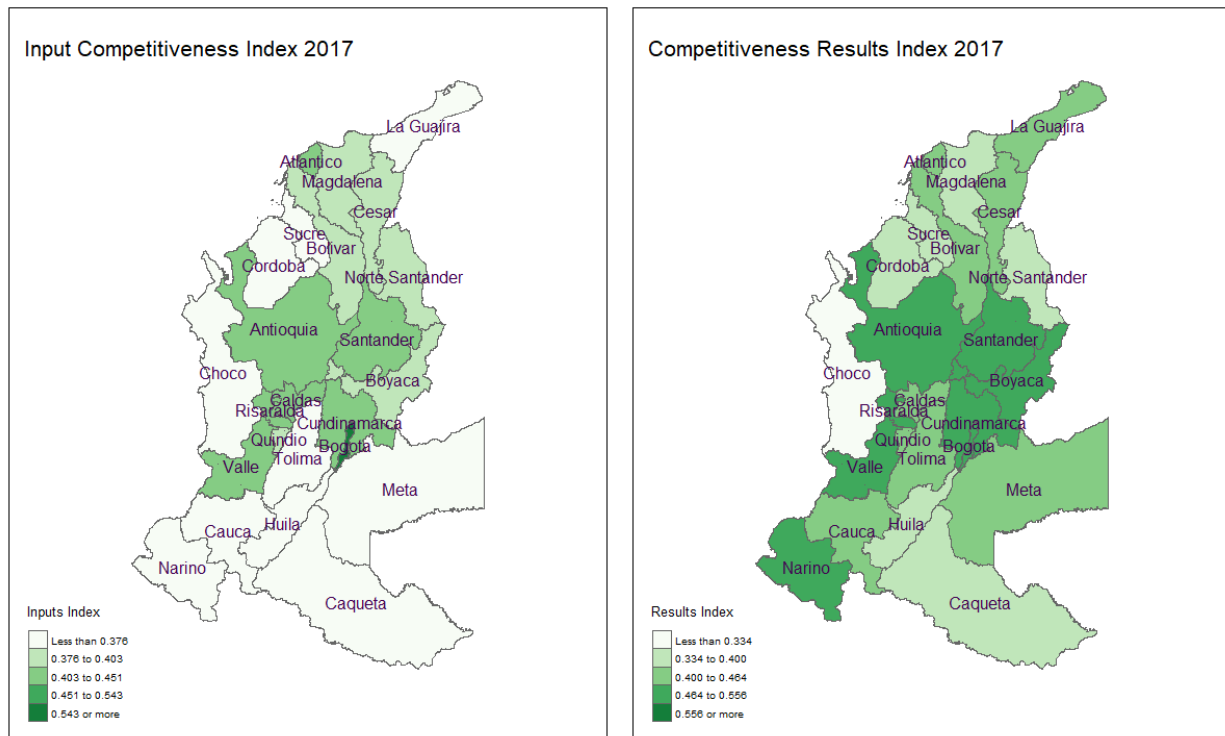
An additional observation is that in the case of Chile, since the lowest competitiveness category is not present in 2017, the gap of competitiveness between the highest and lowest ranking regions is lower than the one in Colombia and Mexico. Thus, regional competitiveness inequalities, measured through the Input and Results Competitiveness rankings are lower in Chile.

Map 1: Chile. 2017 Competitiveness Capabilities Index and Competitiveness Results Index by Region.



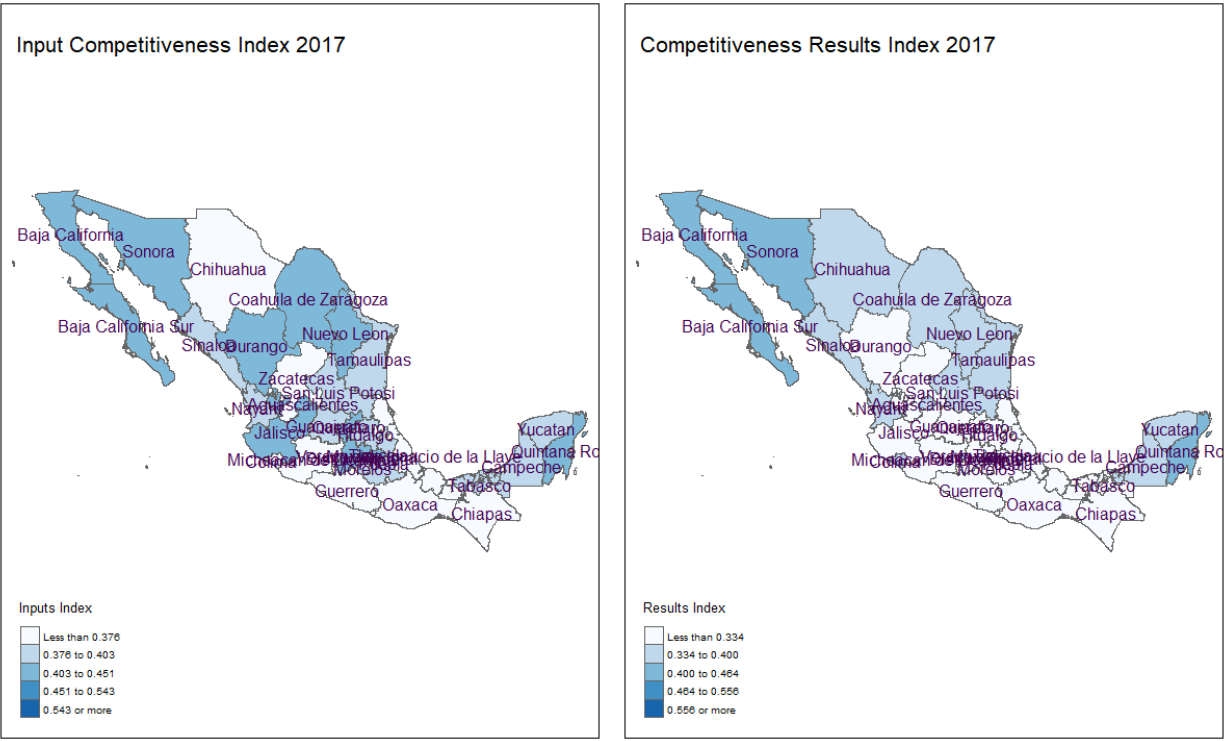
Source: Author

Map 2: Colombia. 2017 Competitiveness Capabilities Index and Competitiveness Results Index by Department.



Source: Author

Map 3: Mexico. 2017 Competitiveness Capabilities Index and Competitiveness Results Index by Region.

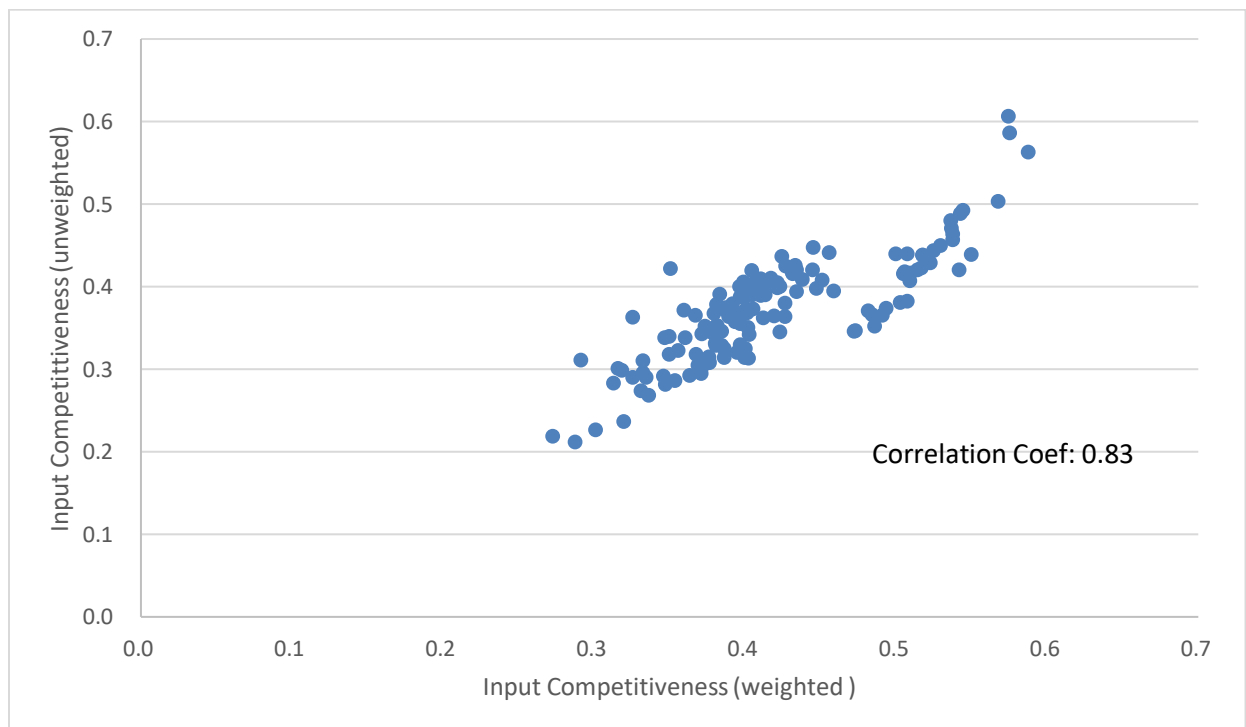


Source: Author

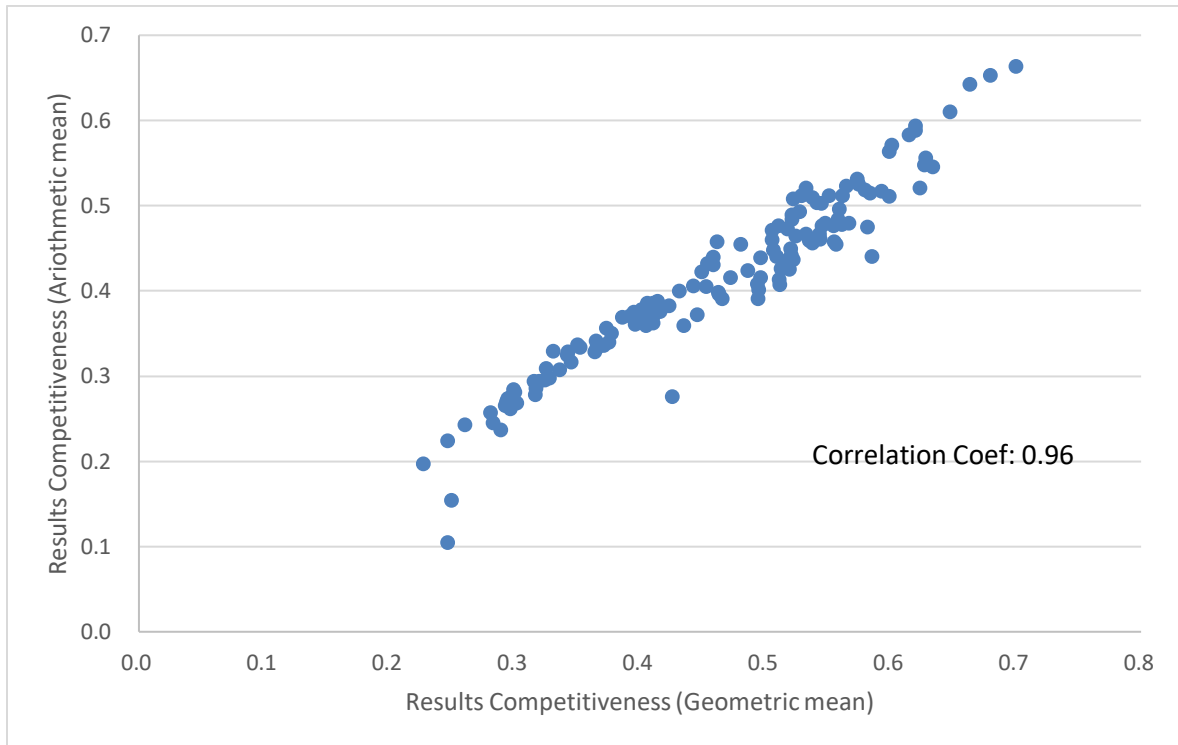
The results of alternative indexes are presented in graph 1 and graph 2. The alternative indexes are used to test for consistency of the index when applying different weighting methods for the variables that compose each factor in the Input Competitiveness Index (graph 1) or when using the arithmetic mean instead of the geometric mean in the Results Competitiveness Index (graph 2).

The Input Competitiveness Index shows consistent results when compared with an index with no PCA weighting system. Similarly, Results Competitiveness Index show similar rankings using arithmetic means instead of geometric means, evidenced by the graph trend and high correlation coefficient between variables.

Graph 1. Consistency test for Input Competitiveness. Weighted vs Unweighted Input Competitiveness Index.



Graph 2. Consistency Test for Results Competitiveness. Arithmetic Mean Vs Geometric Mean of the Results Competitiveness Index.



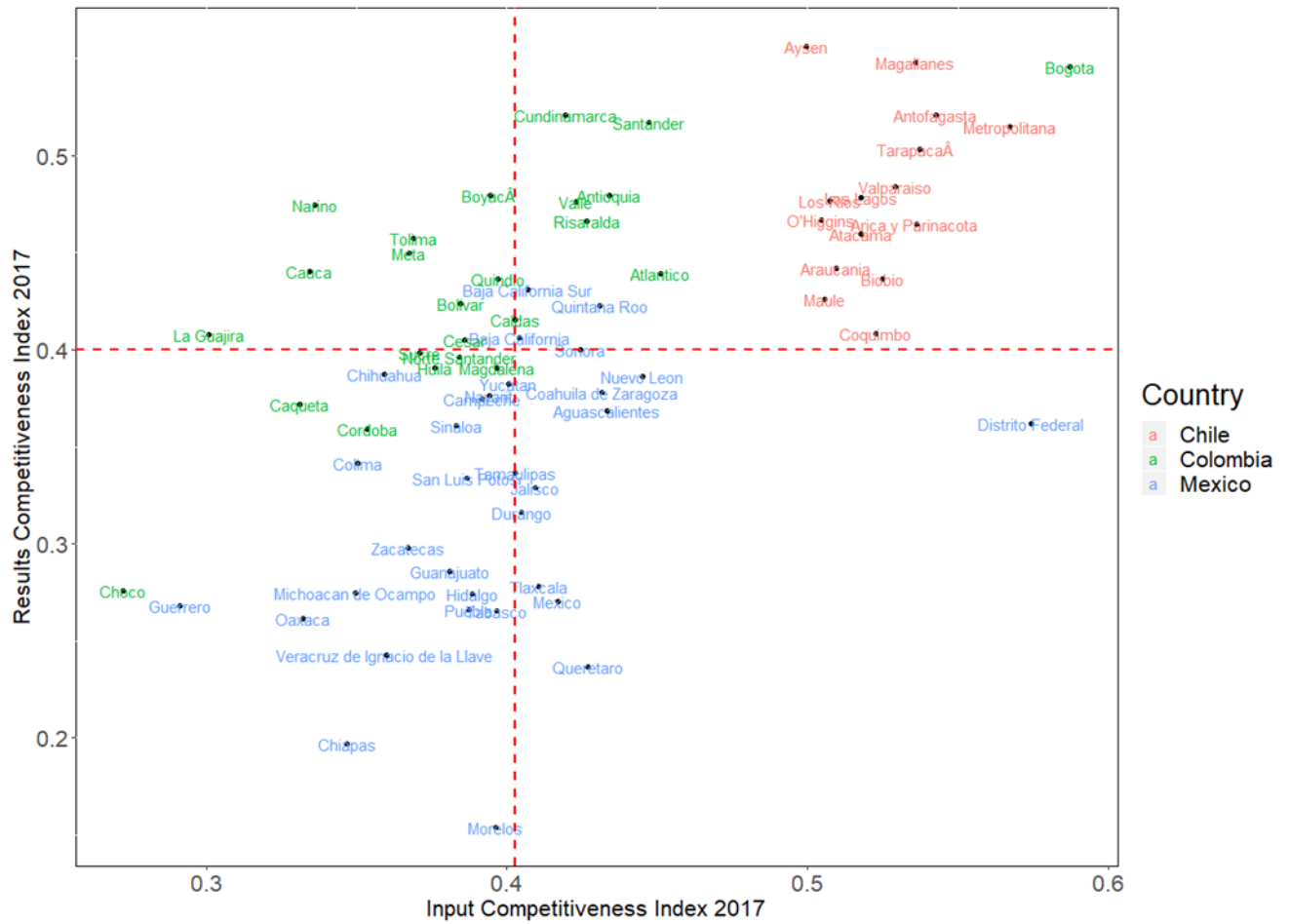
4.2. Competitiveness Trends and Links Between Inputs and Results

Graph 3 shows the Results Competitiveness Index for 2017 and the Inputs Competitiveness Index for 2017. Crossing red lines show the median score for the two indexes. Regions from Chile are clustered in high levels of competitiveness for both inputs and results, together with seven regions from Colombia and three regions from Mexico. The clustering of regional competitiveness by countries suggests that there are strong country effects influencing overall scores.

Most regions that present below median levels of Input and Results Competitiveness are from Mexico. *Chocó*, from Colombia, presents unusually low levels of Input and Results Competitiveness in 2017 along with the Mexican regions of *Guerrero*, *Chiapas*, *Oaxaca*, *Morelos*, and *Veracruz de Ignacio de la Llave*.

On the other hand, all three regions that contain the national capitals from each country have the largest level of Input Competitiveness. However, Metropolitana region remains clustered among other regions in Chile, while in the case of *Bogotá* (Colombia) and *Distrito Federal* (Mexico) they are not clustered within the other regions in each country (see graph 3). The regions that hold the capital, Bogotá and DF show unusual levels of competitiveness compared to other regions in their respective countries. Bogotá shows high levels of both Results and Input Competitiveness. DF shows high levels of input competitiveness.

Graph 3. Results Competitiveness Index 2017 vs Input Competitiveness Index 2017



Source: author

Graph 4 shows for each country average scores for each competitiveness factor and component along the Input and Results Competitiveness Index. According to these results, the differences in Regional Input Competitiveness between countries are explained by Regional Infrastructure, Innovation and Education, and Institutions factors. On the other hand, Results Competitiveness differences are explained by the Environmental and Social components.

In average, Chile shows a higher relative score of Input Competitiveness, and this is specifically due to higher scores in Regional Infrastructure and Institutions factors.

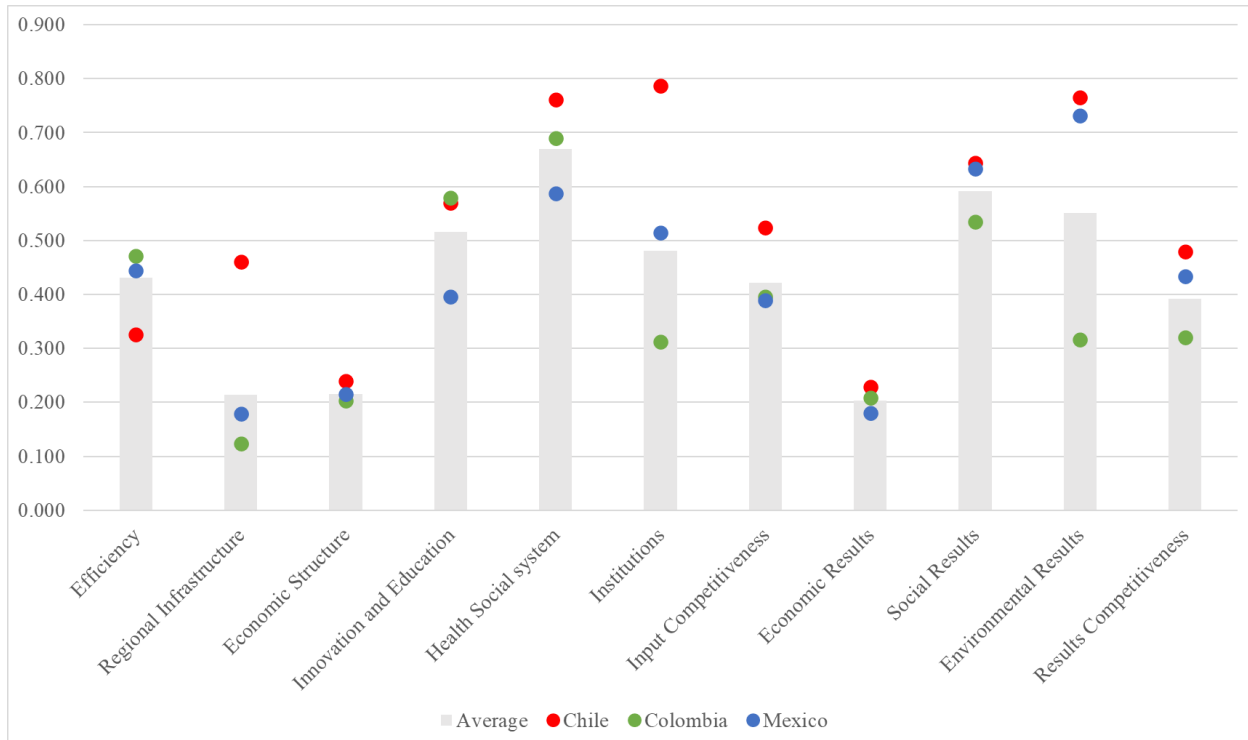
Both Mexico and Colombia have similar Input Competitiveness average scores, and low relative scores compared to Chile.

In Mexico, the Innovation and Education factor shows the lower relative score, while in Colombia the Institutions factor shows the lower relative score.

Results Competitiveness Index scores are similar between Mexico and Chile but are relative lower for Colombia. The largest gaps between countries are observed in the Environmental Results Component. Specifically, Colombia shows the lowest relative score in the Environmental Results Component.

Economic and Social Results scores do not show large gaps between the three countries. However, Mexico shows below average scores for the Economic Results Component and Colombia the lowest average score for the Social Results Component.

Graph 4: Average Scores for Competitiveness Pillars and Competitiveness Index by Country in 2017



Graph 5 shows the variation in the Results Competitiveness Index between 2008-2017 and the initial levels of the Input Competitiveness Index in 2008 for all regions. The highest levels of variation of the Results Competitiveness Index between 2008 -2017 are from Chilean regions of Magallanes, Arica y Parinacota, Tarapacá and Los Rios. On the other hand, all regions from Colombia show a decrease in Results Competitiveness. Mexican regions show mixed values around the zero-variation point.

Regions with higher levels of Input Competitiveness in 2008 yielded a higher increase of their level of Results Competitiveness Index between 2008-2017. The correlation coefficient between these two variables is 0.52.

These results suggest that there is a positive relation between levels of Input Competitiveness and changes in Results Competitiveness, thus higher Regional Input Competitiveness levels might increase the variation of the regional Results Competitiveness Index.

Graph 6 shows the variation in Results Competitiveness Index between 2008-2017 and the initial levels of Results Competitiveness for 2008. The correlation coefficient between these two variables is -0.43.

The graph trend shows that those regions with higher initial levels of Results Competitiveness Index had lower increases in the Results Competitiveness Index between 2008-2017, thus suggesting a convergence trend between 2008 and 2017.

Specifically, regions from Colombia that had high levels of Results Competitiveness in 2008 had less variation in the Index between 2008-2017, while regions from Chile and Mexico, that had a lower level of Results Competitiveness had a catch-up in their level of the index. This could be an effect of a “diminishing returns” pattern for the Results Competitiveness Index, since making progress on economic, social, and environmental outcomes could become increasingly difficult as the initial levels of those outcomes is higher.

An atypical case is Bogota which, despite having a high Input Competitiveness Index in 2008, decreased in the Results Competitiveness Index between 2008 and 2017 (graph 5). However, Bogota already had high levels of the Results Competitiveness Index in 2008 (graph 6), which could explain the decrease in the period.

Table 5: Variation Coefficients (CV) for Results Components and Results Competitiveness Index by Country

Component	Chile		Colombia		Mexico		All	
	2008	2017	2008	2017	2008	2017	2008	2017
Economic Results Component	0.052	0.055	0.074	0.051	0.047	0.037	0.101	0.050
Social Results Component	0.079	0.079	0.097	0.108	0.131	0.131	0.106	0.121
Environmental Results Component	0.147	0.083	0.085	0.101	0.059	0.059	0.284	0.231
Results Competitiveness Index	0.040	0.043	0.070	0.068	0.060	0.059	0.114	0.090

4.3. Changes in Results Competitiveness and its Inducing Factors

Table 6 shows regression results estimated using a mixed effect model of random intercepts for country groups and fixed effects for all other explanatory variables. The use random intercepts allows controlling “country effects” in the model. The dependent variable is the variation of the Results Competitiveness Index from 2008 to 2017.

Model (1) tests for convergence in Results Competitiveness Index and for the effect of the 2008 Input Competitiveness Index. Both factors are significant in determining changes in the Results Competitiveness Index between 2008 and 2017. The initial level of Input Competitiveness Index increased the change in results competitiveness index. On the other hand, higher levels of 2008 Results Competitiveness Index yield lower increases in the results index, showing a convergence pattern in this index between 2008 and 2017.

Model (2) adds a dummy variable for regions that contain a national capital city in order to tests for the significance of this feature in those three particular regions: Metropolitana in Chile, Distrito Federal (DF) in Mexico, and Bogota in Colombia. The dummy variable for Capital city is significant, suggesting that the regions that contain capital cities showed significantly lower variation in the Results Competitiveness Index between 2008 and 2017. In this model (2), both the 2008 Results Competitiveness Index and 2008 Input Competitiveness Index remained significant.

Model (3) tests for the individual Input Competitiveness factors influence over variations in the Results Competitiveness Index. The model shows significance only for the Health and Social System factor and the 2008 level of results competitiveness index.

Model (4) adds the dummy variable for regions that contain capital cities to model (3), showing no significance for the Capital city and only for the Health and Social System factor and the 2008 level of Results Competitiveness Index, just as in model (3).

The 2008 value of the Results Competitiveness Index is significant in all presented models, thus confirming the significance of the convergence trend between regions for Results Competitiveness in the 2008-2017 period.

Overall results suggest that differences in performance are explained by the 2008 level of the Results Competitiveness Index and by the 2008 level of the Input Competitiveness Index.

Additionally, model 3 and 4 allows to identify that the specific factors that have a significant effect over the variation in the Results Competitiveness Index between 2008-2017 were the “Health and Social System” and being a region that holds a capital city. Thus, higher levels of the 2008 Input factor “Health and Social System” are linked to a positive increase of the Results Competitiveness Index between 2008-2017. Thus, high levels in individual factors, except for “Health and Social System”, did not yield improvements in Results Competitiveness for the studied period.

According to the Akaike’s information criterion and Bayesian information criterion, the model that combines the lowest value for both criteria is (2), thus this would be the model with the highest explanatory power out of the four models, the particularity of this model is that it includes Inputs Competitiveness Index as a whole, not separated in individual factors, and that it includes the dummy variable of “Capital City”.

The fact that in model (2) the initial level of the Input Competitiveness Index is significant, as a whole, to the variations in Results Competitiveness Index, is an indication that improvements in Input Competitiveness may require a systemic approach in order to have an effect on Results Competitiveness. In other words, improving Results Competitiveness may require improving in

all factors related to Input Competitiveness. Improving individual factors may not lead to an increase in Results Competitiveness.

Furthermore, in model (2) regions that hold a capital city, had significant lower variations of the Results Competitiveness Index between 2008 and 2017. The negative effect of regions that hold capital cities on Results Competitiveness Index variation may be linked to law of diminishing returns pattern since these regions already have high levels of Results Competitiveness Index, high density, market size and high levels of concentration of population and production. This result is consistent with the fact that the three regions that contain the national capitals from each country have unusually high levels of competitiveness compared to other regions in their respective countries, especially in the case of Bogotá and DF. However, the verification of this theory requires further specific research and study

Table 6: Linear Mixed Model Results

Dependent Variable: 2008/2017 Variation in Results Competitiveness Index				
Linear Mixed Model fit by Maximum Likelihood				
	(1)	(2)	(3)	(4)
Results Competitiveness Index 2008	-0.3500***	-0.4020***	-0.3307***	-0.3176***
<i>Standard error</i>	<i>0.0627</i>	<i>0.0359</i>	<i>0.0679</i>	<i>0.0684</i>
Input Competitiveness Index 2008	0.4272***	0.7081***		
<i>Standard error</i>	<i>0.0874</i>	<i>0.0705</i>		
Efficiency and Costs 2008			-0.35764	-0.4080
<i>Standard error</i>			<i>0.3166</i>	<i>0.3171</i>
Regional Infrastructure 2008			-0.00224	0.0588
<i>Standard error</i>			<i>0.0583</i>	<i>0.0795</i>
Institutions 2008			-0.06931	-0.0633
<i>Standard error</i>			<i>0.046</i>	<i>0.0460</i>
Education and Innovation 2008			0.05739	0.0498
<i>Standard error</i>			<i>0.0539</i>	<i>0.0538</i>
Health and Social System 2008			0.2367***	0.2326***
<i>Standard error</i>			<i>0.0682</i>	<i>0.0677</i>
Economic Structure 2008			0.0502	0.0792
<i>Standard error</i>			<i>0.0936</i>	<i>0.0963</i>
Capital		-0.0664***		-0.0350
<i>Standard error</i>		<i>0.0226</i>		<i>0.0313</i>
Intercept	-0.0275	-0.031***	-0.0193	-0.0192
<i>Standard error</i>	<i>0.0125</i>	<i>0.0040</i>	<i>0.0238</i>	<i>0.0239</i>
Number of observations	71	71	71	71
R squared marginal	0.573	0.750	0.658	0.660
R-squared conditional	0.686	0.750	0.881	0.884
Akaike's information criterion	-263.395	-267.283	-267.884	-267.118
Bayesian information criterion	-252.081	-253.707	-245.257	-242.228

Significance codes: '***' 0.01, '**' 0.05, '*' 0.1, ' ' 1. Standard error values in cursives.

4.4. Top Ranking Regions – Regional Competitiveness Categories

This section presents results for top ranking regions for the Input and Results Competitiveness Index in 2017.

Since there are two indexes and rankings, for Input and Results competitiveness, regions may present a high ranking for both types of competitiveness or for only one type of competitiveness. Therefore, top ranking regions are selected and divided according to the following three possible cases:

- Case 1: High in Input Competitiveness / High in Results Competitiveness
- Case 2: High in Input Competitiveness / Low in Results Competitiveness
- Case 3: Low in Input Competitiveness / High in Results Competitiveness

Through the analysis of these cases, we intend to identify top-ranking regions characteristics and if there are any common characteristics between or within countries.

4.4.1. Case 1: High in Input Competitiveness / High in Results Competitiveness

This case represents the regions that are competitive under the definition of this thesis, by having both the capacity (inputs) to generate well-being through productivity as well as achieving a positive outcome for residents and workers of the region, in terms of economic, social, and environmental aspects.

Table 7 shows selected regions for Case 1: High in Input Competitiveness / High in Results Competitiveness. Values in red are presented when an Input factor or Results component has a lower value than the average of all regions. Values in blue represent a maximum value for that Input factor or Results component.

Most of the regions that have top levels for both types of competitiveness are from Chile. Only Bogota, house of Colombia's capital, has top level rankings for both types of competitiveness.

Regarding Input competitiveness, the efficiency factor is below average for all the selected regions from Chile and just above average for Bogota. This result suggests that these top regions may not focus on Competitiveness based on low costs, described as “low road competitiveness” by Aiginger *et al* (2013), Aiginger & Vogel (2015) or Malecki (2017), but rather in Input factors such as innovation, education, or health.

All of these high-ranking regions have top level rankings for Innovation and Education Factors and Health and Social System Factors. Bogota has the highest level for Regional Infrastructure factor from Input Competitiveness.

Bogotá (Colombia), Metropolitana (Chile) and Valparaíso (Chile), are regions that allocate big cities and that constitute crucial economic poles within their countries, Bogota and Metropolitana holding the capital, and thus, crucial economic services and Valparaíso region, housing the main Chilean ports (Valparaíso and San Antonio), and a wide variety of tourist services. Similarly, Antofagasta (Chile) and Tarapacá (Chile) are highly competitive regions that specialize in mining, specifically copper extraction, Chile’s main export.

Table 7. Case 1: High in Input Competitiveness / High in Results Competitiveness									
Region Country	Bogota	Metropolitana	Antofagasta	Tarapacá	Valparaíso	All Regions			
	Colombia	Chile	Chile	Chile	Chile	Mean	St Dev	Max	Min
Input Ranking	1	3	4	5	8				
Results Ranking	3	7	5	8	9				
Efficiency	0.45	0.32	0.37	0.33	0.32	0.43	0.06	0.50	0.31
Regional Infrastructure	0.81	0.52	0.50	0.49	0.49	0.21	0.18	0.81	0.02
Economic Structure	0.34	0.31	0.16	0.19	0.23	0.21	0.04	0.37	0.14
Innovation and Education	0.56	0.67	0.64	0.58	0.64	0.52	0.13	0.88	0.10
Health Social system	0.79	0.80	0.81	0.86	0.71	0.67	0.09	0.86	0.32
Institutions	0.56	0.78	0.78	0.78	0.79	0.48	0.20	0.80	0.00
Results Economic	0.23	0.24	0.39	0.28	0.22	0.20	0.05	0.39	0.07
Results Social Results	0.87	0.75	0.64	0.71	0.65	0.59	0.12	0.89	0.18
Environmental	0.80	0.76	0.57	0.65	0.81	0.55	0.23	0.86	0.04

Bogota, Colombia

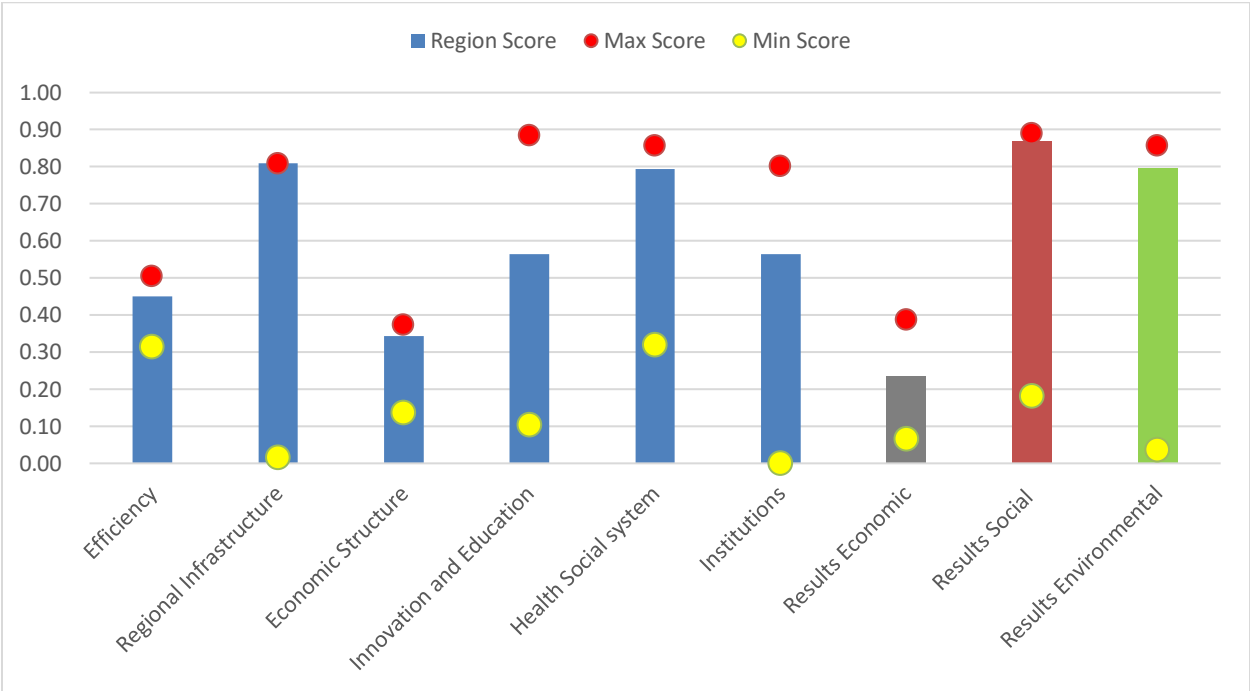
Bogotá is the capital of Colombia. Bogotá is located in the central part of the country, and also enjoys an outstanding geographical position in Latin America, concentrating many of the flights, connections, and logistic services for the major cities like Sao Paulo, Mexico City, Santiago, and New York. It had a population of 8,080,734 in 2017 (DANE), a density of 5,035 Inhabitants /Km² and held 27.4% of the country's GDP. Poverty was 12.4% in 2017 (Dane) and GDP per capita reached US\$ 24,121 in 2017 (estimation based in World Bank Data).

Bogota is ranked first in the Input Competitiveness Index and third in the Results Competitiveness Index. For Input Competitiveness Bogota presents high scores in the following factors: Efficiency, Regional Infrastructure, Economic Structure and Health and Social System (graph 7).

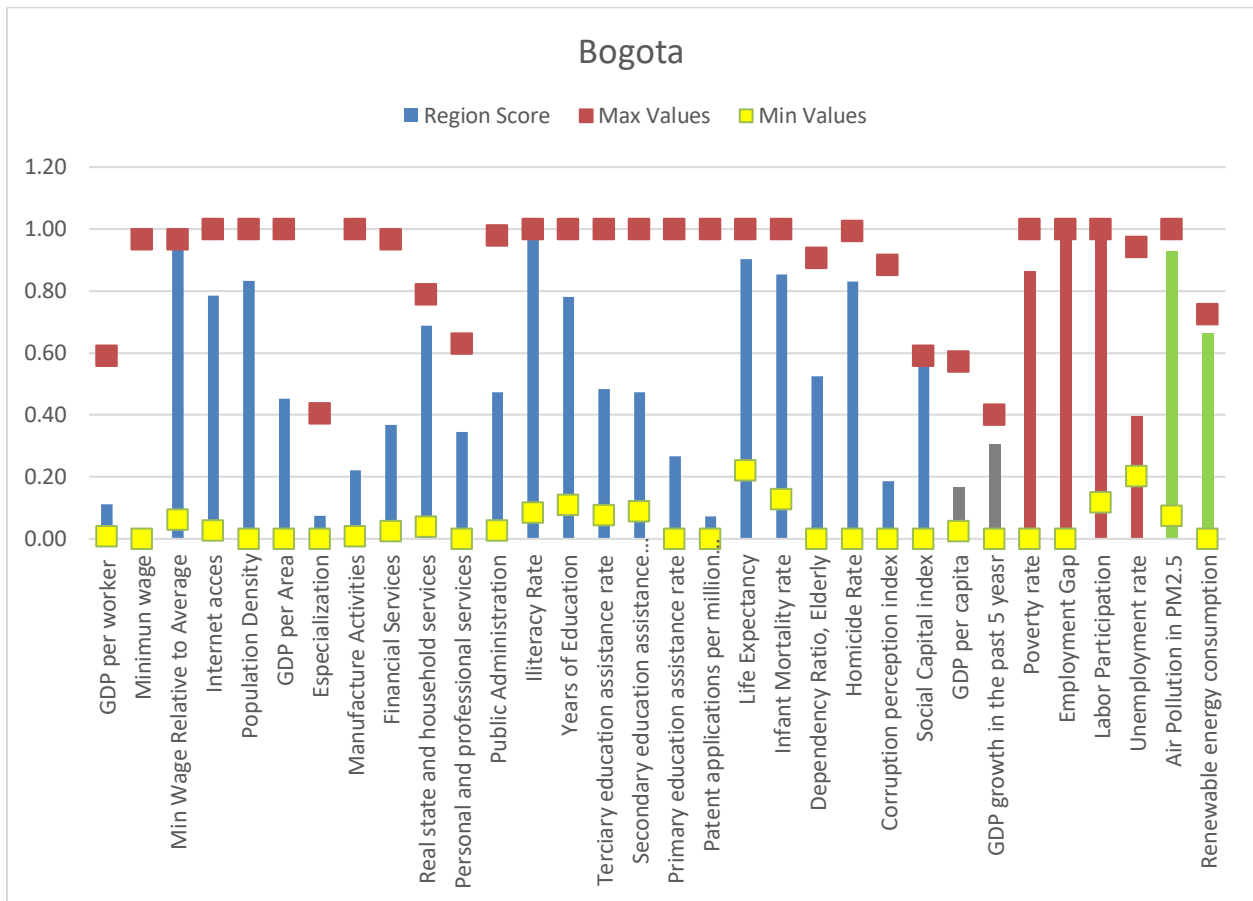
In the efficiency factor, Bogota does not have either unusually high levels of GDP per worker or low minimum wages, but scores very high in the ratio of minimum wage relative to average wages of full-time workers (graph 8). Regarding infrastructure, Bogota has high access to internet and high densities. The economic structure is predominantly manufacturing activities and services. Illiteracy rate is 1.3% which is very low and average years of education are 10.7, which is a relatively high level compared to the other regions. The score for health and social system factor is high, infant mortality rate is 11.6 deaths per 1,000 births one of the lowest in the three countries and life expectancy 78.9 years one of the highest of all regions analyzed.

Regarding Results Competitiveness, Bogota scores high in Social and Environmental components, and has mid-level results in the Economic results component (see graph 7). Bogota has high performance in indicators of Air Pollution, measured by PM 2.5 (average level in $\mu\text{g}/\text{m}^3$ experienced by the population), and social results indicators such as poverty (12.4%) and low employment gap between men and woman (13.6%).

Graph 7: Bogota. Scores for Input Competitiveness Factors and Results Competitiveness Components.



Graph 8: Bogota. Scores for Input Competitiveness and Results Competitiveness Variables.



Metropolitana, Chile

Metropolitana region houses Chile's capital, Santiago. In 2017, the region had a population of 7,112,808 (INE), a density of 486 inhabitants /Km² and held 45.4% of the country's GDP. Poverty was 5.4% in 2017 (CASEN survey) and GDP per capita reached US\$ 28,524 in 2017 (estimation based in World Bank Data). The economic structure is predominantly financial services, which represent 23.5% of the region's GDP. Commerce also constitutes an important economic sector, with 19.1% of the region's GDP.

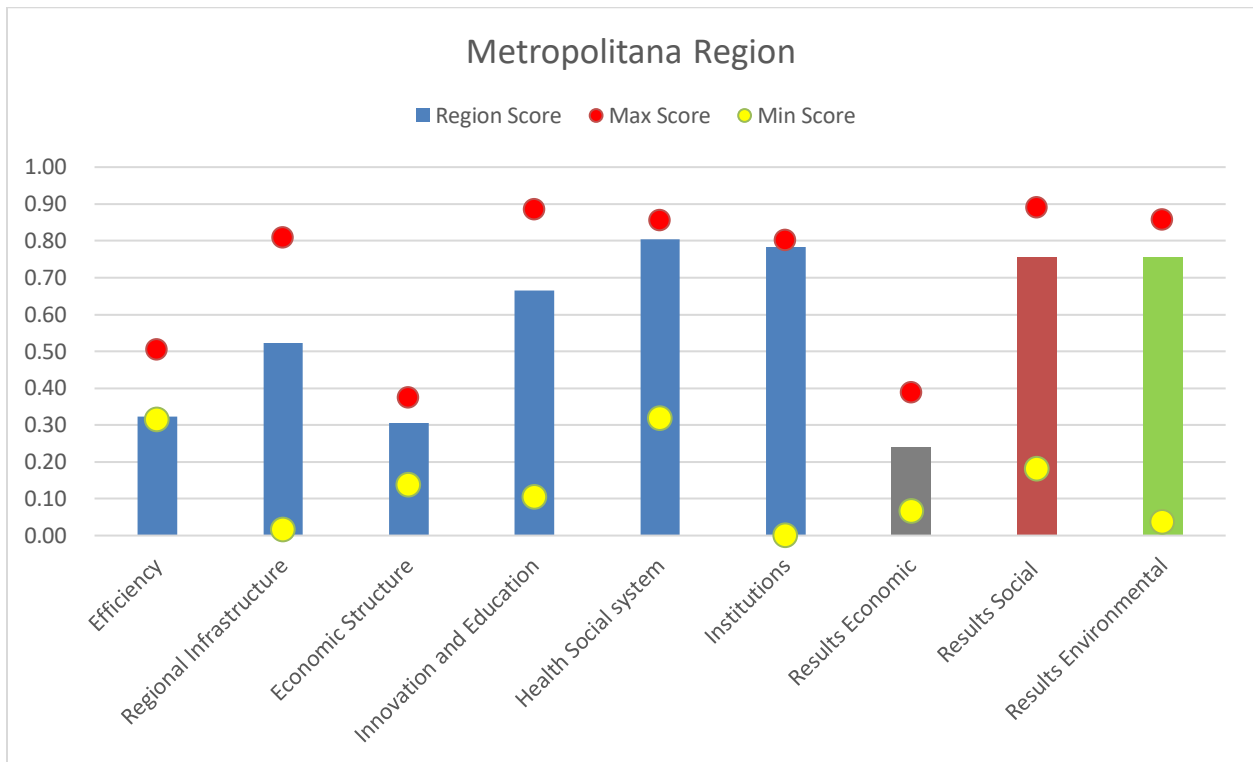
Metropolitana region is ranked 3 in the Input Competitiveness Index and 7 in the Results Competitiveness Index. The region presents high scores in input factors of Health and Social System and Institutions. Results competitiveness scores are relatively high in the social and environmental components (graph 9).

In the Health and Social System factor, Metropolitana scores very high in infant mortality rate, which is 6.6 deaths per 1,000 births one of the lowest in the three countries, and life expectancy at 79.47 years (graph 10). In the institutional factors, the scores for Intentional Homicide Rate and Corruption perception index are high, thus meaning they have low levels of both intentional homicide rate and corruption perception.

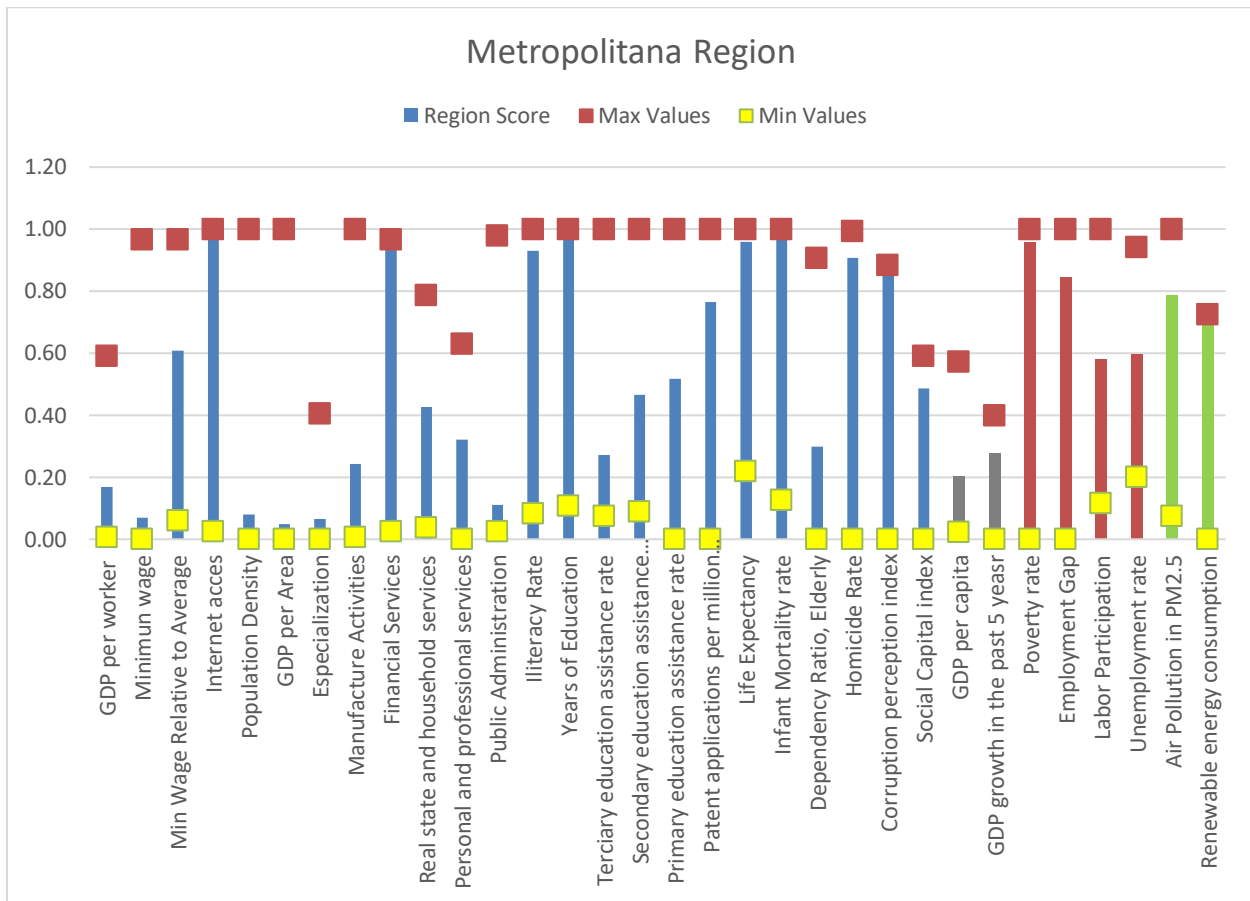
Regarding regional infrastructure, Metropolitana scores high in the access to internet variable which reaches 89.9% coverage in 2017. Illiteracy rate is 2.44% which is very low compared to the other regions and average years of education are 11.82, which is a relatively high level.

In Results Competitiveness, Metropolitana region scores high in Social and Environmental factors, and has mid-level results in the Economic results factor. Metropolitana regions has high scores for the environmental results indicators of Renewable Energy Consumption and in social results indicators such as poverty (12.4%) and employment gap between men and woman (13.6%).

Graph 9: Metropolitana Region. Scores for Input Competitiveness Factors and Results Competitiveness Components.



Graph 10: Metropolitana Region. Scores for Input Competitiveness and Results Competitiveness Variables.



Antofagasta, Chile

Antofagasta region is located in the northern part of the country and is well known for being specialized in mining and copper extraction. In 2017, the mining sector represented 53.6% of Antofagasta's GDP. In 2017, the region had a population of 607,534 (INE), a density of 5 inhabitants /Km² and held 10.2% of the country's GDP. Poverty was 5.1% in 2017 (CASEN survey) and GDP per capita is the highest in Chile, reaching US\$ 74,666 in 2017 (estimation based in World Bank Data).

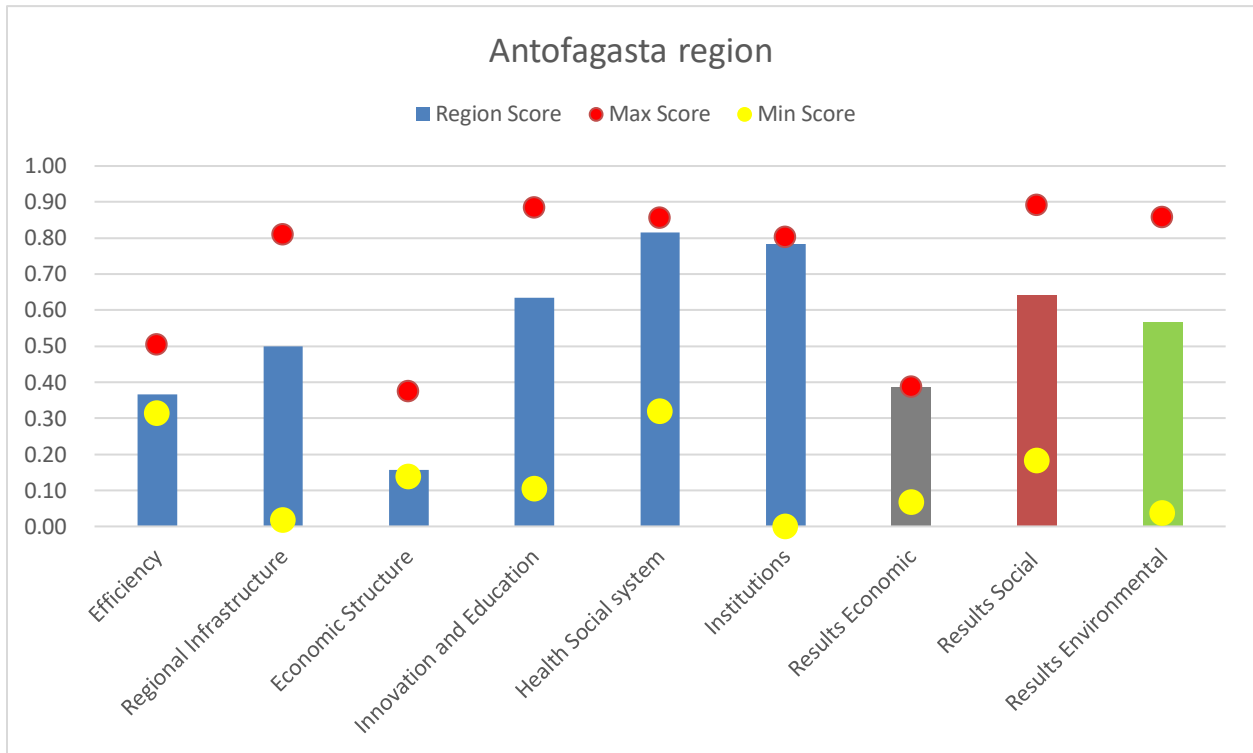
Antofagasta region is ranked 4 in Input Competitiveness Index and 5 in the Results Competitiveness Index. The region presents high scores in Input factors of Health and Social System and Institutions. Results competitiveness scores relatively high in the Economic factor (graph 11).

In the Health and Social System factor, Antofagasta scores very high in infant mortality rate, which is 7.3 deaths per 1,000 births (graph 12). Regarding the institutional factors, the scores for Intentional Homicide Rate and Corruption perception index are high, thus meaning they have low levels of both intentional homicide rate and corruption perception.

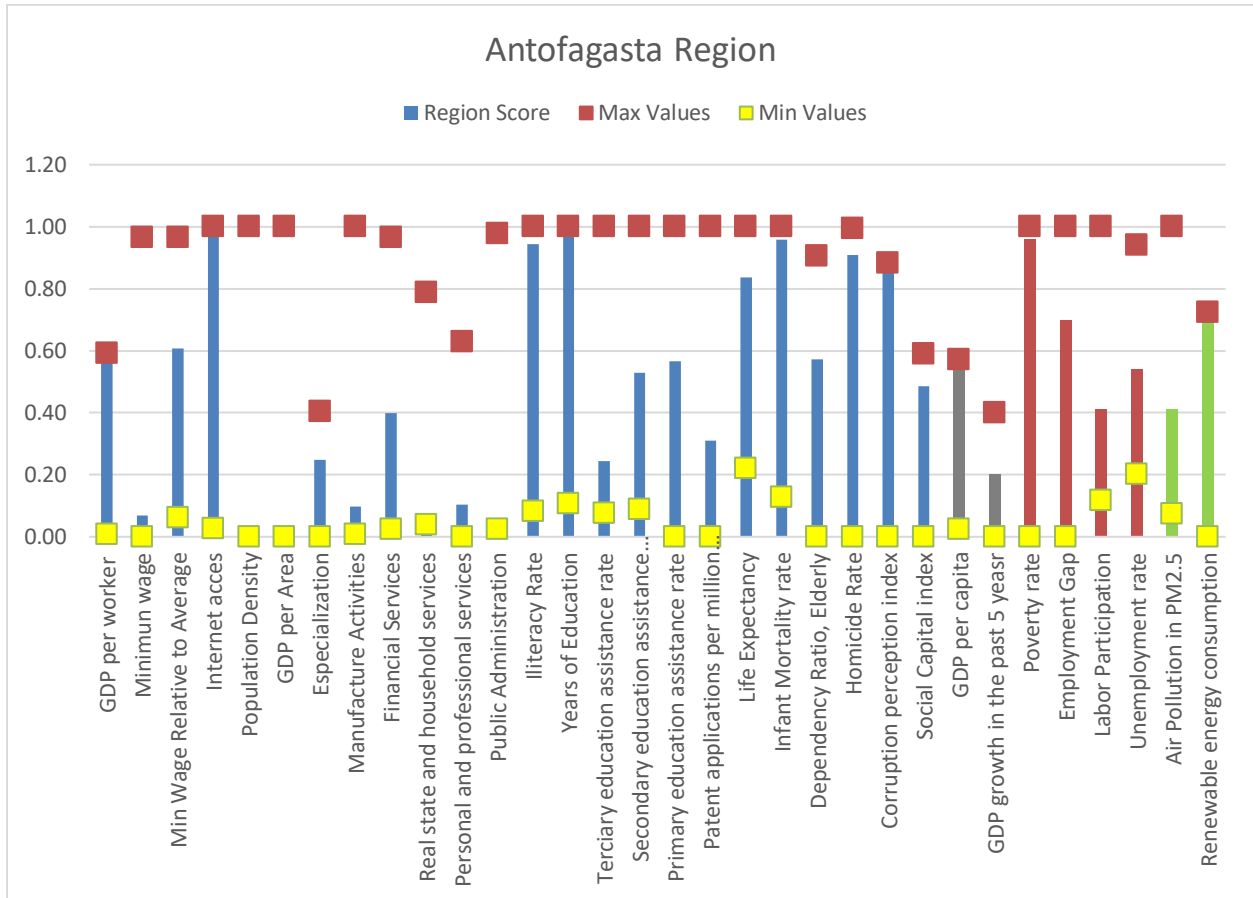
In regional infrastructure, Antofagasta region scores high in the access to internet variable which reaches 92.9% coverage in 2017. Illiteracy rate is 2.22% which is very low compared to the other regions and average years of education are 11.83, which is a relatively high level.

Regarding Results competitiveness, Antofagasta region has the highest valuer in Chile for the variable GDP per capita. This high level of GDP per capita is explained due to the mining activity, which in 2017 represented 53.6% of the region's GDP and consists mainly of copper extraction, boosting GDP at relative high level when compared to other regions.

Graph 11: Antofagasta Region. Scores for Input Competitiveness Factors and Results Competitiveness Components.



Graph 12: Antofagasta Region. Scores for Input Competitiveness and Results Competitiveness Variables.



Tarapacá, Chile

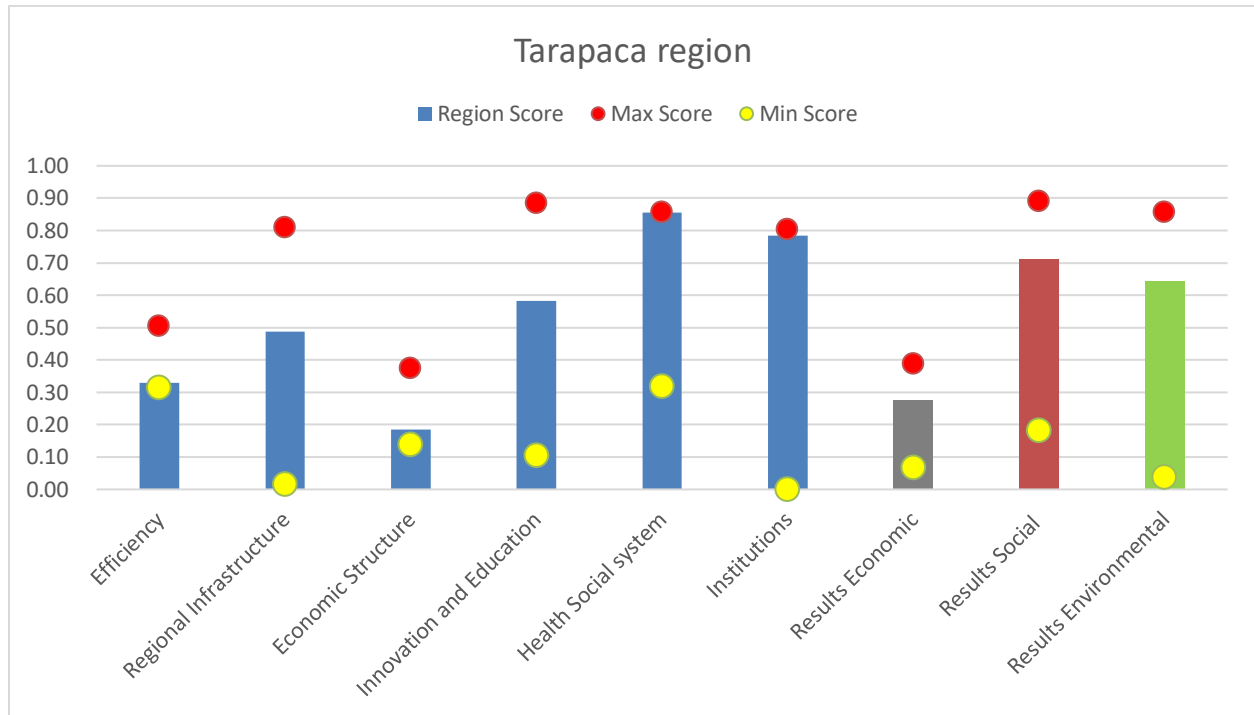
Tarapacá region is located in the northern part of the country, it also is known for mining and copper extraction, which in 2017 represented 36.8 % of the region's GDP which is the third highest share in this sector after Antofagasta and Atacama regions. In 2017, the region had a population of 330,558 (INE), a density of 8 inhabitants /Km² and held 2.51% of the country's GDP. Poverty was 6.4% in 2017 (CASEN survey) and GDP per capita reached US\$ 33,963 in 2017 (estimation based in World Bank Data).

Tarapaca region is ranked 5 in the Input Competitiveness Index and 8 in Results Competitiveness Index. The region presents high scores in Input factors of Health and Social System and Institutions. Results competitiveness components have relatively high scores in all components (graph 13).

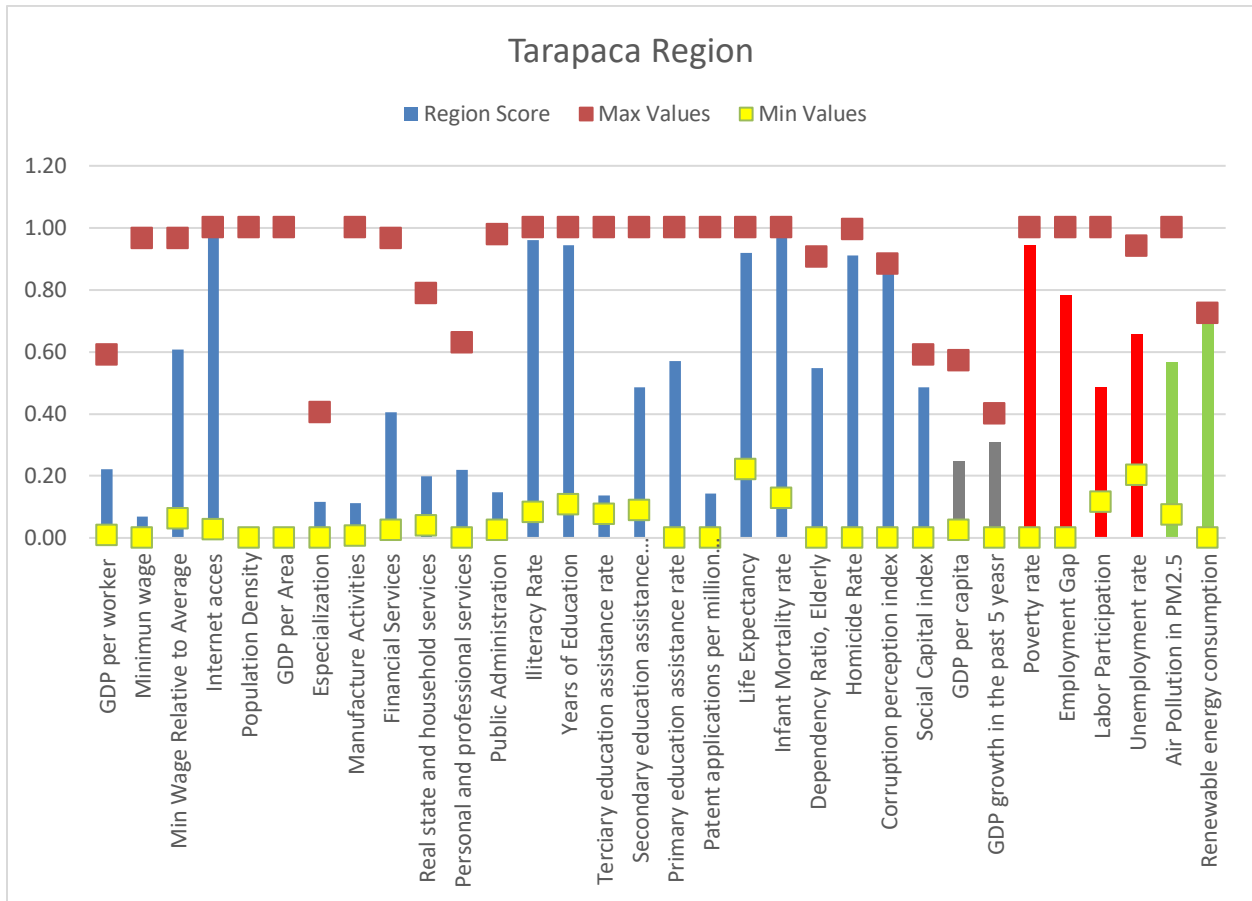
In the Health and Social System factor, Tarapaca region has a low infant mortality rate at 5.7 deaths per 1,000 births and a relatively high life expectancy at 78.99 years. All institutional variables are ranked high (graph 14).

Results competitiveness of all components is relatively high, and specific high-ranking variables are GDP growth in a 5-year period, poverty rate and use of renewable energy.

Graph 13: Tarapaca Region. Scores for Input Competitiveness Factors and Results Competitiveness Components.



Graph 14: Tarapaca Region. Scores for Input Competitiveness and Results Competitiveness Variables.



Valparaiso, Chile

Valparaiso region is located in the central part of the country towards the coastline. It is an important urban and economic pole, known for its port cities, Valparaiso, and San Antonio, and for housing many other tourism-focused cities such as Viña del Mar and Algarrobo.

In 2017, Valparaiso region had a population of 1,815,902 (INE), a density of 113 inhabitants /Km² and held 9.36% of the country's GDP. Poverty was 7.1% in 2017 (CASEN survey) and GDP per capita reached US\$ 23,020 in 2017 (estimation based in World Bank Data).

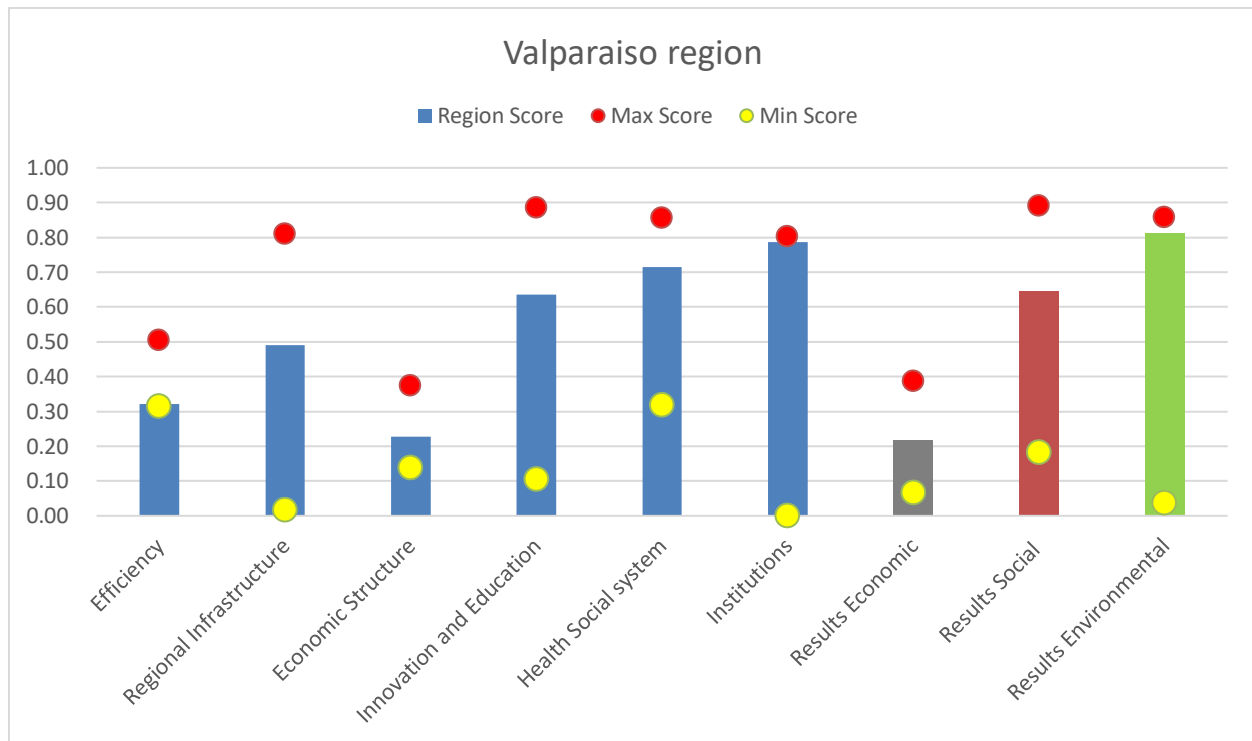
Valparaiso region is ranked 8 in Input Competitiveness and 9 in Results Competitiveness. The region presents high scores in Input factors of Health and Social System and Institutions. Results competitiveness scores are relatively high in the Environmental component (graph 15).

Valparaiso's GDP of manufacturing industry represents 16.5% of the total regional GDP and Transport, Information and Communication activities represent 12.4% of the regional GDP, both are important activities in the region and shares are relatively high amongst other regions in Chile.

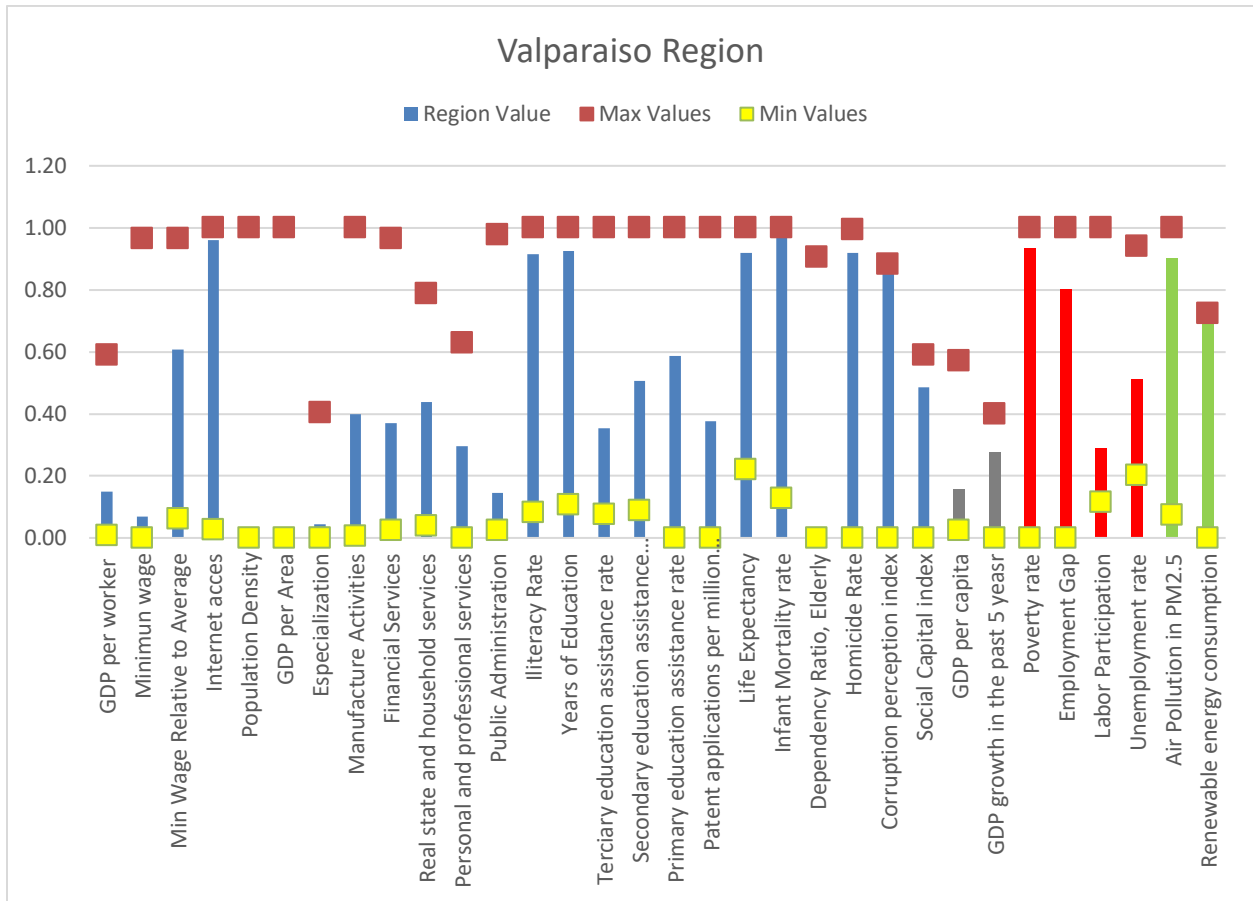
In the Health and Social System factor, Valparaiso region has an infant mortality rate at 6.4 deaths per 1,000 births and a relatively high life expectancy at 79.10 years. All institutional variables are ranked high (graph 16).

Results competitiveness of all components is relatively high, and specific high-ranking variables are GDP growth in a 5-year period, poverty rate, employment gap, pollution, and use of renewable energy.

Graph 15: Valparaiso Region. Scores for Input Competitiveness Factors and Results Competitiveness Components.



Graph 16: Valparaiso Region. Scores for Input Competitiveness and Results Competitiveness Variables.



4.4.2. Case 2: High in Input Competitiveness / Low in Results Competitiveness

Case 2 represent regions that have high levels of competitiveness capabilities (input competitiveness), but at the same time, are lacking in competitiveness outcomes. This case could represent regions which have not been able to transfer their competitive capacity into a competitive outcome for its citizens and companies.

Table 8 present selected regions for Case 2: High in Input Competitiveness / Low in Results Competitiveness. Values in red are presented when an Input factor or Results component has a lower score than the average of all regions. Values in blue represent a maximum value for that Input factor or Results component.

In general, these regions show high levels in the Innovation and Education factor, DF from Mexico, has the highest value of this factor amongst all regions. On the other hand, Nuevo Leon, presents below average scores in many factors, but relatively high scores in Innovation and Education and Health and Social System.

Table 8. Case 2: High in Input Competitiveness / Low in Results Competitiveness									
Region Country	DF Mexico	Arica y Parinacota Chile	Biobio Chile	Nuevo Leon Mexico	Atlántico Colombia	All Regions			
						Mean	St Dev	Max	Min
Input Ranking	2	6	9	20	18				
Results Ranking	49	18	26	42	24				
Efficiency Regional Infrastructure	0.49	0.32	0.32	0.48	0.44	0.43	0.06	0.50	0.31
Economic Structure	0.68	0.44	0.46	0.16	0.29	0.21	0.18	0.81	0.02
Innovation and Education	0.37	0.28	0.27	0.21	0.23	0.21	0.04	0.37	0.14
Health Social system Institutions	0.88	0.61	0.57	0.69	0.56	0.52	0.13	0.88	0.10
	0.67	0.77	0.74	0.76	0.66	0.67	0.09	0.86	0.32
	0.35	0.79	0.79	0.36	0.53	0.48	0.20	0.80	0.00
Results Economic	0.31	0.22	0.18	0.27	0.21	0.20	0.05	0.39	0.07
Results Social	0.70	0.63	0.57	0.61	0.67	0.59	0.12	0.89	0.18
Results Environmental	0.22	0.73	0.81	0.35	0.62	0.55	0.23	0.86	0.04

Distrito Federal, Mexico

Distrito Federal (DF) region is home to Mexico City, the capital of Mexico, and it is considered a separate region (Estado) to the region of Mexico (Estado de Mexico), according to the political-administrative division of Mexico. However, just as in the case of Cundinamarca and Bogota, DF and the region of Mexico may be considered one functional region, in that sense that within the city of Mexico, which geographically transcends the borders of DF onto the region of Mexico, there are constant and free flows of economic and social factors that are not limited by the political-administrative division.

DF had a population of 8,945,826 in 2017 (INEGI), a density of 6,049 Inhabitants /Km² and held 16.5% of the country's GDP. Poverty was 27.6% in 2016 (INEGI) and GDP per capita reached US\$ 44,351 in 2017 (estimation based in World Bank Data).

Distrito Federal is ranked 2 in the Input Competitiveness and 49 in the Results Competitiveness Index. Distrito Federal presents high scores in Input factors of Efficiency, Economic Structure and Innovation and Education. Results competitiveness score high the Economic factor, but very low in the Environmental factor, which explains the relatively low ranking in Results competitiveness (graph 17).

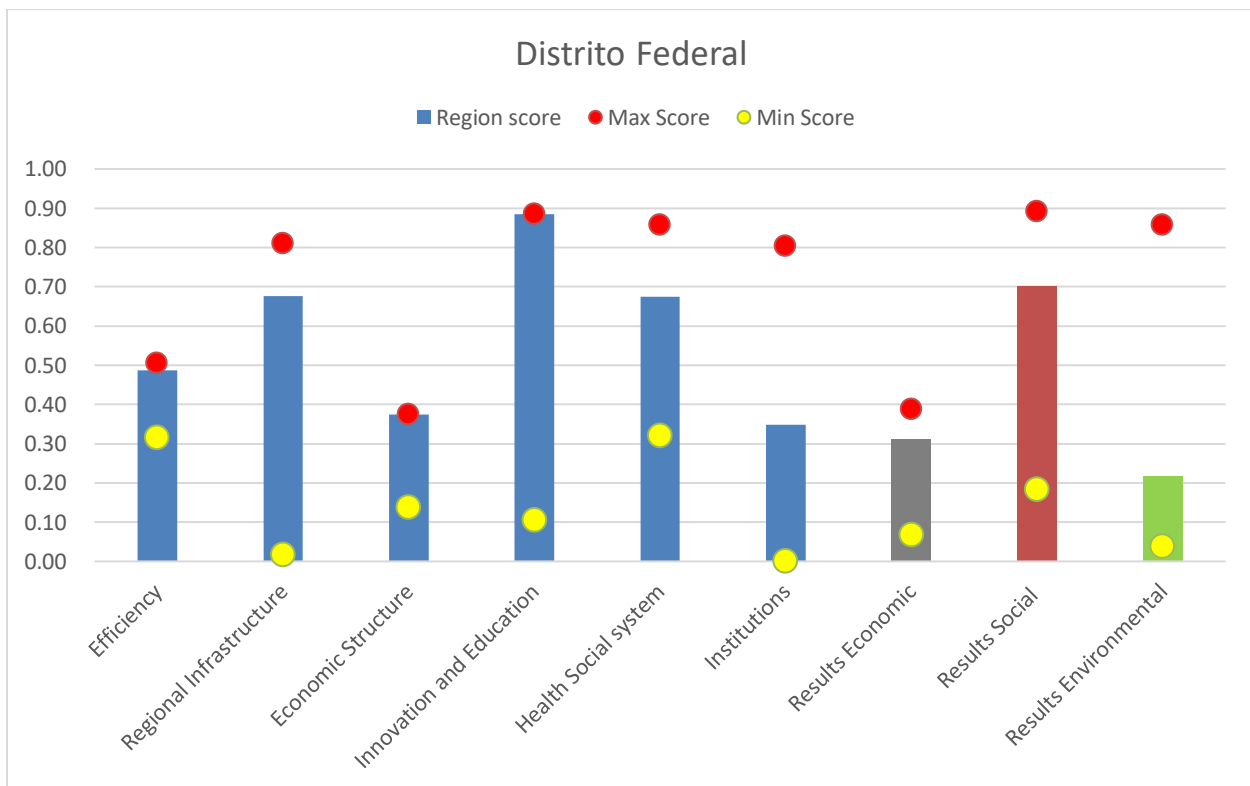
The existence of economic and social interaction between the region of Mexico and DF is an expected result since the city of Mexico overcomes the political-administrative boundaries of DF. Having a higher level of competitiveness input indicators compared to competitiveness results indicators is an expected outcome, since DF is a place where economic activities take place, but being the core of the City of Mexico, there are externalities that appear due to the great agglomeration such as pollution, crime, increase in time and cost of transportation and high costs of living. Thus, many people that work in DF live outside the boundaries of DF, within the region of Mexico.

Efficiency variable minimum wage relative to average wages of full-time workers scores very high, meaning that minimum wages are aligned with average wages. Variables related to education and health have all high levels relative to other regions. Other variables that have high scores are,

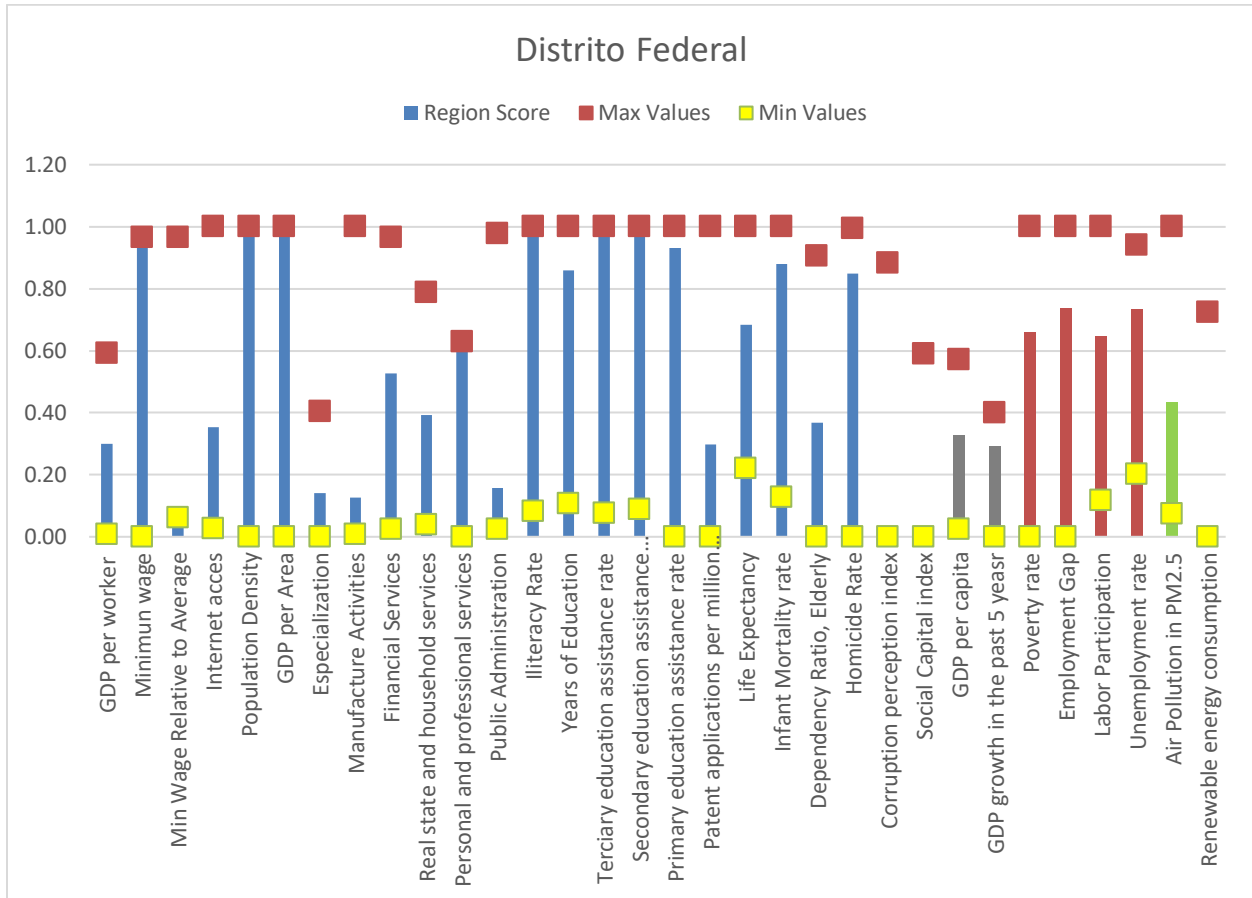
population density, and GDP per area. The economic structure of DF is characterized by the specialization in commerce and services. Personal and professional services represented 25.28% of DF’s GDP in 2017.

Results components and variables are ranked average, except for the consumption of renewable energy variable, which is amongst the lowest in all regions (graph 18).

Graph 17: Distrito Federal. Scores for Input Competitiveness Factors and Results Competitiveness Components.



Graph 18: Distrito Federal. Scores for Input Competitiveness and Results Competitiveness Variables.



Arica y Parinacota, Chile

Arica y Parinacota is located in the northern border of the country and limits with Perú to the north. The region's capital, Arica, is a port city that offers transport services to the northern part of Chile and to other countries like Bolivia and Perú. This region is economically specialized in services; important economic activities are personal services (16.8 % of the region's GDP), public administration (15.8% of the region's GDP) and transport, information, and communications (14% of the region's GDP).

In 2017, the region had a population of 226,068 (INE), a density of 15 inhabitants /Km² and held 10.2% of the country's GDP. Poverty was 8.4% in 2017 (CASEN survey) and GDP per capita reached US\$ 16,900 in 2017 (estimation based in World Bank Data).

Arica y Parinacota region is ranked 6 in Input Competitiveness and 18 in Results Competitiveness. It shows high levels of in the Input Competitiveness index and relatively low ranking in the Results Competitiveness. Presents high scores in Input factors of Health and Social System and Institutions. Results competitiveness scores are relatively high in the Environmental factor (graph 19).

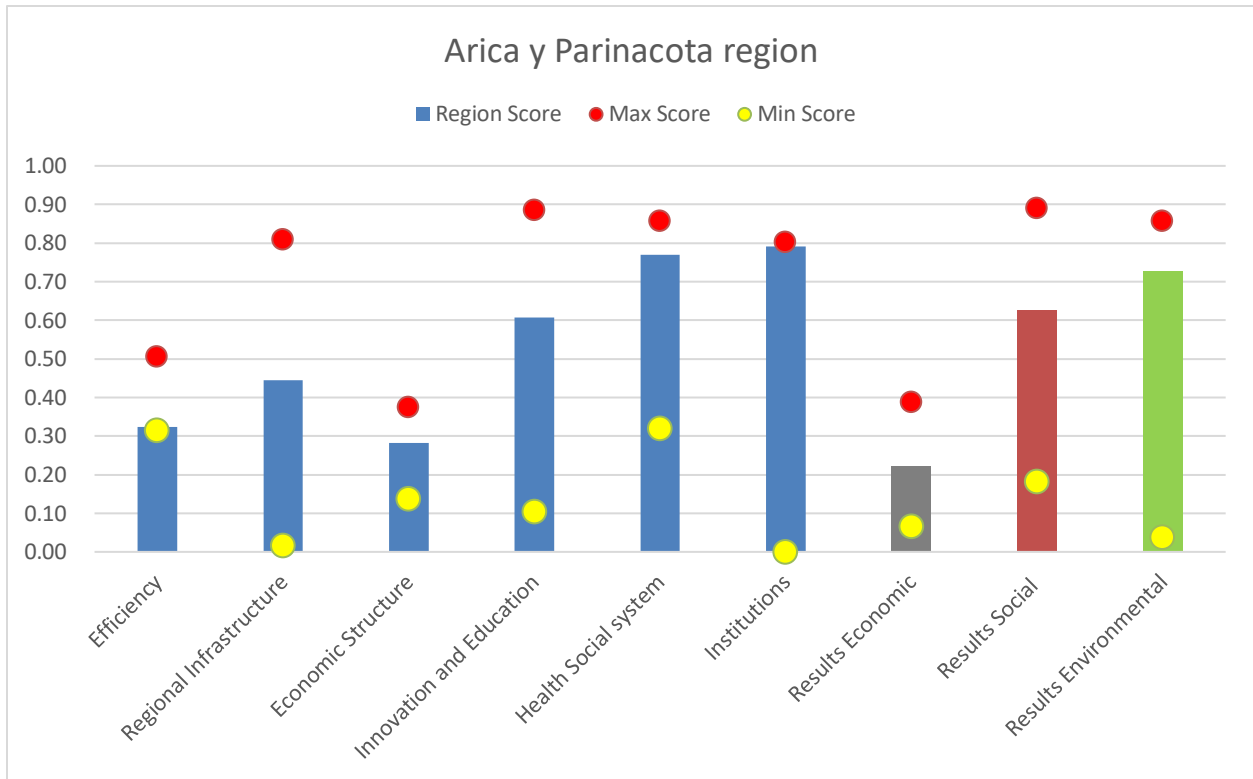
In the Health and Social System factor, Arica y Parinacota scores very high in infant mortality rate, which is 7.3 deaths per 1,000 births. The institutional factors, the scores for Intentional Homicide Rate, Corruption perception index, and Social Capital Index are high, thus meaning they have low levels of both intentional homicide rate and corruption perception and high levels of social capital indicators (graph 20).

Regarding regional infrastructure, Arica y Parinacota region scores relatively high in the access to internet variable which reaches 83% coverage in 2017. Illiteracy rate is 2.69% which is very low compared to the other regions and average years of education are 11.35, which is a relatively high level.

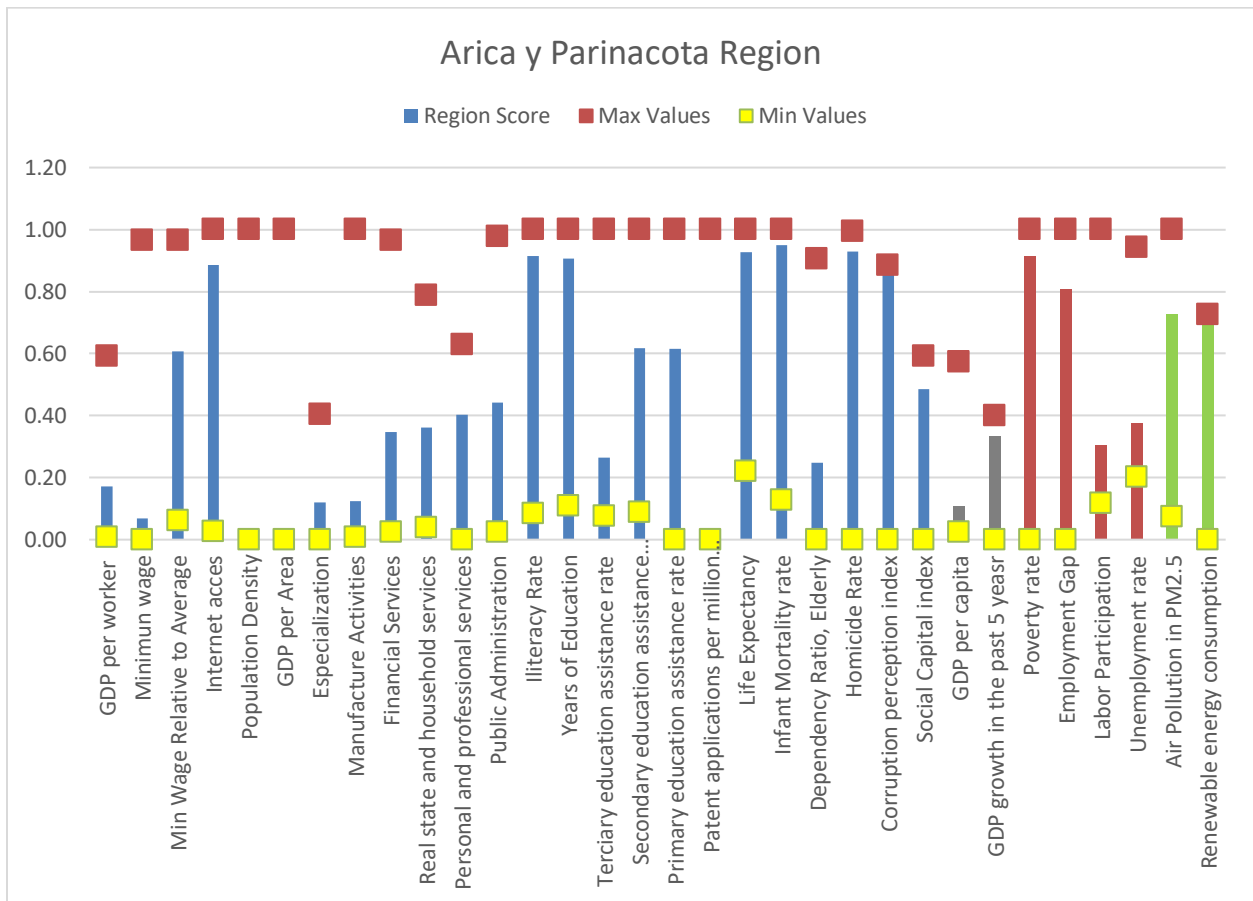
In the efficiency factor, Arica y Parinacota scores high in the minimum wage relative to average wage, meaning that labor cost is lower relative to other regions.

Regarding Results competitiveness, both environmental variables, air pollution and use of renewable energy have relatively high score.

Graph 19: Arica y Parinacota Region. Scores for Input Competitiveness Factors and Results Competitiveness Components.



Graph 20: Arica y Parinacota Region. Scores for Input Competitiveness and Results Competitiveness Variables.



Biobio, Chile

Biobio region is located in the central-south part of the country. The region's capital, Concepción, is an important urban and economic pole in the southern part of Chile. Biobio is considered an important industrial pole, the manufacturing industry represents 22.4% of the total regional GDP, mainly due to the forestry industry, and with a GDP share that relatively high amongst other regions in Chile. Other important activities in Biobío region are fishery and agricultural production,

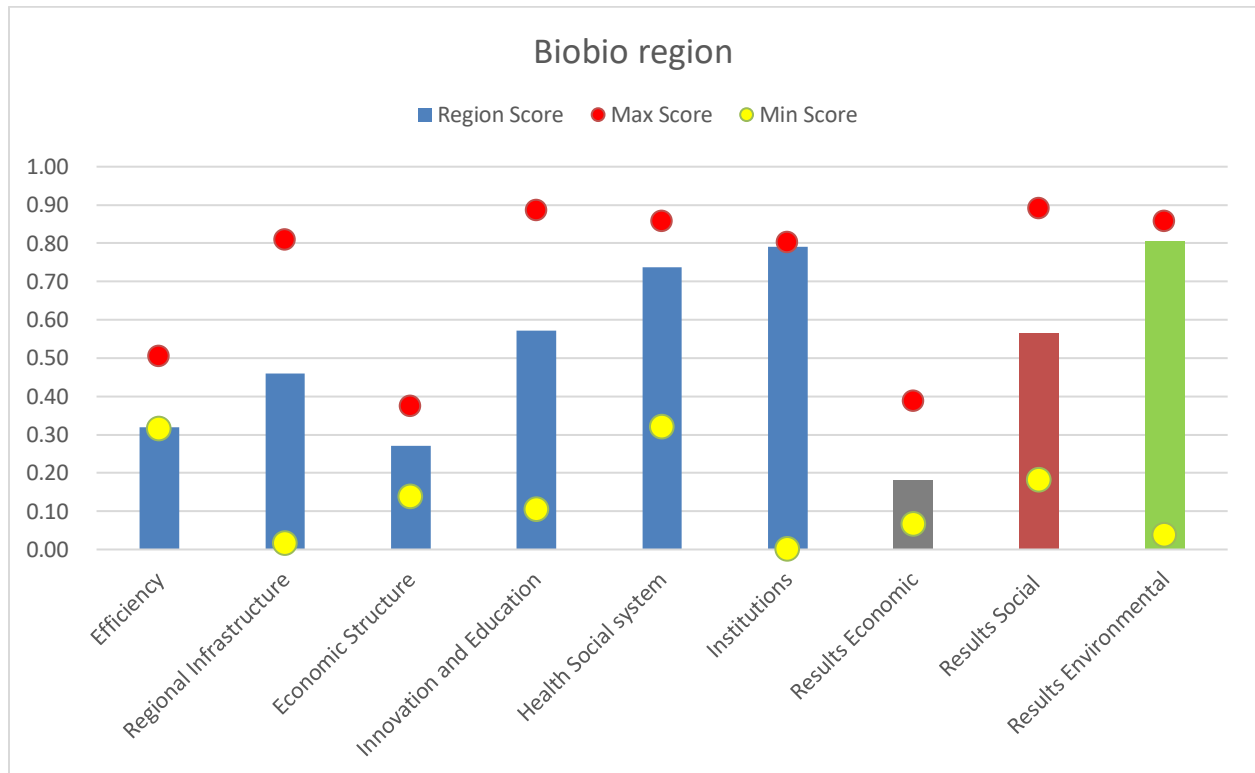
In 2017, the region had a population of 2,037,414 (INE), making the second largest region in terms of population after the Metropolitan region. Density is of 58 inhabitants /Km² and held 8.17% of the country's GDP. Poverty was 13.2% in 2017 (CASEN survey) which is the second highest level of poverty in Chile after Araucania region (17.2 % poverty in 2017). Regional GDP per capita reached US\$ 17,921 in 2017 (estimation based in World Bank Data).

Biobio region is ranked 9 in Input Competitiveness Index and 26 in the Results Competitiveness Index. The region presents high scores in Input factors of Health and Social System and Institutions. Results competitiveness scores are relatively high in the Environmental factor (graph 21).

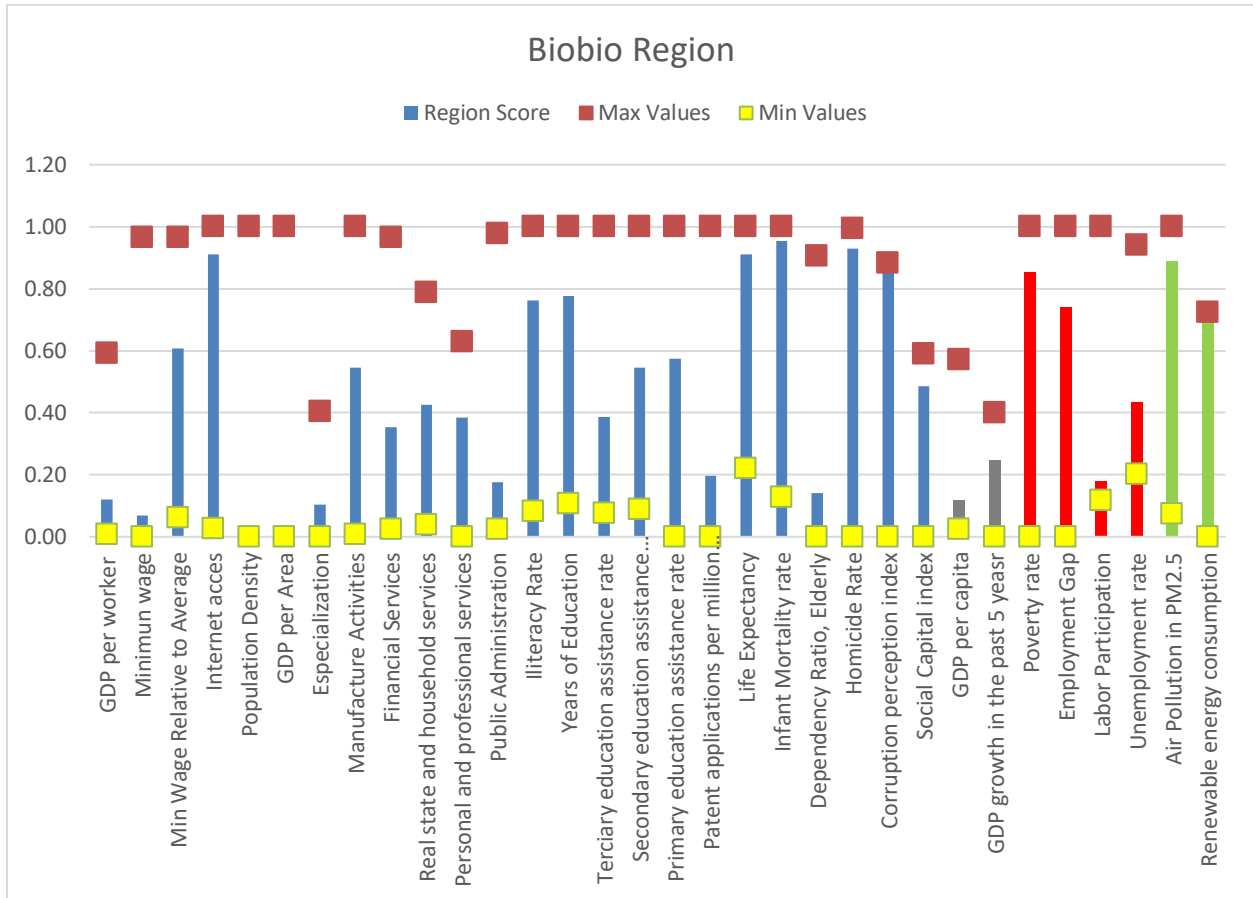
Input indicators are relatively high for indicators related to education, health and social system and Institutions (graph 22).

Results competitiveness of the environmental component is relatively high, and specific high-ranking variables are pollution in PM_{2.5} and the use of renewable energy.

Graph 21: Biobio Region. Scores for Input Competitiveness Factors and Results Competitiveness Components.



Graph 22: Biobio Region. Scores for Input Competitiveness and Results Competitiveness Variables.



Nuevo Leon

Nuevo Leon is located in the north-East part of Mexico. The region's capital is Monterrey, a city with over 5 million inhabitants, making it the second largest populated area after Mexico City. Monterrey is home to many of the largest and most important Mexican companies. The economic structure of Nuevo Leon is characterized by the specialization in the manufacturing industry. The Manufacturing Industry represented 26.2% of Nuevo Leon's GDP in 2017.

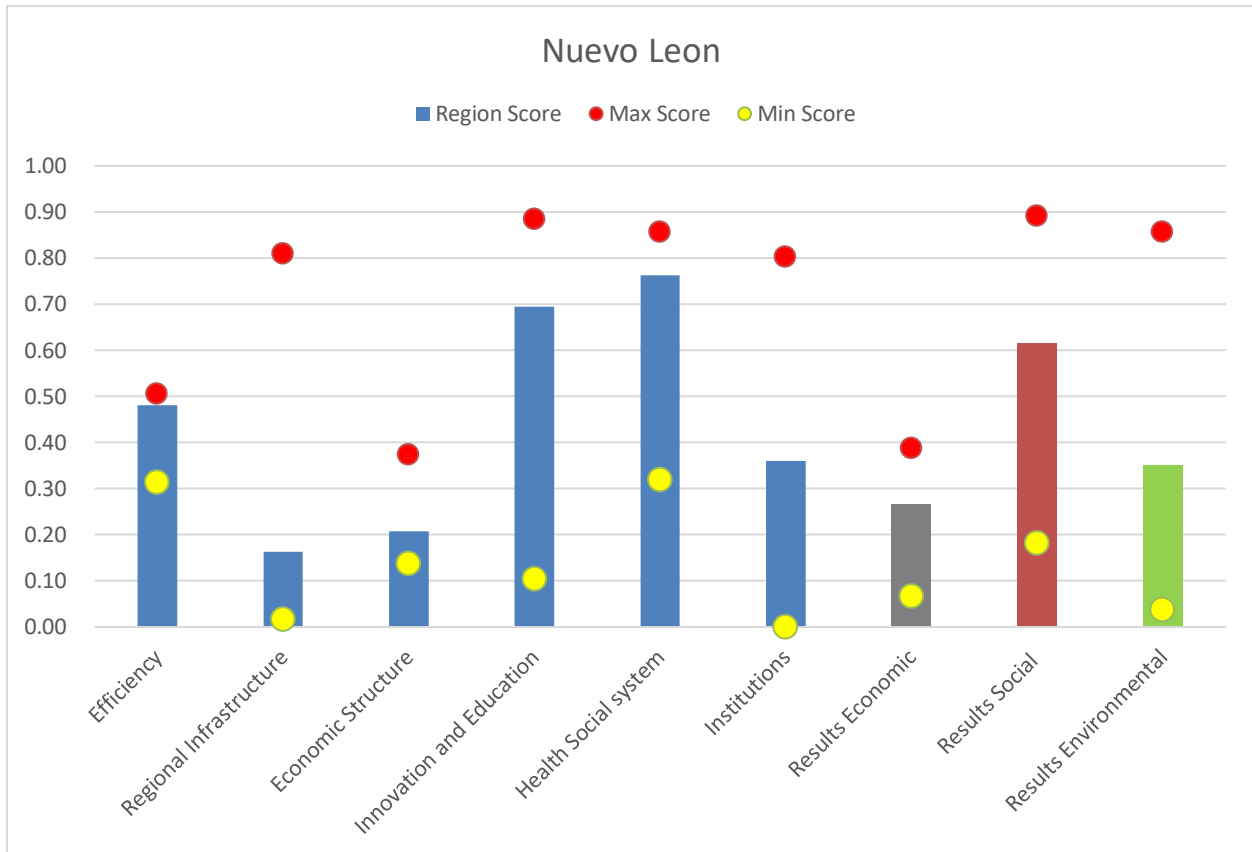
Nuevo Leon had a population of 5,318,740 in 2017 (INEGI), a density of 82 Inhabitants /Km² and held 7.5% of the country's GDP. Poverty was 14.2% in 2016 (INEGI) and GDP per capita reached US\$ 34,117 in 2017 (estimation based in World Bank Data).

Nuevo Leon is ranked 20 in the Input Competitiveness and 42 in the Results Competitiveness Index. Nuevo Leon presents low relative scores in most Input factors, except Efficiency and Health and Social System. Results competitiveness scores are average in all components (graph 23).

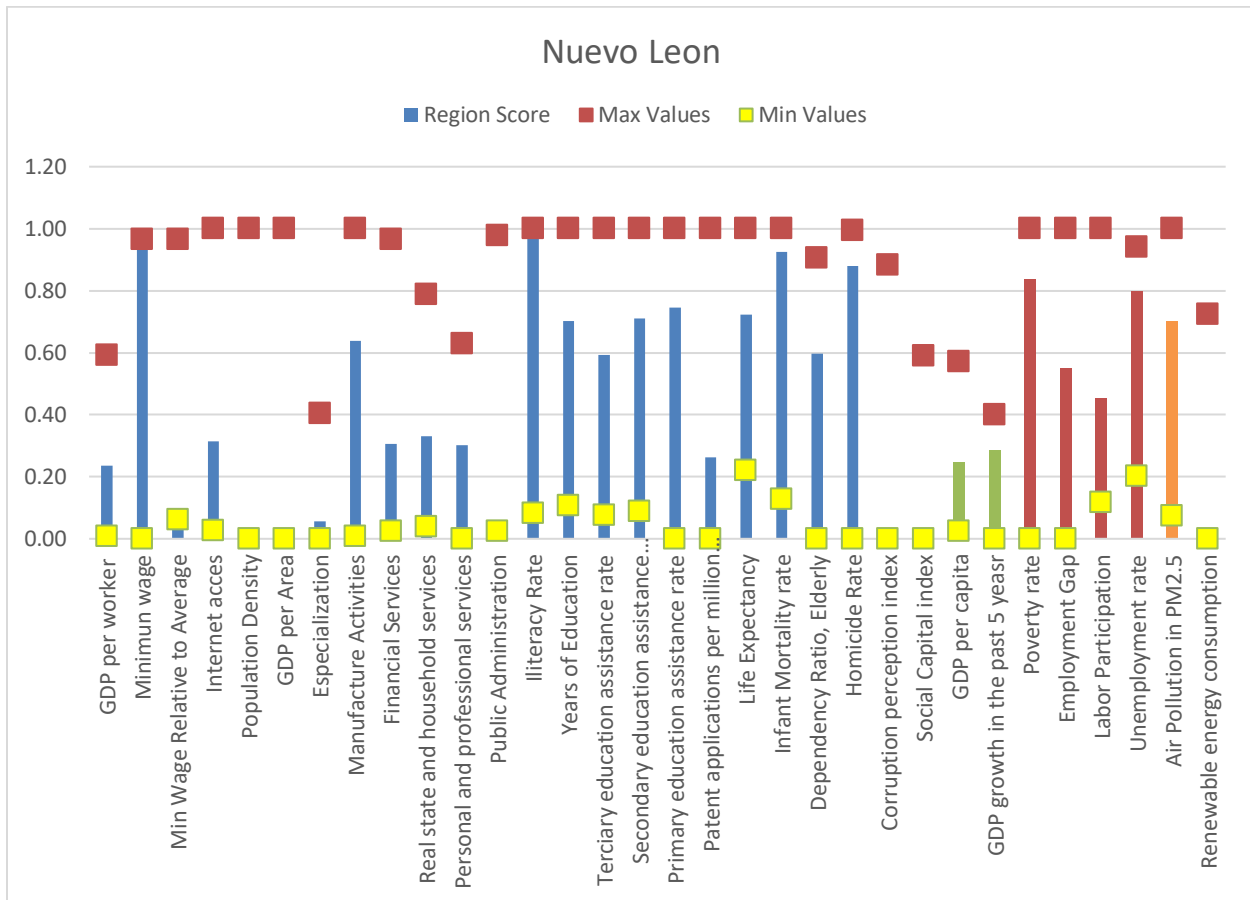
The variable minimum wage within the Efficiency factor of Input Competitiveness scores very high, meaning, that Nuevo Leon has low labor costs, thus favoring cost competitiveness. Variables related to education, such as illiteracy rate, and health, such as infant mortality rate, have also high rankings relative to other regions (graph 24).

Results components and variables are ranked average, except for the consumption of renewable energy variable, which is amongst the lowest in all regions.

Graph 23: Nuevo Leon Region. Scores for Input Competitiveness Factors and Results Competitiveness Components.



Graph 24: Nuevo Leon Region. Scores for Input Competitiveness and Results Competitiveness Variables.



Atlántico, Colombia

Atlántico's capital, Barranquilla, an important port city in Colombia and constitutes also an industrial and touristic pole for Colombia. Tourism centers around business and commerce activities. The economic structure of Atlántico is characterized by the specialization in commerce (22.5% of the region's GDP in 2017) and Manufacturing Industry (16.9% of the region's GDP in 2017).

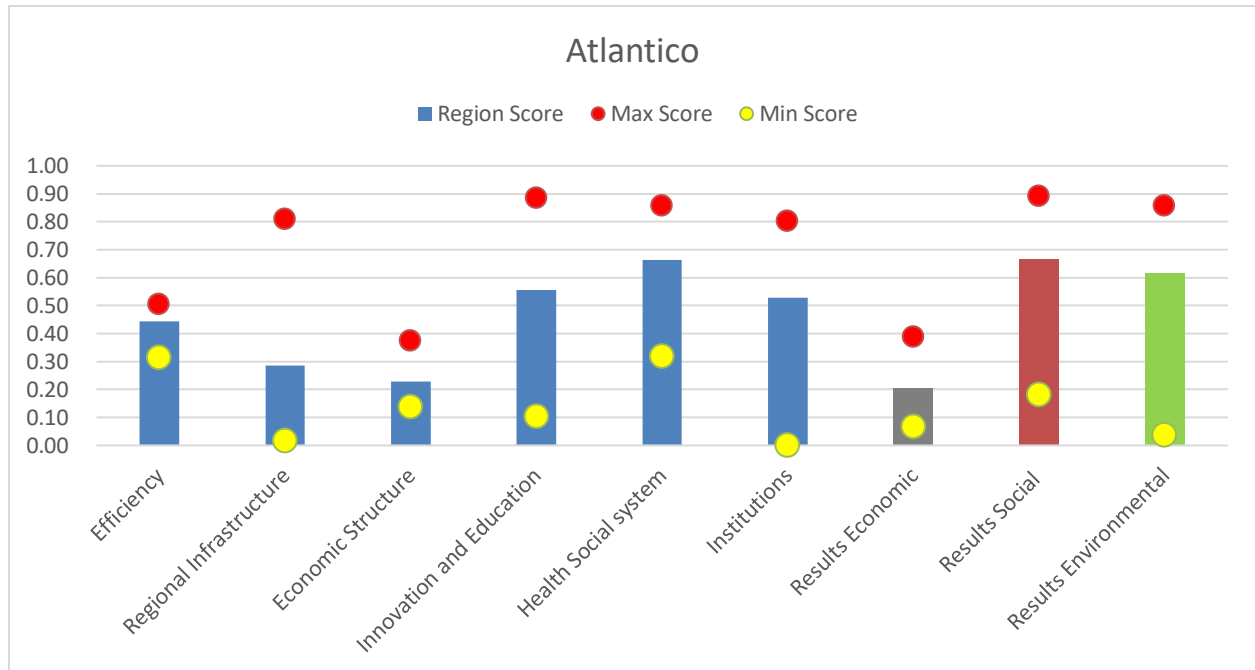
Atlántico had a population of 2,517,897 in 2017 (DANE), a density of 743 Inhabitants /Km² and held 4.7% of the country's GDP. Poverty was 24.3% in 2017 (DANE) and GDP per capita reached US\$ 13,378 in 2017 (estimation based in World Bank Data).

Atlántico is ranked 20 in the Input Competitiveness and 42 in the Results Competitiveness Index. Atlántico presents low relative scores in most Input factors, except Efficiency and Health and Social System. Results competitiveness scores are average in all components (graph 25).

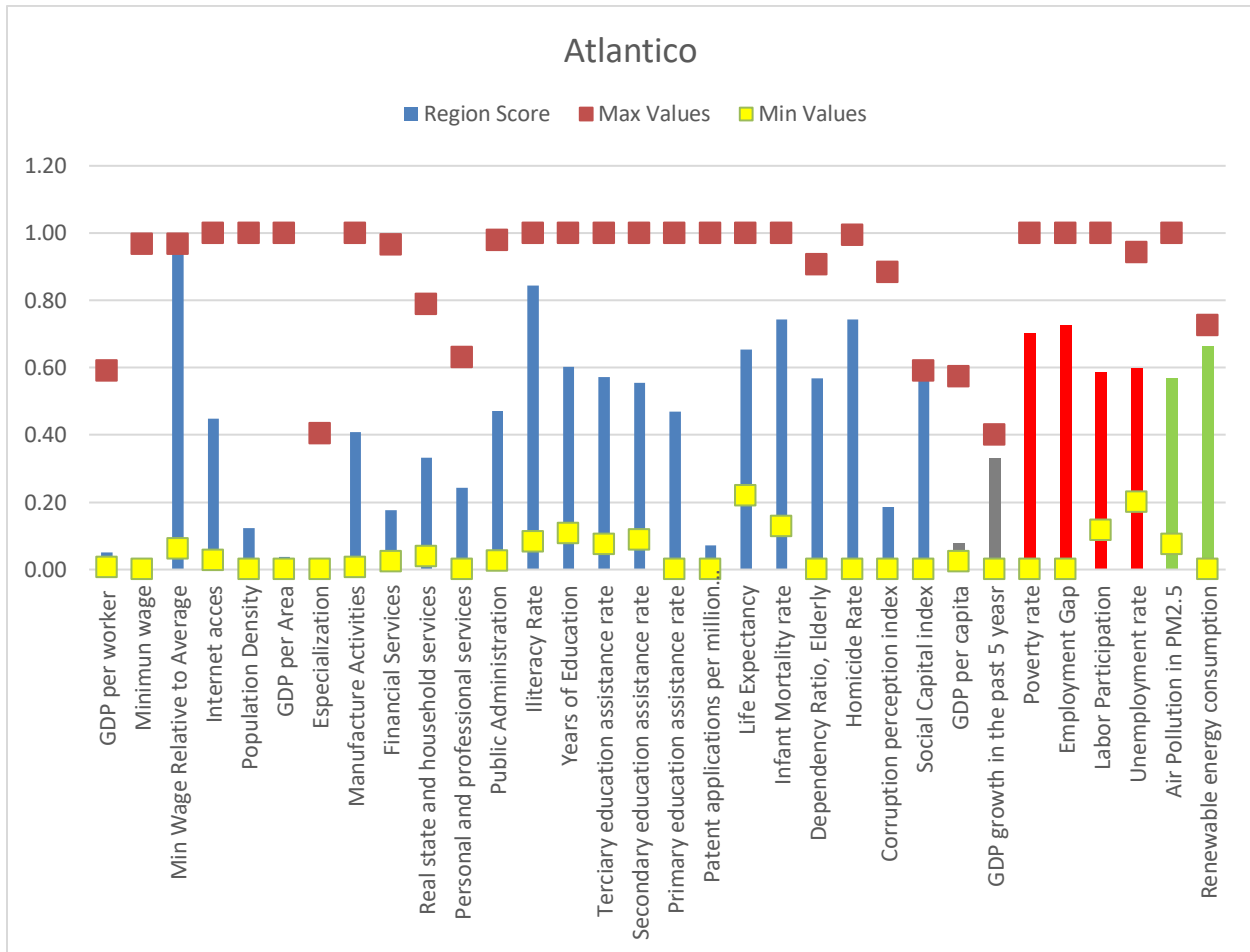
The variable minimum wage relative to average within the Efficiency factor of Input Competitiveness scores very high, meaning, that Atlántico has minimum wages that are in line with average wages (graph 26). Variables related to education, such as illiteracy rate, and health, such as infant mortality rate, have also high rankings relative to other regions.

Results components and variables are ranked average, except for GDP per capita, which is amongst the lowest in all regions.

Graph 25: Atlántico Region. Scores for Input Competitiveness Factors and Results Competitiveness Components.



Graph 26: Atlántico Region. Scores for Input Competitiveness and Results Competitiveness Variables.



4.4.3. Case 3: Low in Input Competitiveness / High in Results Competitiveness

Case 3 represent regions that show high levels of competitiveness outcomes despite having low levels of competitiveness capabilities (input competitiveness), but at the same time, are lacking in competitiveness outcomes. This case could represent regions which have been able to obtain competitiveness results due to factors that are not related to competitiveness inputs, or regions which have not been able to maintain high input competitiveness levels.

Table 9 shows selected regions for Case 3: Low in Input Competitiveness / High in Results Competitiveness. Values in red are presented when an Input factor or Results component has a lower value than the average of all regions. Values in blue represent a maximum value for that Input factor or Results component.

These types of regions have high levels of results competitiveness, despite not having the competitiveness inputs to achieve this outcome. Some of these regions may be obtaining transferences from other regions, for instance, in the case of Aysén, there is a notorious presence and support of the Chilean central government, or in the case of Cundinamarca, there could be spill-over effects obtained from the country's capital, Bogotá.

Table 9: Case 3: Low in Input Competitiveness / High in Results Competitiveness									
Region Country	Aysén	Cundinamarca	Magallanes	Santander	Baja California Sur	All Regions			
	Chile	Colombia	Chile	Colombia	Mexico	Mean	St Dev	Max	Min
Input Ranking	17	29	7	19	33				
Results Ranking	1	4	2	6	27				
Efficiency	0.32	0.44	0.33	0.45	0.47	0.43	0.06	0.50	0.31
Regional Infrastructure	0.39	0.21	0.50	0.23	0.18	0.21	0.18	0.81	0.02
Economic Structure	0.25	0.18	0.26	0.19	0.15	0.21	0.04	0.37	0.14
Innovation and Education	0.50	0.49	0.60	0.57	0.59	0.52	0.13	0.88	0.10
Health Social system	0.79	0.63	0.73	0.67	0.77	0.67	0.09	0.86	0.32
Institutions	0.74	0.56	0.80	0.58	0.27	0.48	0.20	0.80	0.00
Results Economic	0.26	0.21	0.25	0.23	0.29	0.20	0.05	0.39	0.07
Results Social	0.77	0.89	0.78	0.81	0.68	0.59	0.12	0.89	0.18
Results Environmental	0.85	0.77	0.86	0.73	0.41	0.55	0.23	0.86	0.04

Aysén region, Chile

Aysén region is located in the southern part of the country in an area known as Patagonia. Aysén is characterized for being a vast region, full of rivers and lakes, with a low population density (1 inhabitant/Km²) and a relatively isolated condition, because many parts of the region are difficult to reach by road. In the economic structure, Aysén's GDP of public administration services represents 14.3% of the total regional GDP, which is the highest share among Chilean regions (graph 28). The regions received funds and support from the central government for isolated areas.

In 2017, the region had a population of 103,158 (INE) and held 0.69% of the country's GDP. Poverty was 4.6% in 2017 (CASEN survey) and GDP per capita reached US\$ 29,747 in 2017 (estimation based in World Bank Data).

Aysén region is ranked 17 in Input Competitiveness and 1 in Results Competitiveness. It is the highest level of Results Competitiveness index and yet the lowest ranking in the Input Competitiveness index among Chilean regions.

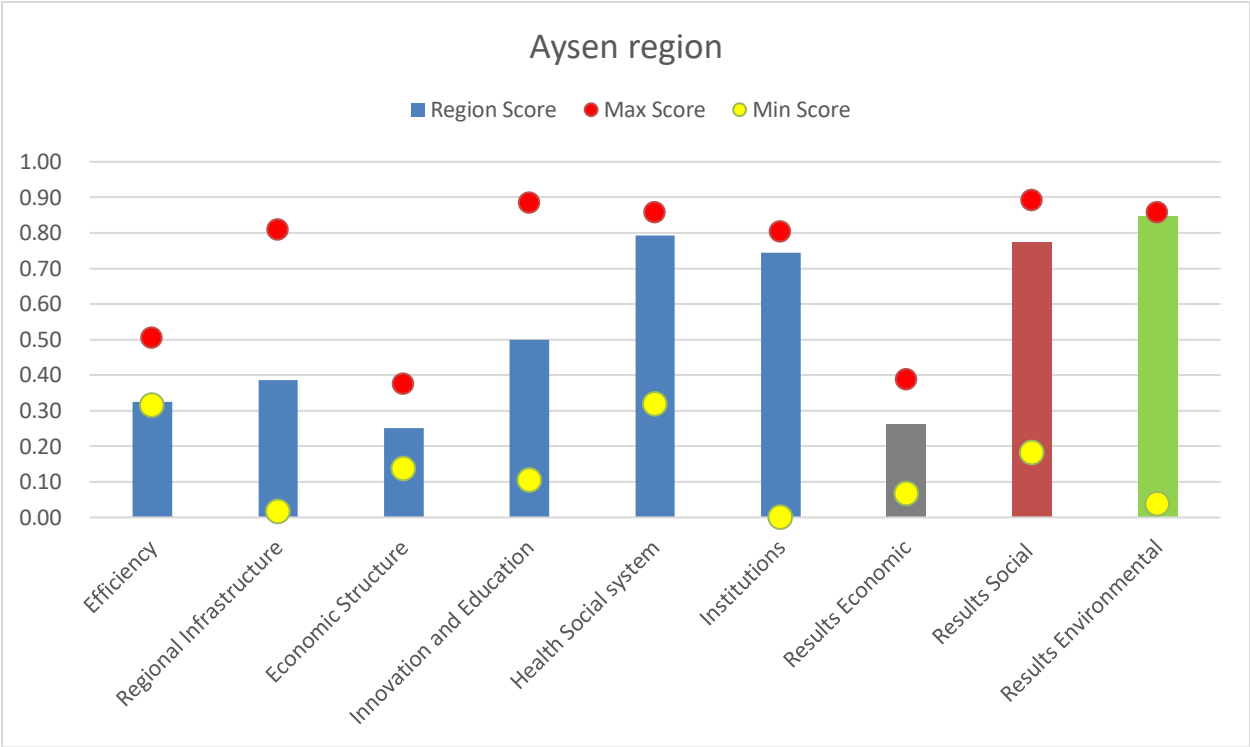
The Environmental and Social components have relatively high scores, thus boosting the Results Competitiveness ranking (graph 27).

In the Health and Social System factor, Aysén region has the lowest infant mortality rate in the among the whole sample of regions at 5.6 deaths per 1,000 births.

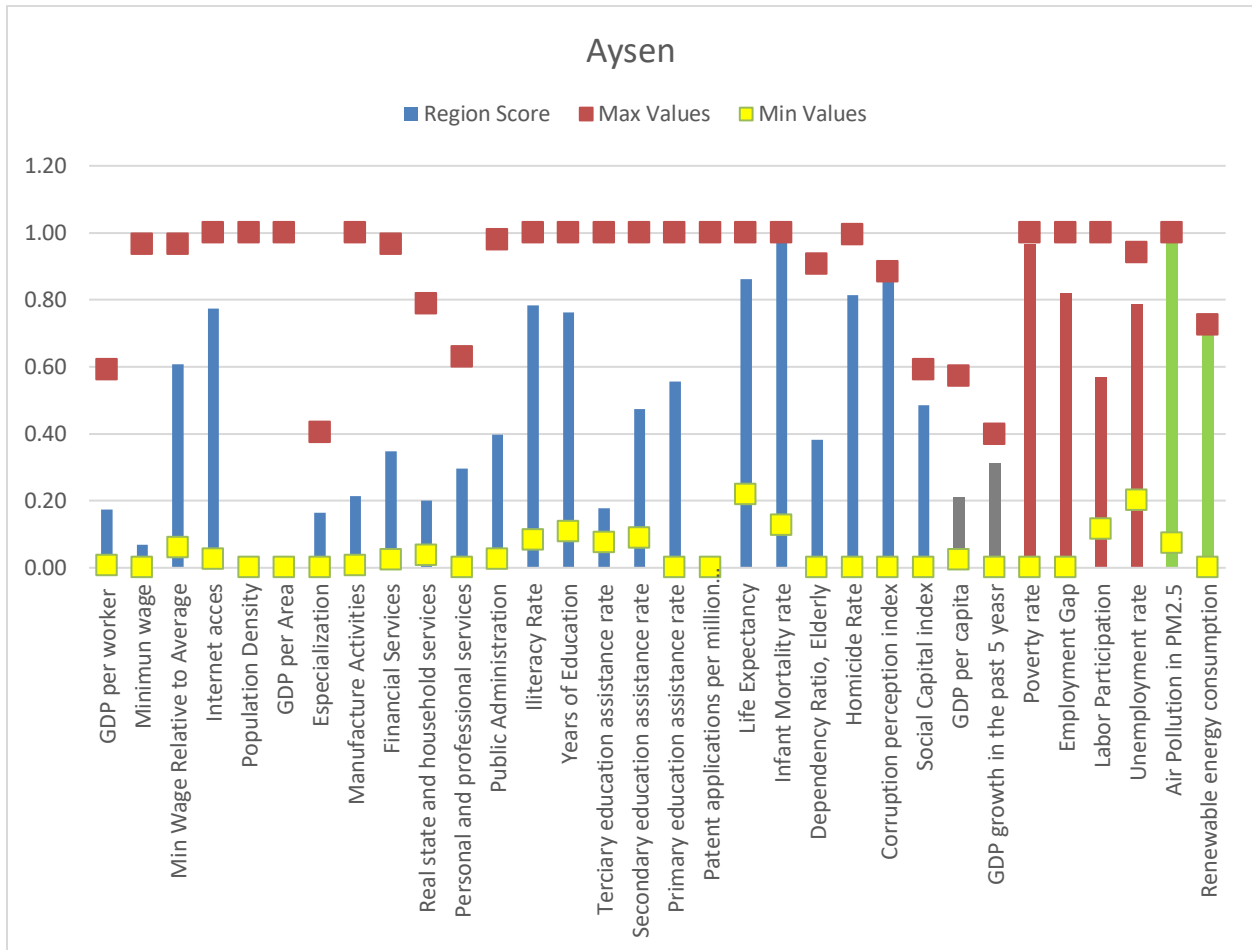
The majority of other indicators related to inputs factors stand at average levels of the indicators. Illiteracy rate is 4.88% and average years of education are 10.61, which are about average levels amongst Chilean regions.

Regarding Results competitiveness, both environmental variables, air pollution and use of renewable energy have the highest scores amongst all regions. In the social component, poverty, employment gap, and unemployment rate show relatively high scores.

Graph 27: Aysén Region. Scores for Input Competitiveness Factors and Results Competitiveness Components.



Graph 28: Aysén Region. Scores for Input Competitiveness and Results Competitiveness Variables.



Cundinamarca, Colombia

Cundinamarca region encloses Bogota, the capital of Colombia, and it is considered a separate region (departamento) to Bogota, according to the political-administrative division of Colombia. However, Cundinamarca and Bogota may be considered one functional region, in that sense that within the region there are constant and free flows of economic and social factors that are not limited by the political-administrative division.

The existence of economic and social spillovers from the Bogotá to Cundinamarca is an expected result, since a vast part of the political and economic activity takes place within Bogotá, while in Cundinamarca houses many of the residents that carryout those activities. Having a higher level of competitiveness results indicators compared to competitiveness input indicators is an expected outcome of the spillovers from Bogota.

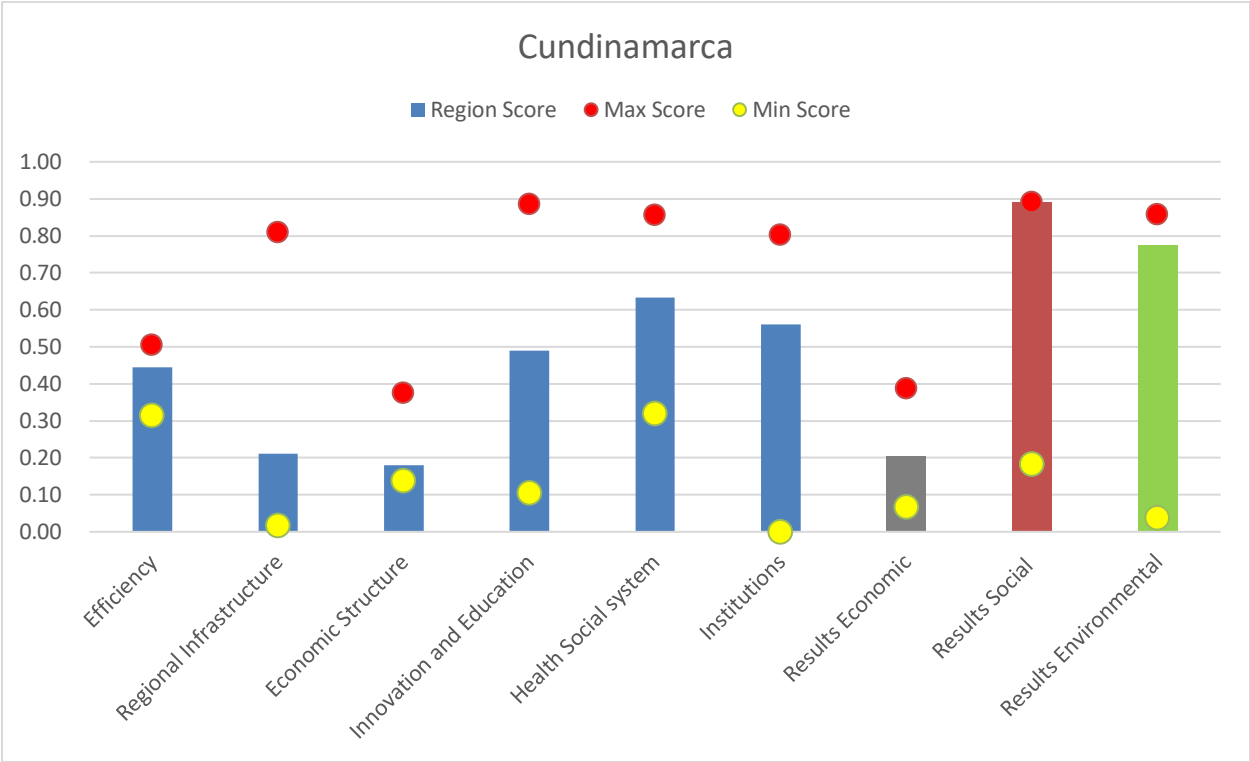
Cundinamarca had a population of 2,762,784 in 2017 (DANE), a density of 114 Inhabitants /Km² and held 6.5% of the country's GDP. Poverty was 14.7% in 2017 (Dane) and GDP per capita reached US\$ 16,660 in 2017 (estimation based in World Bank Data).

Cundinamarca is ranked 29 in the Input Competitiveness and 4 in the Results Competitiveness Index. The region presents high scores in input factors of Efficiency. Results competitiveness scores are relatively high in the Social and Environmental components (graph 29).

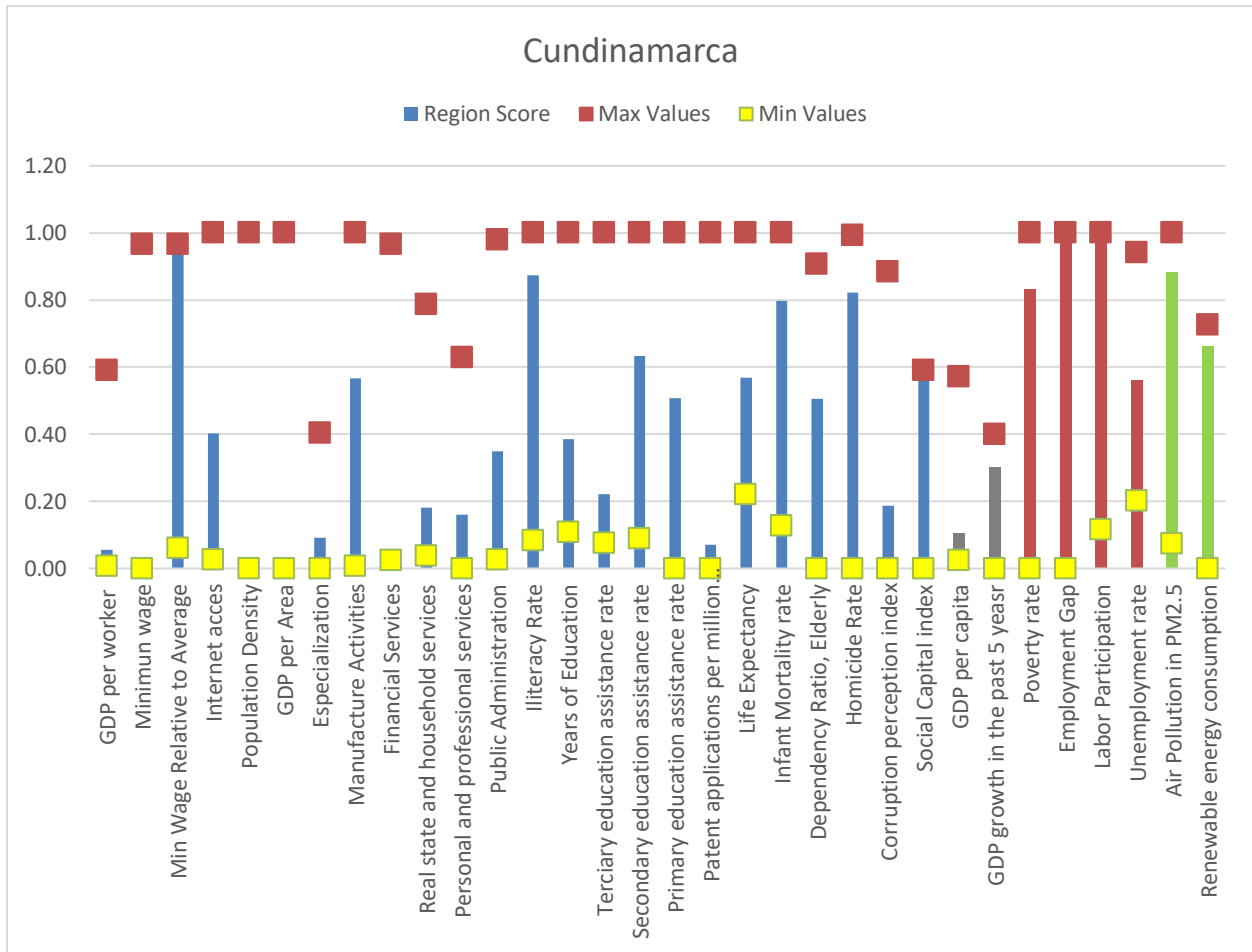
Efficiency variable minimum wage relative to average wages of full-time workers scores very high, meaning that minimum wages are aligned with average wages. Other variables that have high scores are illiteracy rate, homicide rate (high score of this variable means a low homicide rate), and social capital index shows a top score amongst all regions (graph 30). The economic structure of Cundinamarca is characterized by the specialization in manufacturing industry, which represents 23.3% of the regional GDP.

Results variable scores for the social component are the highest amongst the whole sample of regions. Although scores for poverty rate and unemployment rate are relatively high (meaning the nominal value of this variable is low), employment gap and labor participation rate are amongst the highest scores in the whole sample of regions.

Graph 29: Cundinamarca Region. Scores for Input Competitiveness Factors and Results Competitiveness Components.



Graph 30: Cundinamarca Region. Scores for Input Competitiveness and Results Competitiveness Variables.



Magallanes, Chile

Magallanes region is located in southern border part of the country, in Patagonia, and borders with Aysén Region to the north. Magallanes has a relatively diversified economy, with important mining activities, with the extraction and production of coal, gas, and oil. Tourism, cattle production and forestry are also important activities.

Magallanes region's GDP of the manufacturing industry represents 22.4% of the total regional GDP constituting an important activity in the region with a GDP share that is relatively high amongst other regions in Chile. Being a relatively isolated area in Chile, public administration GDP also holds an important share at 11.6% of the region's GDP.

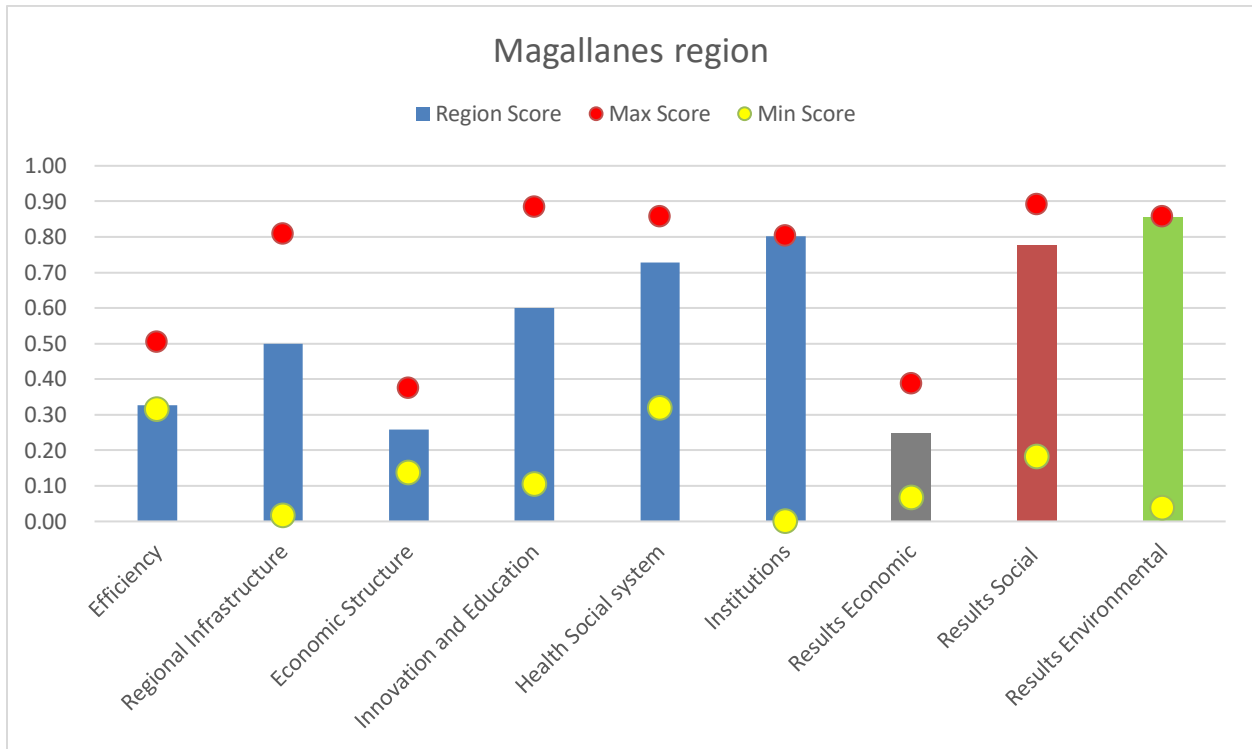
In 2017, the region had a population of 166,533 (INE), making the second largest region in terms of population after the Metropolitan region. Density is of 1 inhabitants /Km² and held 1.12% of the country's GDP. Poverty was 2.1% in 2017 (CASEN survey) which is the lowest highest level of poverty in Chile. Regional GDP per capita reached US\$ 30,151 in 2017 (estimation based in World Bank Data).

Magallanes is ranked 7 in the Input Competitiveness Index and 2 in the Results Competitiveness Index. The region presents high scores in input factors of Health and Social System and Institutions. Results competitiveness scores are relatively high in the Social and Environmental factor (graph 31).

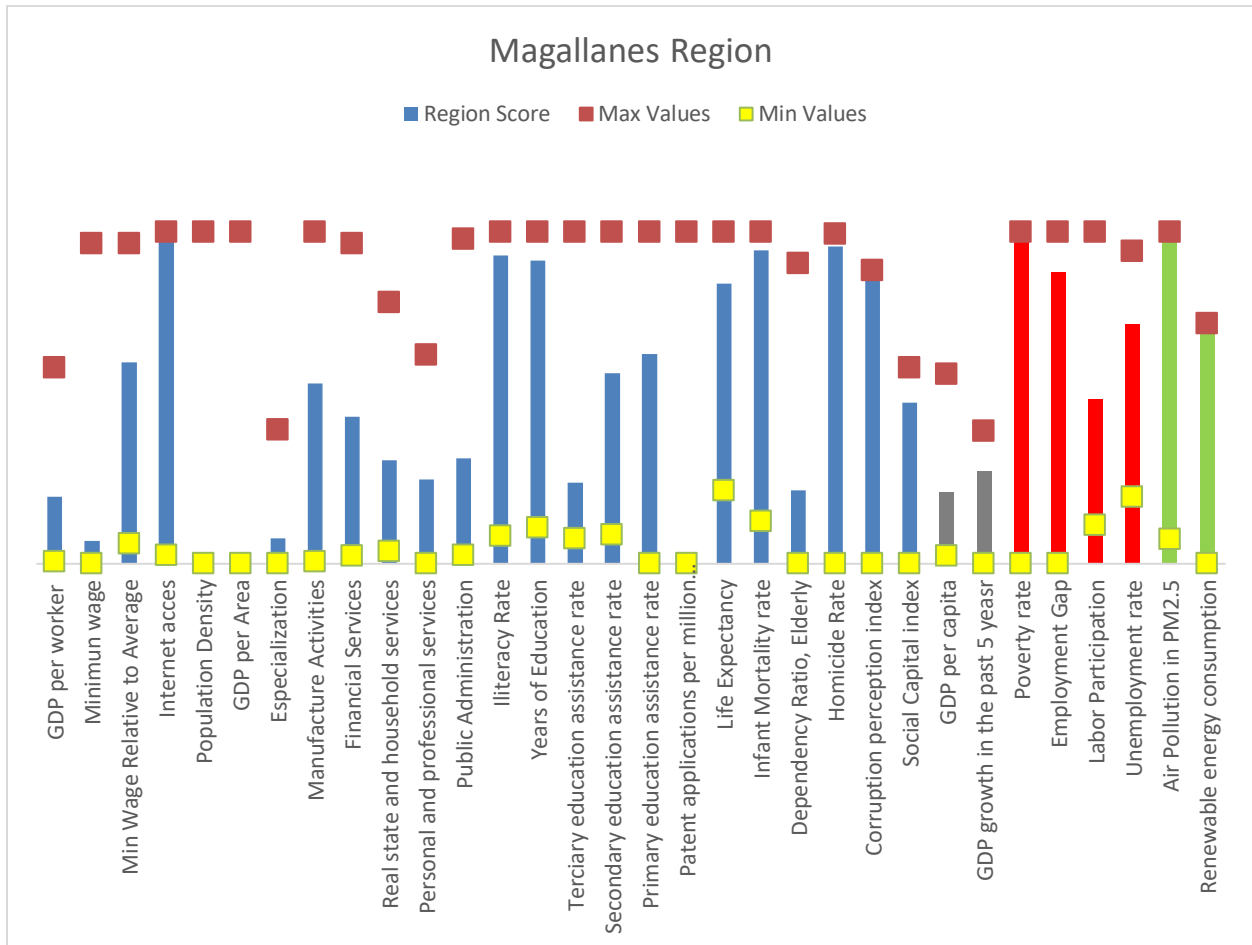
Input indicators are relatively high for indicators related to education, health and social system and Institutions (graph 32).

Results competitiveness of the environmental and social component are relatively high, and specific high-ranking variables are poverty, employment gap, pollution in PM_{2.5} and the use of renewable energy.

Graph 31: Magallanes Region. Scores for Input Competitiveness Factors and Results Competitiveness Components.



Graph 32: Magallanes Region. Scores for Input Competitiveness and Results Competitiveness Variables.



Santander, Colombia

Santander is located in the north-east part of Colombia. Santander 's capital Bucaramanga, is an important industrial pole, concentrating food industry, textile, footwear, construction, and refinery activities. In 2017, manufacturing industry represented 20% of the region's GDP and commerce 16% of the region's GDP. Santander has passed through an industrialization process; however, agriculture has been an historically important activity in this region, and in 2017 held 10% of the region's GDP.

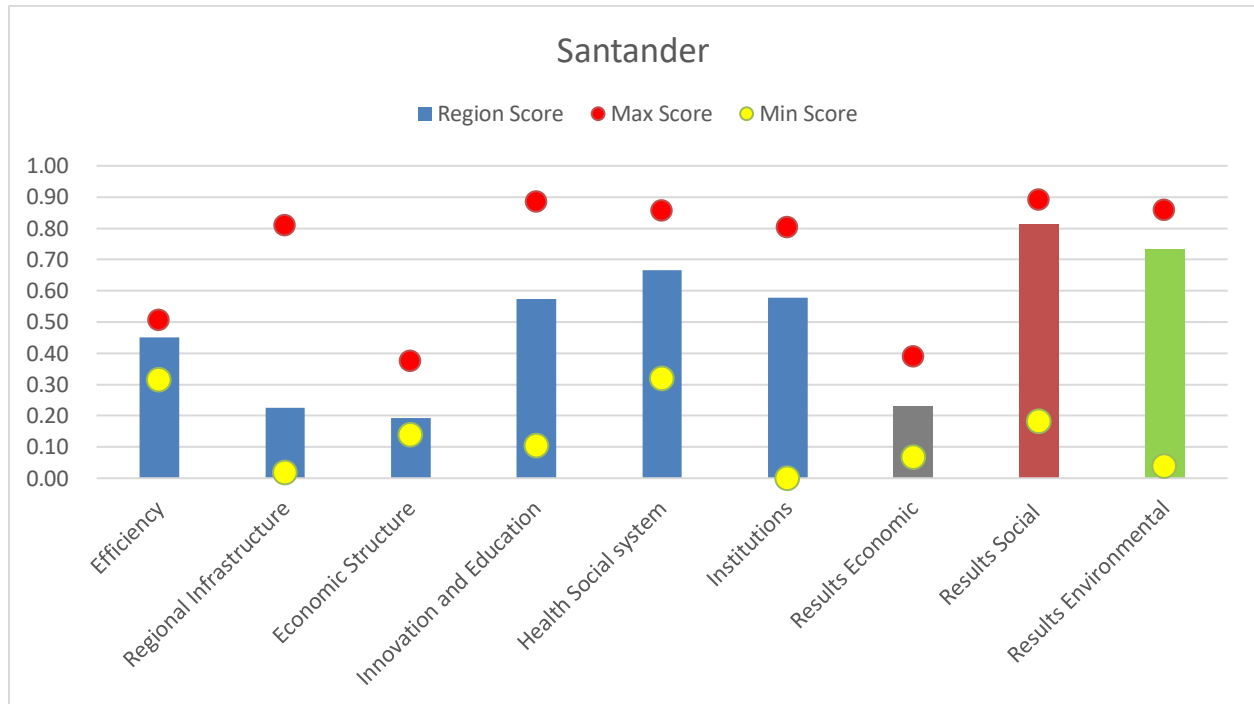
Santander had a population of 2,080,938 in 2017 (DANE), a density of 68 Inhabitants /Km² and held 6.7% of the country's GDP. Poverty was 18.9% in 2017 (Dane) and GDP per capita reached US\$ 22,984 in 2017 (estimation based in World Bank Data).

Santander is ranked 19 in the Input Competitiveness Index and 6 in the Results Competitiveness Index. The region presents high scores in input factors of Efficiency and Health and Social System. Results competitiveness scores are relatively high in the Social and Environmental components (graph 33).

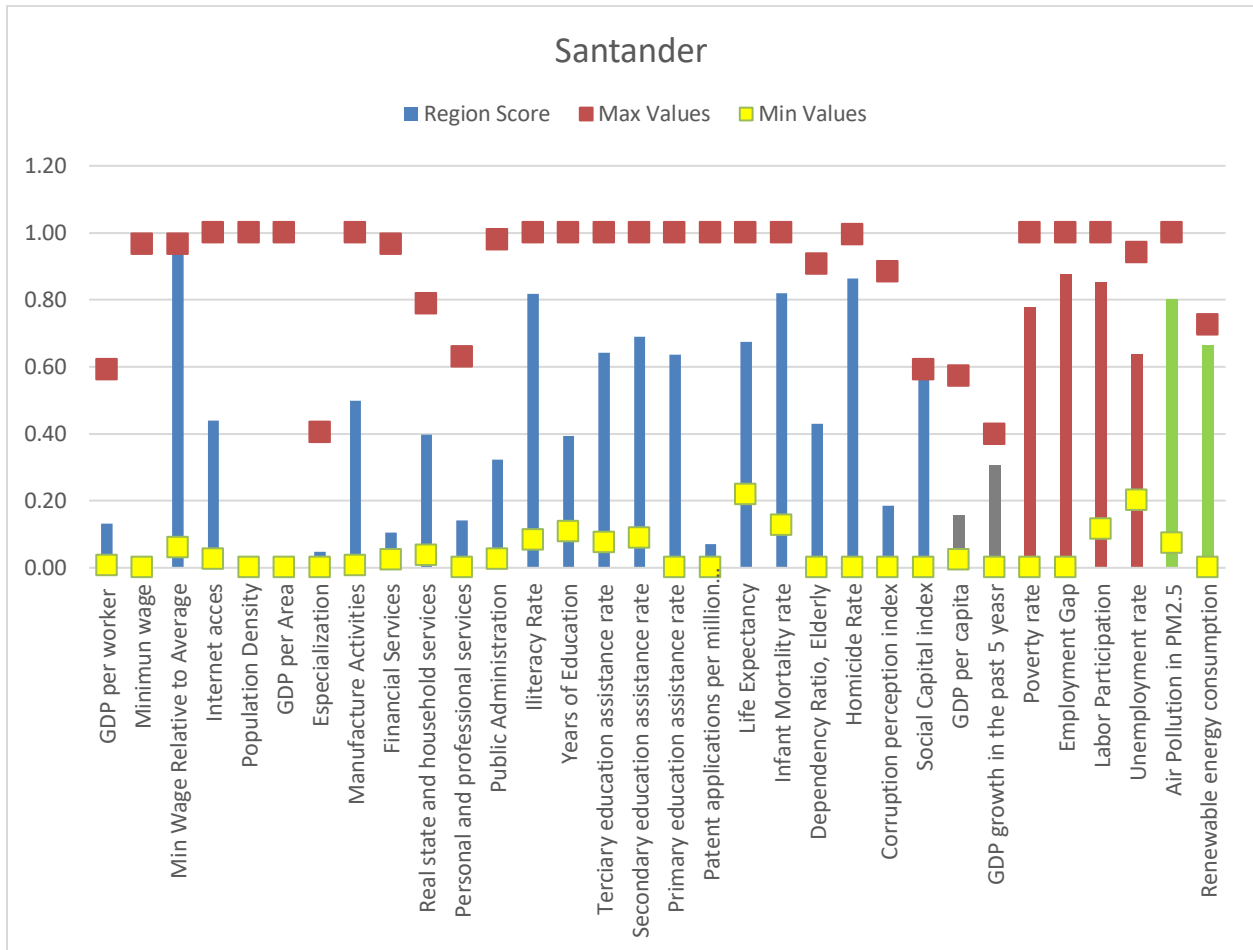
Efficiency variable minimum wage relative to average wages of full-time workers scores very high, meaning that minimum wages are aligned with average wages. Other variables that have high scores are those related to education and specifically, the institutional variable social capital index shows a top score amongst all regions (graph 34).

Results variable scores are very high for all social and environmental components. Economic component variables are around average levels.

Graph 33: Santander Region. Scores for Input Competitiveness Factors and Results Competitiveness Components.



Graph 34: Santander Region. Scores for Input Competitiveness and Results Competitiveness Variables.



Baja California Sur

Baja California Sur is located in the north-west of Mexico, and it is known for its tourism sector. The economic structure of Baja California Sur is specialized in construction, commerce, and tourism services. In 2017, construction represented 24.3% of Baja California Sur's GDP, commerce 19.1% of the region's GDP and tourism services 14.2% of the region's GDP.

Baja California Sur had a population of 744,447 in 2017 (INEGI), a density of 10 Inhabitants /Km² and held 0.9% of the country's GDP. Poverty was 22.1% in 2016 (INEGI) and GDP per capita reached US\$ 296,586 in 2017 (estimation based in World Bank Data).

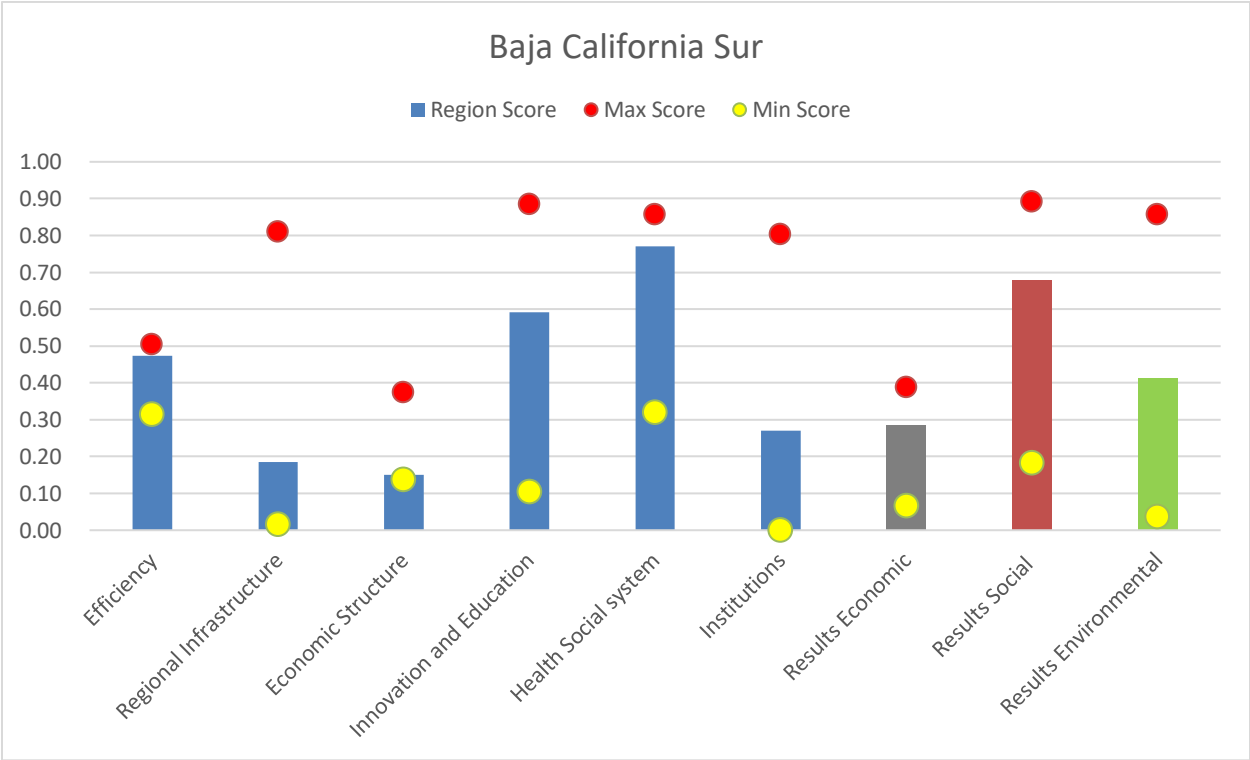
Despite not showing a high level of competitiveness compared to regions from other countries, the Results Competitiveness index is relatively high within Mexican regions. Baja California Sur is ranked 33 in the Input Competitiveness and 27 in the Results Competitiveness Index. Baja California Sur presents low relative scores in most Input factors, except Efficiency and Health and Social System (graph 35).

Results competitiveness scores are relatively high in Economic component, and around average scores in the Social and Environmental components, which explains the relatively higher overall Results Competitiveness index.

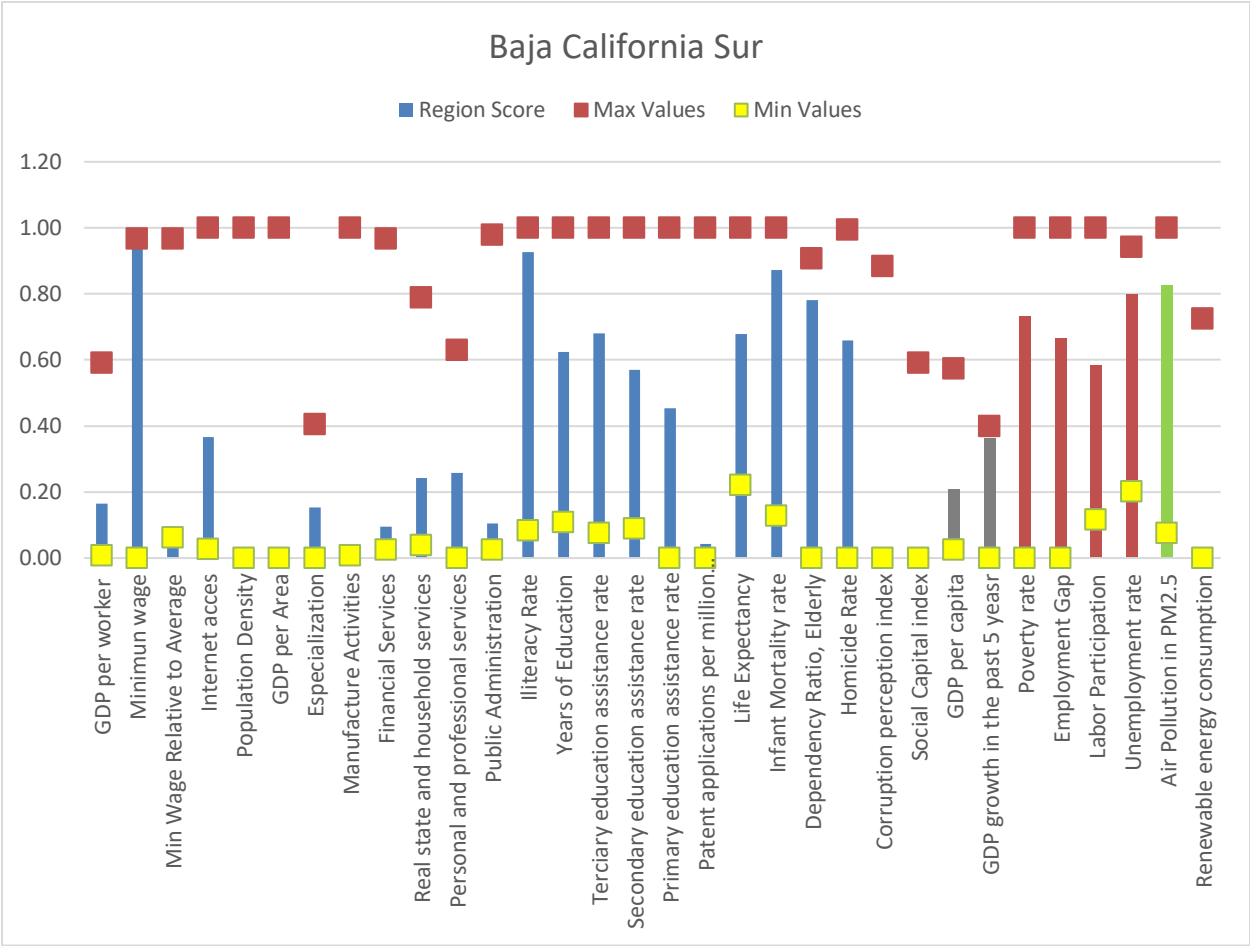
The variable minimum wage within the Efficiency factor of Input Competitiveness scores very high, meaning, that Baja California Sur has low labor costs, thus favoring cost competitiveness. Variables related to education, such as illiteracy rate, and Tertiary education assistance rate have also high rankings relative to other regions (graph 36). Infant mortality rate and Elderly dependency rate are also ranked high, meaning that health and social system factors are well positioned amounts the universe of regions.

Results components are ranked relatively high for the economic and social components, but low for the environmental component mainly due to the low ranking of the consumption of renewable energy variable.

Graph 35: Baja California Sur Region. Scores for Input Competitiveness Factors and Results Competitiveness Components.



Graph 36: Baja California Sur Region. Scores for Input Competitiveness and Results Competitiveness Variables.



4.5. Country Analysis: Regional Competitiveness Rankings and Trends

4.5.1 Chile: Ranking Results and Regional Trends

Table 10 presents rankings and scores for Input Competitiveness and Results Competitiveness Index in 2017 for 15 Chilean regions. The highest-ranking region for Input Competitiveness is Metropolitana region, followed by Antofagasta and Tarapacá. These regions also show relatively high levels of Results Competitiveness.

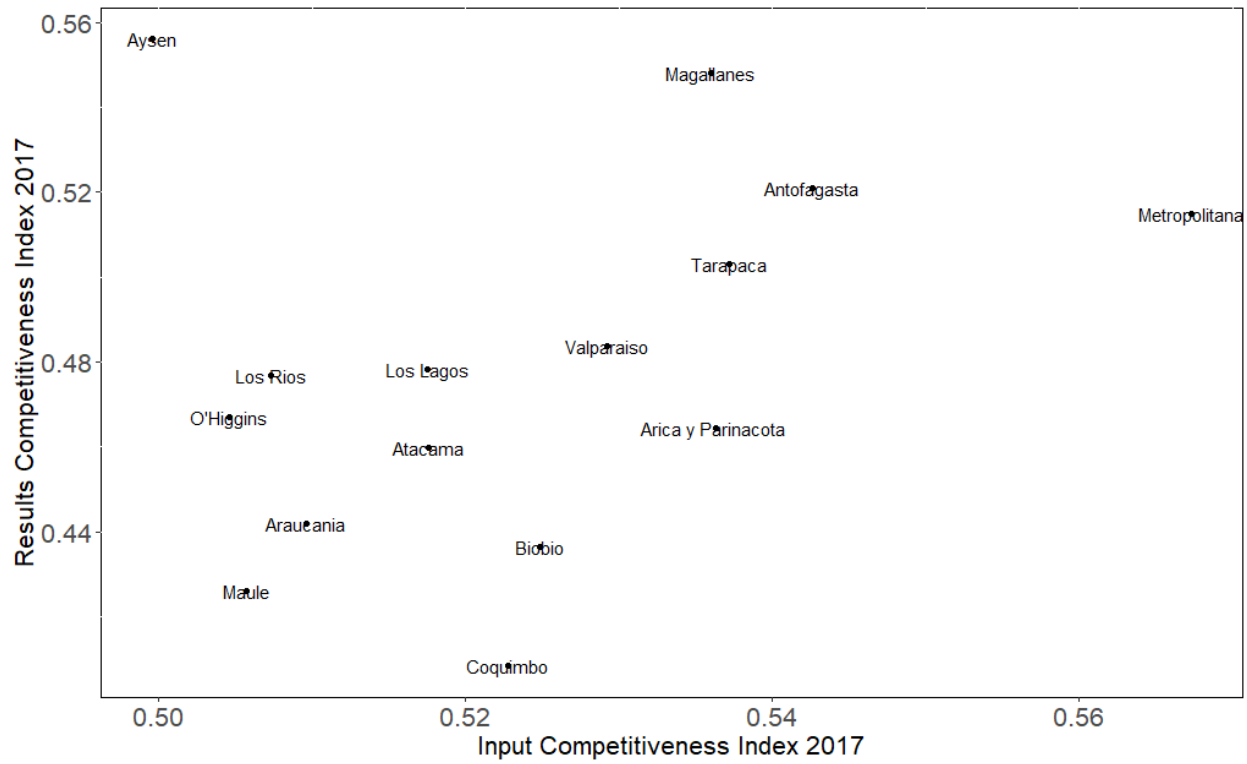
Graph 37 shows that, in general, high ranking regions for Input Competitiveness also show high rankings for results competitiveness. The most notable exception is Aysén region, which ranks as the top region in terms of results but the lowest in input competitiveness.

On the other hand, Metropolitana region shows an unusually high Input Competitiveness score, but fails in achieving a high score in Results Competitiveness.

Table 10: Chile Rankings for Input and Results Competitiveness 2017

Region	Ranking Inputs	Input Competitiveness Score 2017	Ranking Results	Results Competitiveness Score 2017
Metropolitana	3	0.57	7	0.51
Antofagasta	4	0.54	5	0.52
Tarapacá	5	0.54	8	0.50
Arica y				
Parinacota	6	0.54	18	0.46
Magallanes	7	0.54	2	0.55
Valparaíso	8	0.53	9	0.48
Biobío	9	0.52	26	0.44
Coquimbo	10	0.52	32	0.41
Atacama	11	0.52	19	0.46
Los Lagos	12	0.52	12	0.48
Araucanía	13	0.51	22	0.44
Los Ríos	14	0.51	13	0.48
Maule	15	0.51	28	0.43
O'Higgins	16	0.50	16	0.47
Aysén	17	0.50	1	0.56

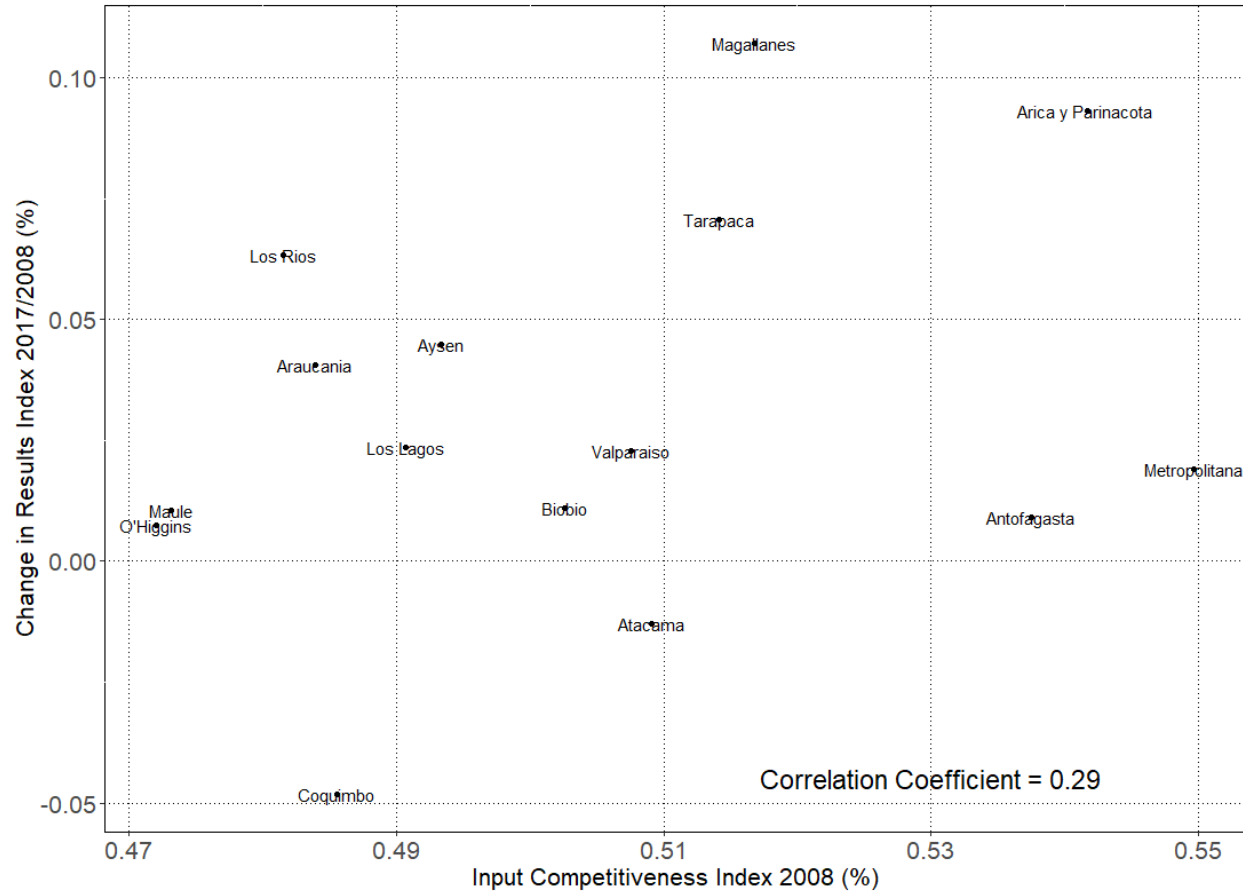
Graph 37. Chile. Results Competitiveness Index 2017 vs Input Competitiveness Index 2017



Graph 38 shows the variation in Results Competitiveness Index between 2008 and 2017 and the Input Competitiveness Index in 2008. There is no clear graphical trend, but the correlation coefficient between the two variables is 0.29, thus there is an apparent positive relation between the initial levels of Input Competitiveness and the variation of results competitiveness in Chile in the studied period.

Graph 39 shows the Changes in Results Competitiveness Index between 2008 and 2017 and the Results Competitiveness Index 2008. The correlation coefficient between these two variables is -0.43, which suggests a convergence trend for Regional Results Competitiveness Index between 2008 and 2017 in Chile. Regions with lower levels of the Results Competitiveness Index in 2008, such as Arica y Parinacota, Los Rios, Tarapacá and Araucanía showed a higher variation in the Results Competitiveness Index between 2008 and 2017.

Graph 38. Chile. Changes in Results Competitiveness Index 2017/2008 Vs Input Competitiveness Index 2008



4.5.2 Colombia: Ranking Results and Regional Trends

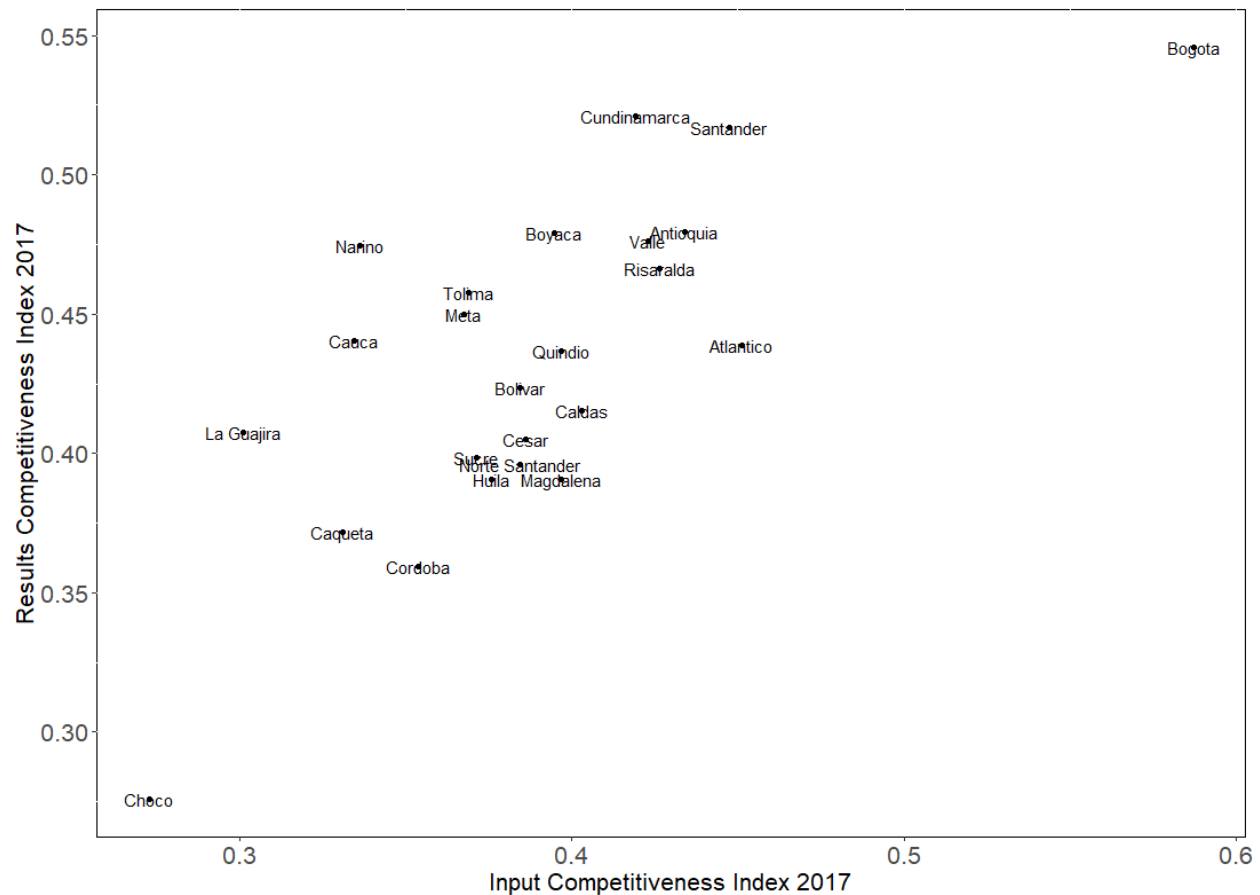
Table 11 presents ranking results and scores for Input Competitiveness and Results Competitiveness Index in 2017 for 24 Colombian regions. The highest-ranking region in Colombia according to the Input Competitiveness Index is Bogota, followed by Atlántico and Santander. It is important to note, that only Bogota shows a high ranking (1) relative to the whole sample. In fact, despite Atlántico and Santander being placed in the top in Colombia, they are ranked relatively low, 18 and 19, in the sample including all countries. Moreover, of these three top regions, Bogota and Santander also show relatively high levels in the Results Competitiveness Index.

Graph 40 shows scores for Input and Result Competitiveness in 2017. The case of Santander is especially interesting, since it is ranked with a relatively low score in Input Competitiveness compared to Bogota and to the whole sample of regions (ranked 19) but relatively high in Results Competitiveness (6). Likewise, Cundinamarca is ranked 4 in the Results Competitiveness Index, but only 29 in the Input Competitiveness Index.

Table 11: Colombia. Rankings for Input and Results Competitiveness 2017

Region	Ranking Inputs	Input Competitiveness Score 2017	Ranking Results	Results Competitiveness Score 2017
Bogota	1	0.59	3	0.55
Atlántico	18	0.45	24	0.44
Santander	19	0.45	6	0.52
Antioquia	21	0.43	10	0.48
Risaralda	26	0.43	17	0.47
Valle	28	0.42	14	0.48
Cundinamarca	29	0.42	4	0.52
Caldas	36	0.40	31	0.42
Quindío	39	0.40	25	0.44
Magdalena	41	0.40	39	0.39
Boyacá	43	0.39	11	0.48
Cesar	49	0.39	35	0.41
Bolivar	50	0.38	29	0.42
Norte Santander	51	0.38	38	0.40
Huila	54	0.38	40	0.39
Sucre	55	0.37	37	0.40
Tolima	56	0.37	20	0.46
Meta	57	0.37	21	0.45
Cordoba	61	0.35	51	0.36
Nariño	65	0.34	15	0.47
Cauca	66	0.33	23	0.44
Caquetá	68	0.33	47	0.37
La Guajira	69	0.30	33	0.41
Choco	71	0.27	60	0.28

Graph 40. Colombia. Results Competitiveness Index 2017 Vs Input Competitiveness Index 2017

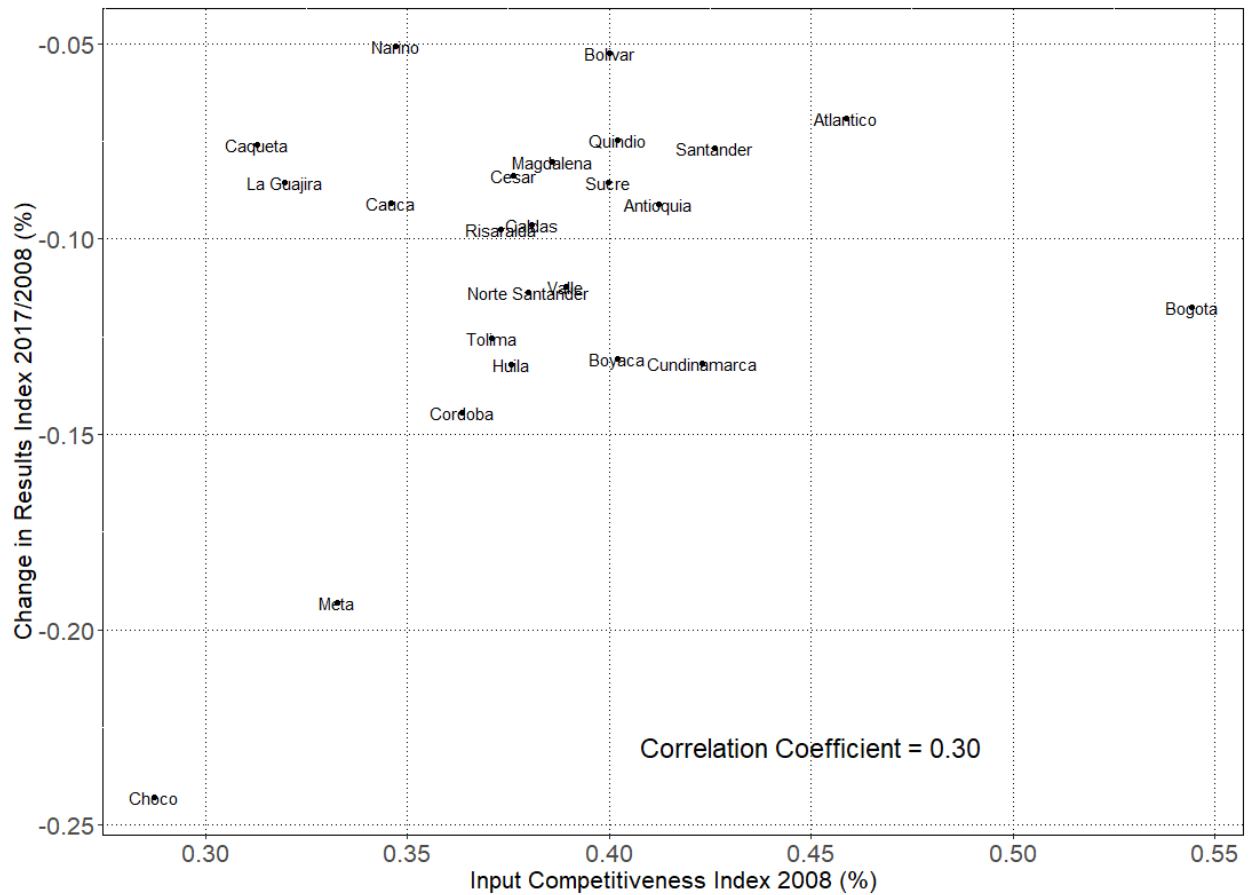


Graph 41 shows the variation in Results Competitiveness Index between 2008 and 2017 and the Input Competitiveness Index in 2008. The correlation coefficient between the two variables is 0.30, suggesting a positive relation between the initial levels of Input Competitiveness and the variation of results competitiveness in Colombia in the studied period. The case of Bogota is atypical since it had the highest level of Input Competitiveness Index in 2008, but progress in the index was relatively lower compared to the other regions of Colombia between 2008 and 2017.

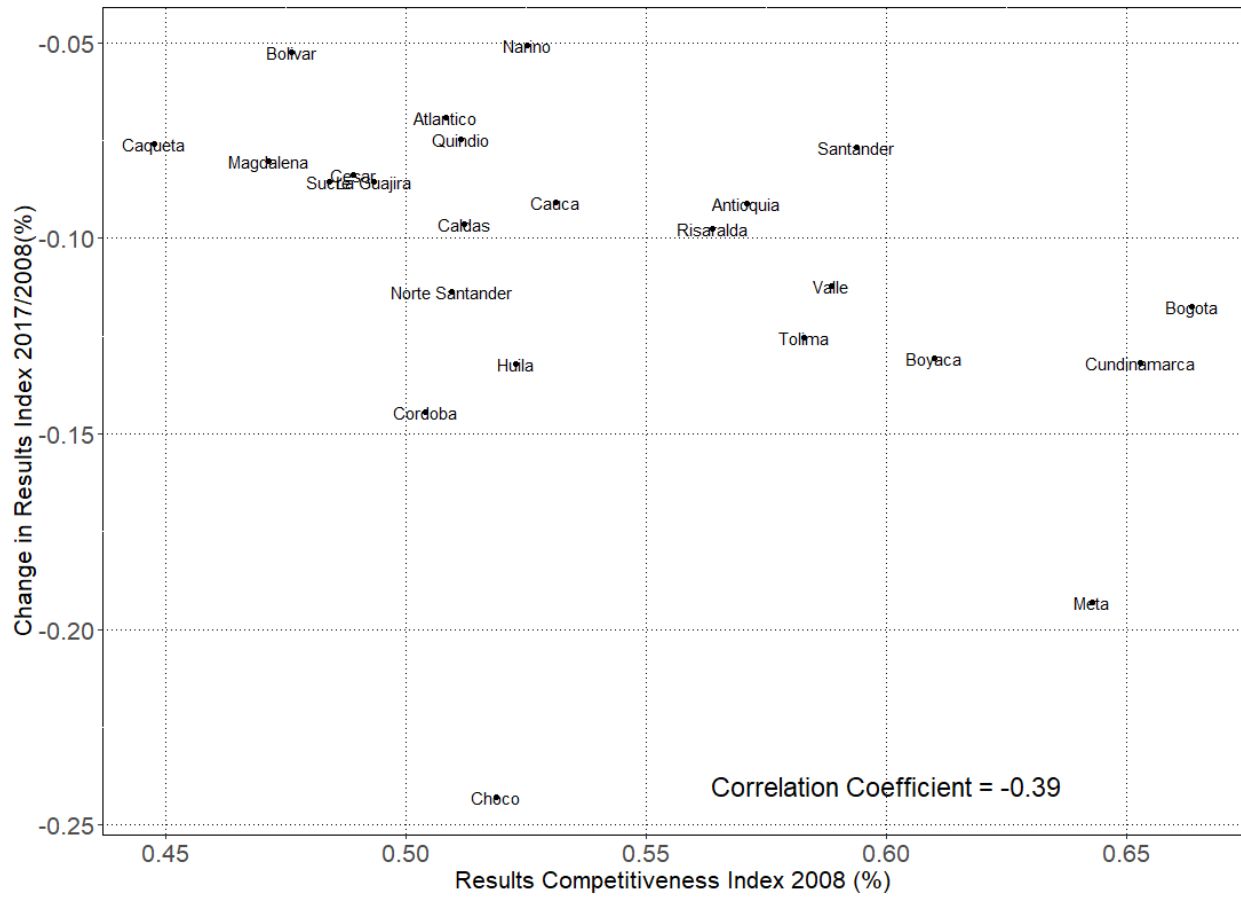
Graph 42 shows the Changes in Results Competitiveness Index between 2008 and 2017 and the Results Competitiveness Index 2008. The correlation coefficient between these two variables is -0.39, which suggests a convergence trend for Regional Results Competitiveness Index between 2008 and 2017 in Colombia. Regions with lower levels of the Results Competitiveness Index in

2008, such as Bolivar, Caquetá and Magdalena showed a higher variation in the Results Competitiveness Index between 2008 and 2017.

Graph 41. Colombia. Changes in Results Competitiveness Index 2017/2008 Vs Input Competitiveness Index 2008



Graph 42. Colombia. Changes in Results Competitiveness Index 2017/2008 Vs Results Competitiveness Index 2008



4.5.3 Mexico: Ranking Results and Regional Trends

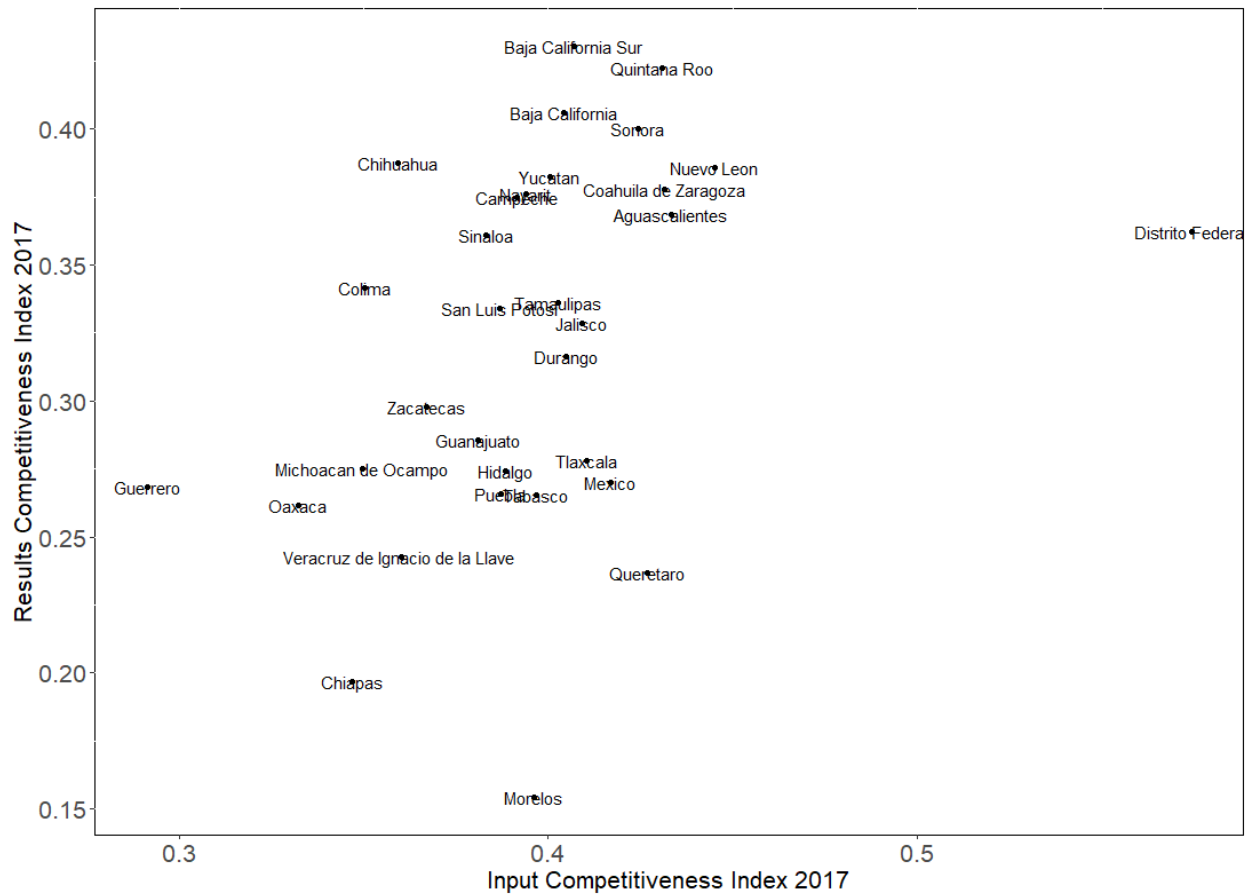
Table 12 presents ranking results and scores for Input Competitiveness and Results Competitiveness Index in 2017 for 33 Mexican regions. The highest-ranking region in Mexico according to the Input Competitiveness Index is Distrito Federal, followed by Nuevo Leon and Aguascalientes. In the case of Mexican regions, none of them show relatively high values when it comes to Results Competitiveness. The highest ranked region is Baja California Sur at rank 27 for the Results Competitiveness Index.

Graph 43 shows scores for Input and Result Competitiveness in 2017. The case of Distrito Federal is atypical to the rest of the regions, since it shows a much lower value for Results Competitiveness Index given its high score for Input Competitiveness.

Table 12: Mexico Rankings for Input and Results Competitiveness 2017

Region	Ranking Inputs	Input Competitiveness Score 2017	Ranking Results	Results Competitiveness Score 2017
Distrito Federal	2	0.57	49	0.36
Nuevo Leon	20	0.45	42	0.39
Aguascalientes	22	0.43	48	0.37
Coahuila de Zaragoza	23	0.43	44	0.38
Quintana Roo	24	0.43	30	0.42
Queretaro	25	0.43	69	0.24
Sonora	27	0.42	36	0.40
Mexico	30	0.42	63	0.27
Tlaxcala	31	0.41	59	0.28
Jalisco	32	0.41	55	0.33
Baja California Sur	33	0.41	27	0.43
Durango	34	0.40	56	0.32
Baja California	35	0.40	34	0.41
Tamaulipas	37	0.40	53	0.34
Yucatan	38	0.40	43	0.38
Tabasco	40	0.40	66	0.27
Morelos	42	0.40	71	0.15
Nayarit	44	0.39	45	0.38
Campeche	45	0.39	46	0.37
Hidalgo	46	0.39	62	0.27
Puebla	47	0.39	65	0.27
San Luis Potosi	48	0.39	54	0.33
Sinaloa	52	0.38	50	0.36
Guanajuato	53	0.38	58	0.29
Zacatecas	58	0.37	57	0.30
Veracruz de Ignacio de la Llave	59	0.36	68	0.24
Chihuahua	60	0.36	41	0.39
Colima	62	0.35	52	0.34
Michoacán de Ocampo	63	0.35	61	0.27
Chiapas	64	0.35	70	0.20
Oaxaca	67	0.33	67	0.26
Guerrero	70	0.29	64	0.27

Graph 43. Mexico. Results Competitiveness Index 2017 Vs Input Competitiveness Index 2017

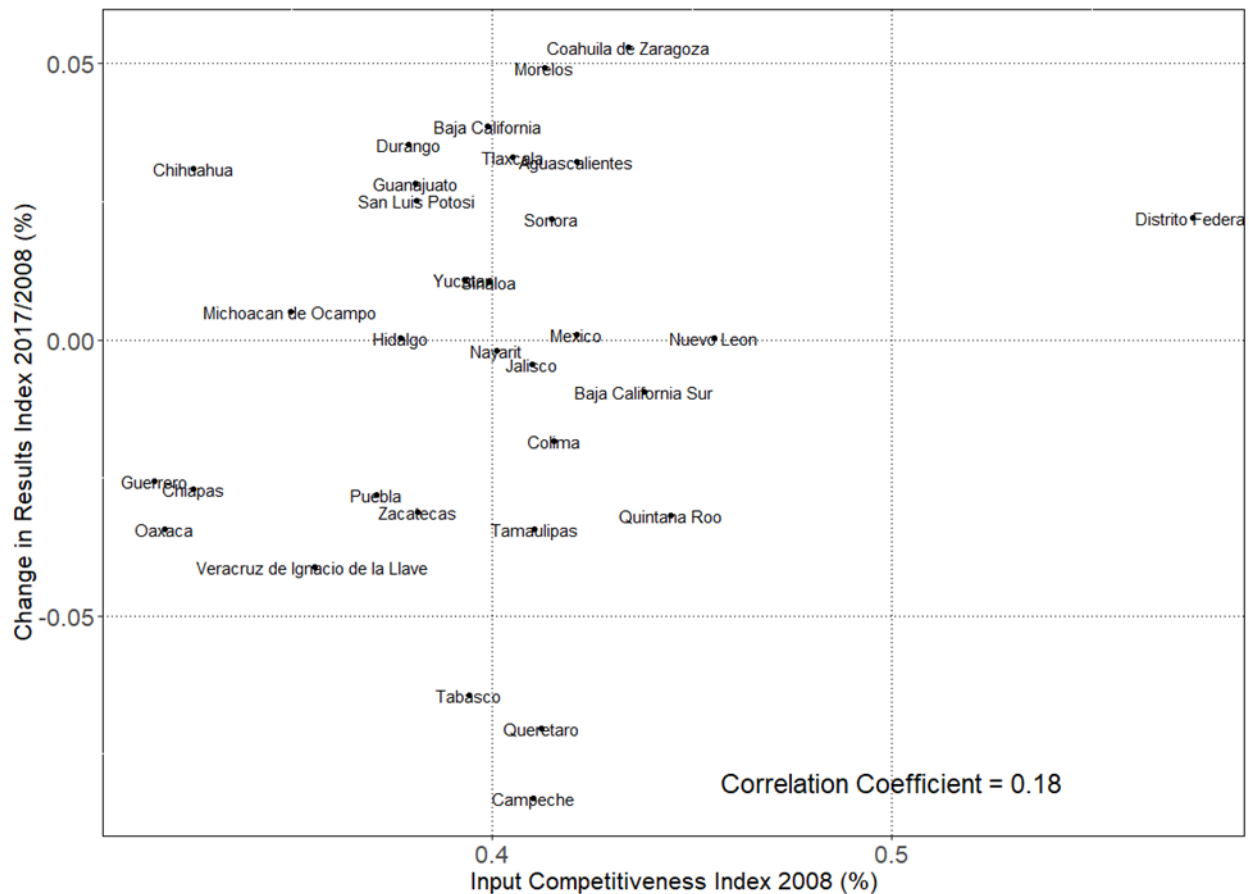


Graph 44 shows the variation in Results Competitiveness Index between 2008 and 2017 and the Input Competitiveness Index in 2008. The correlation coefficient between the two variables is 0.18, which suggests a positive relation between the variables, despite being a relatively low value.

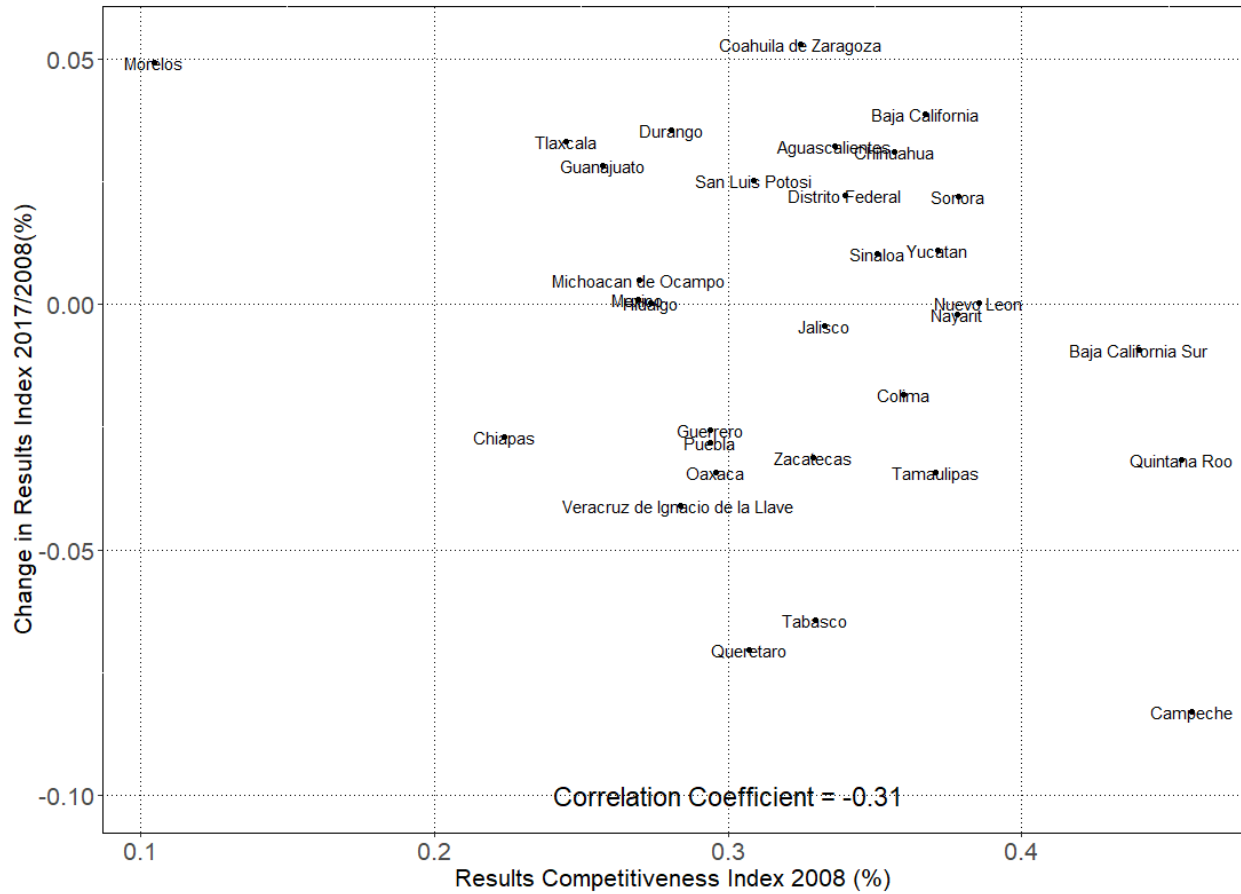
Graphically, there is a positive trend between the initial levels of Input Competitiveness and the variation of results competitiveness in Colombia in the studied period. The exception to this rule is Distrito Federal, which is an outlier value and does not follow this trend. Distrito Federal had the highest level of Input Competitiveness Index in 2008 but did not have the higher growth of the index between 2008 and 2017.

Graph 45 shows the Changes in Results Competitiveness Index between 2008 and 2017 and the Results Competitiveness Index 2008. The correlation coefficient between these two variables is -0.31, which suggests a convergence trend for Regional Results Competitiveness Index between 2008 and 2017 in Mexico. Regions with lower levels of the Results Competitiveness Index in 2008, such Tlaxcala, Guanajuato and Durango showed a higher variation in the Results Competitiveness Index between 2008 and 2017. An extreme case is Morelos, which had the lowest level of the Results Competitiveness Index in 2008, but the second highest increase of this index between 2008 and 2017.

Graph 44. Mexico. Changes in Results Competitiveness Index 2017/2008 Vs Input Competitiveness Index 2008



Graph 45. Mexico Changes in Results Competitiveness Index 2017/2008 Vs Results Competitiveness Index 2008



5. Conclusions

To comply with the objectives of this research, the conclusions are presented below following the research questions raised in section 1.3. Additionally, questions and issues for future research are presented at the end of this conclusions section.

5.1. Research questions

5.1.1 Question 1. What is the definition a competitive region? What specific characteristics does a competitive region have? Are there competitive regions in Latin America? Are there common elements among competitive regions in Latin America?

Regional competitiveness definition and characteristics

Regional competitiveness is *“the ability of a region to sustainable deliver economic, social, and environmental goals to its citizens and workers”*. Competitive regions will offer an “environment” that boosts company productivity.

Furthermore, a competitive region needs to offer attractive conditions for both companies and residents; the region needs to be attractive so that workers will live in that region. The attractive regions will be those that offer higher welfare for its population and workers, and this implies high levels of economic, social, and environmental outcomes. Additionally, having the competitiveness capabilities and achieving the competitive results are necessary to be truly competitive. Likewise, sustainability is a condition to achieve competitiveness because it will allow sustained high performance for the companies.

Following the definition, regional competitiveness may be evaluated by measuring “Input factors” and “Results components”. Inputs factors allow for an attractive and sustainable environment for firms and residents and constitute a “potential capacity” of yielding a competitive outcome.

There are two types of inputs. The first type of input factors corresponds to the ones that lead to “low road” competitiveness: cost and efficiency. The second type of inputs factors are complex

and lead to “high road” competitiveness: regional infrastructure, economic structure, innovation, education, health, social system, and institutions.

On the other hand, results competitiveness components are actual levels performance and wellbeing that the region achieves. Following a comprehensive definition of wellbeing, the result encompasses the economic, social, and environmental performance of the region.

In summary, regions that are competitive under the definition of this thesis, are those that have high scores of both Input and Results Competitiveness, by having both the capacity (inputs) to generate well-being through productivity as well as actually achieving a positive outcome for residents and workers of the region, in terms of economic, social, and environmental aspects (results).

Competitive Regions in Latin America

Examples of competitive regions in Latin America are Bogotá (Colombia), Metropolitana (Chile), Antofagasta (Chile), Tarapacá (Chile), and Valparaíso (Chile). All of these regions have top level scores for both Input and Results Competitiveness in 2017. There are no regions from Mexico that fall under this category, since the top ranked region DF, does not possess high scores for the Results Competitiveness index, and thus, cannot be considered competitive under the definition adopted in this thesis.

Chilean regions present higher levels, in general, for Input and Results Competitiveness compared to Colombia and Mexico, since there are no regions from Chile falling in the lower rankings of competitiveness. Thus, the general situation of regions in Chile seems to follow the requirements to be considered competitive regions under the definition of regional competitiveness, since both Input Competitiveness and Results Competitiveness scores are high.

The top Input Competitiveness index scores in Latin America are found in regions that allocate each country’s capital: Bogotá in Colombia, DF in Mexico, and Metropolitana in Chile. The remaining top-ranking regions for the Input Competitiveness Index correspond mainly to regions from Chile.

On the other hand, regions with top Results Competitiveness index scores are Bogotá, Aysén and Magallanes, these regions show higher levels of social, economic, and environmental indicators in 2107. Results competitiveness rankings are mixed among regions from Chile and Colombia, and regions from Mexico show, in general, lower scores of the Results Competitiveness Index.

Many regions in Colombia fall under the lowest ranking scores of competitiveness, and this situation is much more severe for the Input Competitiveness index than for the Results Competitiveness index. This situation suggests that regions in Colombia seem to have good results or outcome, despite not having the highest competitiveness capabilities, which could be a result of high competitiveness performance in the past, before the studied period.

These results are similar to the general trends observed by Rodríguez and Vial (2020) in the Regional Development Index for Latin America (IDERE LATAM), where they identify urban and capital cities as the ones with the highest development index, and Chile having higher levels of regional development, in general, compared to other countries, including Colombia.

Regions in Mexico also fall under the lowest rankings of competitiveness, but this is much more severe for the Results Competitiveness Index than the Input Competitiveness Index. Hence, regions in Mexico seem to have the capabilities and potential to reach a high competitiveness performance but are not able to achieve those results yet.

In the case of Chile, since the lowest competitiveness category is not present in 2017, the gap of competitiveness between the highest and lowest ranking regions is lower than the one in Colombia and Mexico. Thus, regional competitiveness inequalities, measured through the Input and Results Competitiveness rankings are lower in Chile.

5.1.2. Question 2. What enhances regional economic performance, social wellbeing, and environmental sustainability? How do you measure these aspects?

The advance in competitiveness of regions is measured through the variation between 2008 and 2017 of the Results Competitiveness Index, which allows to summarize the economic performance, social wellbeing, and environmental sustainability components of a region.

The following general aspects were identified by observing key characteristics in the variation of the Results Competitiveness Index between 2008 and 2017.

Initial levels of Input Competitiveness

Regions with higher initial levels of Inputs Competitiveness Index yielded higher progress in the Competitiveness Results Index. Econometric results indicate that the 2008 level of Input Competitiveness Index of a region was significant on the increase the Results Competitiveness Index of regions between 2008 and 2017. This evidence is important since regions that initially had higher levels of Input Competitiveness in 2008 yielded higher progress in economic, social, and environmental outputs, and therefore, higher progress in the welfare of its population.

Regions that hold Capital Cities

When analyzing regional patterns in countries, the three regions that hold capitals for these countries, present atypical behavior both in levels of competitiveness and in their dynamics between 2008 and 2017. Regions that hold a capital city had significant lower variation of the Results Competitiveness Index between 2008 and 2017. In the case of Input Competitiveness, these three regions presented very high levels of the Input Competitiveness Index in 2008, but the progress in this indicator was relatively lower compared to the other regions in their respective countries.

The negative effect of regions that hold capital cities on Results Competitiveness Index variation may be linked to law of diminishing returns pattern since these regions already have high levels of Results Competitiveness Index, high density, market size and high levels of concentration of population and production. This result is consistent with the fact that the three regions that contain the national capitals from each country have unusually high levels of competitiveness compared to other regions in their respective countries. However, the verification of this theory will require further specific research and study.

Moreover, the fact that *Bogotá* and *Distrito Federal* show unusually high levels for both Input and Results Competitiveness, relative to the other regions in their respective countries, may be an indication that they may be competing in a different way than other regions from those countries.

Following this logic, regions that hold capitals, should be considered atypical cases within their countries, and do not represent the overall reality of the bulk of other regions, especially in the case of Colombia and Mexico.

In this sense, cross-country comparison would make most sense when comparing highly competitive regions, like Distrito Federal (Mexico), Bogotá (Colombia) and Metropolitana (Chile), which compete for capital, skilled workers, and foreign investment.

Country Effects

On the other hand, medium and low competitiveness regions cluster around national averages, and this is an indication that these regions may not be competing in the same way high competitiveness regions do. For this type of regions, within country comparison of regional competitiveness would be adequate to identify competitive boosting factors.

All of the described general trends for Input and Results competitiveness suggest that there are country effects taking place and that competitiveness may be heavily influenced by country factors. These results are consistent with the literature review which gives the environment or “milieu” a critical weight on the success or stagnation of a region (Esser *et al*, 1996; Porter, 1998; Camagni, 2003; Bochma, 2010 ; Polesse, 2020).

Convergence in Results Competitiveness

Regarding variation of competitiveness between 2008 and 2017, research results suggest a converge trend in regional Results Competitiveness, since the coefficient of variation decreased between 2008 and 2017 for the whole sample. The economic and environmental components are the ones that explain most of the reduction in dispersion between 2008 and 2017.

The econometric results also suggest a regional convergence trend of the Results Competitiveness Index in the 2008-2017 period, since regions with lower initial levels of Results Competitiveness Index grew more compared to regions with higher levels, allowing them to catch up in their levels of results competitiveness. This situation may be linked to a law of diminishing returns pattern in

those regions that already have high levels of Results Competitiveness Index, and that already have high density, size and concentration of population and production. However, confirmation of this theory requires further specific research and study.

5.2.3. Question 3. Which factors promote regional competitiveness? Are these factors external or endogenous to the region? Do competitiveness boosting factors vary between regions?

Endogenous factors

Factors related to Regional Infrastructure, Innovation and Education, and Institutions present higher variability which would explain most of the regional differences of Input Competitiveness.

The Input Competitiveness factor that has the most significance over results competitiveness variations is “health and social system”. The “health and social system” factor is measured through life expectancy at birth, infant mortality rate and elderly dependency ratio.

Export Intensive Regions are highly competitive regions. Examples of these types of regions are Antofagasta (Chile) and Atacama (Chile) which are specialized in the mining export sector. These regions possess high levels of indicators for both Input and Results Competitiveness.

External Factors

External factors can increase levels of Results Competitiveness index in some regions. Aysén (Chile), Cundinamarca (Colombia), and Magallanes (Chile) are regions that hold high levels of Results Competitiveness, despite having low levels of Input Competitiveness. These regions are not considered competitive under the definition adopted by this research, and the research results suggest that they do not have the potential to gain higher levels of Results Competitiveness or sustain the current levels without the support of external factors, such as central government support in the case of Aysén and Magallanes or positive externalities from the capital city in the case of Cundinamarca.

5.2.4. Question 4. Innovation and technology are known to be critical factors in promoting regional competitiveness; does this also apply to regional competitiveness in Latin America?

What type of innovation factors have been successful?

Competitive regions, that is, regions that have high levels of both Input and Results competitiveness, possess high levels of indicators of Innovation and Education factors in 2017. Regarding Input competitiveness, the efficiency factor is below average for all the selected regions from Chile and just above average for Bogota in 2017, this suggests that highly competitive regions bases do not base their competitiveness in “low road” competitiveness inputs, but rather in “high road” competitiveness inputs such as innovation, education, or economic structure.

Econometric results indicate that other Input Competitiveness factors besides, “health and social system” did not increase Results Competitiveness Index significantly between 2008 and 2017. However, the econometric results also show that Input Competitiveness Index as a whole increased Results Competitiveness significantly, and the model with the most explanatory power is the one that groups Input Competitiveness factors on an Index. This outcome suggests that boosting competitiveness succeeds when it is as a systematic effort in all input competitiveness factors, and not in individual aspects or factors. In other words, improving Results Competitiveness may require improving in all factors related to Input Competitiveness, including innovation and technology.

Policy implications regarding this issue are important, since systematically promoting competitiveness capabilities in less advantaged regions would be crucial to achieve economic, social, and environmental gains in those regions, thus increasing population well-being.

5.2. Questions for future research

Cross-country comparable regional indicators help understand regional performance. Improving the standardization of regional data for Latin American regions and increasing the availability of indicators at the regional level is necessary, especially of those related to environmental and institutional factors, which are not available at the regional level.

Increasing the geographical coverage using these indicators may help understand if these results can be extrapolated to other countries in Latin America. Research to increase the coverage of the analysis would consist in the construction competitiveness indexes for regions from other countries in the same 2008-2017 period.

To support the observed links between input and results competitiveness, studying variations in a longer period of time would allow for further evidence to prove if the competitiveness dynamics of regions hold within time. Research for this purpose would consist in the construction competitiveness indexes in a period that goes beyond 2008 - 2017.

The influence that country effects have over results competitiveness are consistent with Esser *et al* (1996) and Polesse (2020) who state that for regions and cities to success there needs to be a functional national state, which comprehends set of values, general culture, norms, and institutions. Further research is needed to identify specific country factors that may have a greater influence than others.

In summary, further analysis of competitiveness boosting factors including regions from additional Latin American countries and in a longer period of time will increase the robustness of the conclusions and increase understanding of country effects, competitiveness capabilities, and the general characteristics of competitive regions in Latin America.

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Anexo 1. Síntesis en Español

La Competitividad Regional en América Latina: Un Estudio Comparativo de los Factores Clave para el Desempeño Regional

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1.1. Introducción

El lugar donde se establecen las empresas influye en su nivel de productividad; las empresas buscarán instalarse en aquellas regiones que les ofrezcan una ventaja competitiva. Por otra parte, las regiones competirán por la atracción de inversiones extranjeras, ofreciendo beneficios para que las empresas se instalen y hagan negocios en su territorio, generando actividad económica, empleo y riqueza. Estas interacciones y formas de competencia ocurren entre regiones de un país y también internacionalmente, por lo tanto, comparar el desempeño económico regional entre países es fundamental para comprender el éxito de algunas regiones y el estancamiento de otras.

En efecto, empresas y clústers, compiten en los mercados internacionales, con empresas y clústers de otros países. Por ejemplo, las uvas de mesa producidas en el Valle de Copiapó de la región de Atacama en Chile compiten en el mercado de Estados Unidos con las uvas de mesa producidas en el Valle de Ica del Perú. Esto ocurre porque en Chile, la producción y cosecha de uva de mesa del Valle de Copiapó se superpone con la producción y cosecha de Perú y no con la producción de otras regiones de Chile. De esta forma, al evaluar la competitividad de la industria de uva de mesa de la región de Atacama, tendría mucho más sentido comparar el desempeño con sus competidores en Ica, Perú, y no con la industria de uva de mesa de otras regiones de Chile que no compiten con Atacama en los mercados de destino de sus exportaciones.

La competencia internacional entre regiones en América Latina también surge por la atracción de inversiones extranjeras. A modo de ejemplo, la Región Metropolitana, en Chile, compite con regiones de otros países para atraer inversiones extranjeras de empresas de alta tecnología como los servicios web. En el 2018, la empresa Amazon Web Services (AWS) anunció que instalaría un *datacenter* en América Latina y que estaba considerando varios lugares, incluidas localidades en Chile y Argentina. Este centro constituiría una inversión millonaria que permitiría administrar datos y ofrecer servicios para empresas. Sin embargo, AWS no estaba evaluando una ubicación aleatoria en Chile y Argentina; sino que estaba evaluando regiones específicas, que contaran con la infraestructura de telecomunicaciones, la conectividad y la dotación de trabajadores calificados que necesitaba. Además, las autoridades nacionales tanto de Chile como Argentina tenían interés en la llegada de AWS y ofrecieron distintos beneficios para su instalación. AWS aún sigue evaluando alternativas para su instalación.

De manera similar, Huawei instaló en agosto de 2019 un *datacenter* en la Región Metropolitana en Chile después de evaluar diferentes ubicaciones en América Latina. Según el CEO de Huawei en Chile, David Dou Yong, eligieron Chile por su estabilidad política, libertad económica, sistema legal sólido y porque el gobierno de Chile manifestó la intención de convertir al país en un *hub* digital

Los dos tipos de competencia descritos anteriormente se manifiestan entre países; no se limitan a la competencia dentro del país. Por lo tanto, para comprender mejor la competitividad regional se requiere incorporar un enfoque internacional que permita comparar el desempeño económico de las regiones entre países.

En Europa, existen estudios que comparan la competitividad regional como el Índice de Competitividad Regional (RCI) desarrollado por la Comisión Europea que permite identificar características comunes entre regiones competitivas de diferentes países. En América Latina, existen varios rankings de competitividad regional (Argentina, México, Chile, Colombia y Perú) pero no existen estudios que comparen la competitividad regional entre países. Adicionalmente, el conjunto de factores que promueven la competitividad regional en América Latina no está del todo claro y aún existe un debate sobre qué características específicas son las más importantes para impulsar la competitividad regional.

En esta tesis se elabora un modelo que permite comparar la competitividad regional entre tres países latinoamericanos: Chile, Colombia y México. Los resultados muestran que factores institucionales, infraestructura regional, innovación y los niveles de educación juegan un rol clave en la capacidad competitiva de las regiones de estos países. Este resultado cobra mayor relevancia por el hecho de que aquellas regiones con mayor capacidad competitiva también presentan mejor desempeño en aspectos sociales, económicos y ambientales y, por lo tanto, juegan un rol clave en el bienestar de la población que habita en ellas.

1.2. Preguntas de Investigación

1. ¿Cuál es la definición de región competitiva? ¿Qué características específicas tiene una región competitiva? ¿Hay regiones competitivas en América Latina? ¿Hay elementos comunes entre las regiones competitivas de América Latina?
2. ¿Qué mejora el desempeño económico regional, el bienestar social y la sostenibilidad medioambiental? ¿Cómo se miden estos aspectos?
3. ¿Qué factores promueven la competitividad regional? ¿Estos factores son elementos endógenos ó externos a la región? ¿Varían los factores que impulsan la competitividad de una región a otra?
4. Se sabe que la innovación y la tecnología son factores clave en la promoción de la competitividad regional; ¿se aplica esto también a la competitividad regional en América Latina? ¿Qué tipo de factores de innovación han tenido éxito?

1.4. Hipótesis

1. Hay regiones competitivas en América Latina, que tienen un elevado desempeño económico, social y ambiental. Estas regiones poseen capital humano calificado, infraestructura de comunicación y tecnología, tienen una alta capacidad de innovación por parte de las empresas en diversos puntos de la cadena de producción y alojan redes o clústers de empresas de alta tecnología.
2. La comparabilidad entre países es fundamental para comprender el éxito de algunas regiones y el estancamiento de otras. Por lo tanto, para entender la competitividad regional se requiere adoptar

un enfoque de comparabilidad internacional que contraste el desempeño de las regiones entre países.

1.5. Objetivos de Investigación

El principal objetivo de investigación de esta tesis es identificar los factores que promueven la competitividad regional en los países de América Latina (México, Chile, Colombia) en el período 2008 – 2017.

Objetivos específicos:

1. Elaborar una metodología para medir la competitividad regional y sus componentes centrales.
2. Identificar regiones competitivas utilizando una definición sólida y un conjunto comparable de indicadores de competitividad regional para el período 2008 - 2017.
3. Identificar los principales factores de éxito de las regiones competitivas dentro de un marco de aplicación determinado.
4. Establecer una tipología de factores promotores de la competitividad regional que se base en elementos comunes y definir ámbitos de aplicación.
5. Identificar recomendaciones de política que mejorarían el desempeño económico en las regiones menos competitivas.

2. Competitividad Regional: Conceptos y Aplicaciones en América Latina

2.1. *¿Qué es la competitividad? Marco conceptual de competitividad*

Competitividad es un término ampliamente utilizado, tanto en la investigación formal como informal por académicos, políticos y la prensa, entre otros. Los investigadores del tema señalan que coexisten diferentes definiciones e interpretaciones del concepto, por lo que no existe una definición e interpretación única de la competitividad a la fecha (Borozan and Strossmayer, 2008; Aiginger and Firgo, 2017; Ketels, 2016; Huggins and Thompson, 2017; Annoni y Dijkstra, 2017).

Michael Porter abordó formalmente la definición de competitividad en la década de 1980 para explicar el desempeño económico de las empresas basándose en los conceptos de ventajas absolutas y comparativas. Porter (1985, 1990) introdujo el concepto de ventaja competitiva, que es un tipo de ventaja que se crea y se sostiene localmente y que permite a un país tener el liderazgo en ciertas industrias donde el entorno, las instituciones y la competencia les son favorables.

Krugman (1994) cuestiona la existencia y el uso del concepto de competitividad a nivel de países, ya que sería mucho más complejo que la competitividad de las empresas. Argumenta que los países no compiten de la misma manera que las empresas, ya que sus objetivos y la naturaleza misma de la competencia son diferentes. Krugman señala de que las empresas que no son competitivas no son sostenibles y eventualmente desaparecen, pero los países que tienen un desempeño económico pobre desaparecen. Además, Krugman establece que el éxito de un país no es un juego de suma cero; el éxito de un país no es a expensas de otro país, a diferencia de lo que sucede con las empresas, que compiten por cuotas de mercado. Cuando una empresa aumenta su cuota de mercado, lo hace a expensas de otra empresa.

A pesar de las diferencias en el enfoque de la competitividad, Porter (1990;2003) y Krugman (1994) coinciden en que la productividad define la capacidad de una nación para generar bienestar para sus ciudadanos. Además, la capacidad de exportación no es un requisito *per se* para lograr altos niveles de vida. Krugman establece que, en general, los niveles de vida de un país se relacionan con la productividad interna y no con la competencia internacional. Son la

productividad y los factores internos, y no el comercio internacional, los que influyen en el nivel de los salarios y el nivel de vida de un país.

En un país con bajos niveles de comercio, como Estados Unidos, la productividad sería el principal factor detrás del aumento del bienestar (Krugman, 1994). Cuando un país se especializa en un sector productivo pero que no tiene comercio internacional, todavía puede considerarse competitivo en el sentido de que tiene la capacidad de permitir un alto nivel de vida para sus ciudadanos.

2.2. Definición de región

A los efectos de la discusión teórica sobre la competitividad regional, esta investigación define la región como una escala geográfica subnacional que tiene una característica social, económica o cultural común. Esta región puede o no coincidir con la división político-administrativa de un país. Sin embargo, para la medición de la competitividad regional, las regiones se limitan a las divisiones político-administrativas, ya que la gran mayoría de los datos cuantitativos y estadísticas disponibles corresponden a dicha división.

Esta distinción se refleja para comprender las limitaciones de los datos y para la correcta interpretación de los resultados derivados de las mediciones de la competitividad regional.

2.3. El concepto de competitividad regional

Porter (2003) reconoce que gran parte de la investigación sobre competitividad se ha centrado en la escala nacional, sin reconocer las diferencias internas entre regiones. Sugiere que los principales componentes que promueven el desempeño económico son los componentes regionales, como los insumos especializados, la infraestructura, la educación de la fuerza laboral, las instituciones que fomentarán la aglomeración de empresas en forma de clústers. La existencia de clústers define la forma en que las empresas interactúan y compiten, el tipo y la velocidad de la innovación y los incentivos para la creación de empresas.

Storper (1997) define la competitividad regional como la capacidad de una región para atraer y mantener empresas con cuotas de mercado estables o en aumento en una actividad, manteniendo o aumentando al mismo tiempo los estándares de vida de la población. Aiginger (2006) define la competitividad como "la capacidad de un país o lugar para crear bienestar".

Camagni (2002) indica que cuando se enfrenta el proceso de globalización, las regiones, ciudades y territorios compiten por los bienes, la inversión y la atracción de trabajadores. Además, las regiones y los países permiten a las empresas competir en los mercados locales, nacionales o internacionales (Huggins y Thompson, 2017). Así, la competencia existe y "algunos lugares son más competitivos que otros" (Malecki, 2017).

Además, Camagni (2002, 2005) distingue la competitividad nacional de la competitividad regional utilizando teorías del comercio internacional. Una de las principales diferencias surge de la existencia en los países (o inexistencia en el caso de las regiones) de fronteras y barreras que impiden la circulación de factores productivos y ajustes financieros. Cuando un país pierde una ventaja absoluta puede reducir salarios, precios y devaluar su moneda. Estas opciones no existen a nivel de región, ya que no hay fronteras ni barreras que permitan realizar este tipo de ajustes. A consecuencia de esto, en las regiones, los ajustes por medio de la migración se producen más rápido que los ajustes financieros.

Camagni concluye que las regiones pueden tener ventajas absolutas (basadas en su nivel de productividad) pero no pueden tener ventajas comparativas debido a la falta de barreras que tienen

los países. Esta distinción es relevante no sólo porque diferencia la competitividad nacional y regional, sino también porque la productividad tendrá un papel protagónico en el logro de la competitividad regional.

Borozan y Strossmayer (2008) sitúan el concepto de competitividad regional entre la competitividad microeconómica y macroeconómica. La competitividad microeconómica se refiere a la capacidad de una empresa para competir en un mercado con éxito. La competitividad macroeconómica se refiere a la competitividad de los países y está relacionada con la idea de que el entorno que permite a las empresas competir con éxito.

El concepto de competitividad regional no es la agregación de la competitividad microeconómica ni de la productividad de las empresas dentro de la región (Borozan y Strossmayer, 2008). Esta visión no tiene en cuenta los factores fuera de la región, que no son controlables, así como las externalidades (spillovers), las redes y clústers.

La competitividad de las empresas y la competitividad regional se relacionan entre sí en una forma no lineal. El éxito de la empresa no siempre se traduce en éxito regional ó nacional; la forma en que se conectan es compleja (Huggins *et al*, 2014).

Boschma (2010) señala similitudes entre la competitividad de las empresas y la competitividad regional. En primer lugar, a pesar de que las regiones no compiten por la cuota de mercado como lo hacen las empresas, las regiones que crecen económicamente más rápido obtendrán una mayor participación de la economía nacional a expensas de las regiones de crecimiento más lento. En segundo lugar, las regiones que se especializan en sectores similares competirán en la atracción de talento laboral e inversiones. Por otro lado, una distinción básica es que las empresas entran o salen del mercado a medida que tienen éxito o quiebran, mientras que las regiones no cierran ni desaparecen. Las empresas también compiten para atraer talento laboral, pero la naturaleza de los objetivos regionales es mucho más compleja que los objetivos que tienen las empresas.

Las definiciones modernas de competitividad del Foro Económico Mundial y el Centro mundial de competitividad de IMD distinguen implícitamente la competitividad de las empresas de la

competitividad de los países al reconocer un vínculo entre el desempeño de las empresas y la capacidad de un país para producir bienestar para su población.

Según Ibarra-Armenta y Trejo-Nieto (2014), las regiones competitivas tienen niveles elevados y sostenidos de crecimiento económico, junto con altos estándares de bienestar. Además, las regiones competitivas pueden atraer inversiones productivas en un contexto de apertura económica y globalización, lo que les permite alcanzar altos niveles de productividad.

Borozan, D. y Strossmayer (2008) y Aiginger y Vogel (2015) distinguen entre la competitividad de los inputs (costos, productividad, estructura económica y capacidades) y la competitividad de los resultados (bienestar). Malecki (2004), Aiginger y Vogel (2015), y Aiginger y Firgo (2017) consideran una versión estrecha (de bajo nivel) y ilustrada (de alto nivel) de la competitividad de costos. La versión estrecha de la competitividad se basa únicamente en la reducción de costos, como impuestos, salarios, costos de energía, mano de obra o materias primas. La versión ilustrada de la competitividad incorpora la productividad además del costo; si los costos son más altos, una economía todavía puede ser competitiva aumentando la productividad.

Ketels (2016) distingue las definiciones de competitividad por las que se centran en los costos y las que se centran en la productividad. La competitividad de los costos depende de los costos unitarios de producción en un lugar específico; los bajos costos unitarios de producción permiten a las empresas ser competitivas en los mercados globales. Por el contrario, la competitividad de la productividad se basa en la capacidad de un lugar para agregar valor basado en factores de producción.

CSobre las visiones contemporáneas de la competitividad regional ponen de relieve la importancia de aumentar la productividad, pero no a expensas de la calidad de vida de la población. Por ejemplo, un aumento de la productividad mediante la reducción de los salarios no aumentará la calidad de vida de las personas. Aunque puede generar una balanza comercial positiva, no sería sostenible a largo plazo (Huggins y Thompson, 2017). Michael Peneder (2017) define la competitividad como la "capacidad de un sistema económico para desarrollarse" de acuerdo con los objetivos de la sociedad, de manera sostenible y permitiendo el aumento a largo plazo de los niveles de vida. Malecki (2017) señala que el concepto de competitividad regional tiene valor

cuando se centra en las bases y la dinámica del bienestar a largo plazo y no en puntos de vista restrictivos que solo se centran en la cuota de mercado o la competencia de recursos.

2.4. Factores Impulsores de la Competitividad Regional

El avance del libre comercio, la globalización y contar servicios de transporte y comunicación rápidos y eficientes nos llevarían a creer que la ubicación es menos importante. Por el contrario, el lugar de establecimiento de las empresas sigue siendo una variable muy relevante. Las ventajas competitivas se derivan de factores locales, como el conocimiento, la cooperación, la competencia y la concentración (Porter, 1998).

Los estudios las regiones de los países de la OCDE (OCDE, 2009) han identificado los siguientes factores críticos para promover el desempeño regional: capital humano, infraestructura regional, aglomeración de innovación y accesibilidad a los mercados.

A continuación, se describen los principales factores que promueven la competitividad regional.

2.4.1. El Entorno y el “Milieu”

Tanto Porter (1998) como Camagni (2003) reconocen el entorno o *milieu* como un determinante clave de las ventajas competitivas. El contexto regional influirá en el comportamiento y desempeño de las empresas y, en consecuencia, será relevante en la determinación de su competitividad (Bochma, 2010). Las regiones compiten, por lo tanto, en proporcionar la mejor plataforma para alcanzar altos niveles de productividad (Huggins y Thompson, 2017).

Mario Polesse (2020) comparó ciudades dentro de Estados Unidos o en América Latina y afirma que para que las ciudades y las regiones tengan éxito y crezcan, primero tiene que haber un estado nacional funcional, es decir, debe existir un conjunto de valores, normas e instituciones que hagan posible el desarrollo económico. Una ciudad por sí sola, no puede tener éxito en un contexto desfavorable.

Esser *et al* (1996) señalan la creación de un entorno local favorable para lograr la competitividad, junto con un esfuerzo colectivo de empresas, asociaciones, Estado y otras partes interesadas. La

ausencia de un entorno favorable reduce la capacidad de una empresa para lograr competitividad sostenible.

El entorno local está estructurado por factores que surgen de diferentes escalas o niveles, por ejemplo, la política macroeconómica del gobierno federal, así como las instituciones locales, la infraestructura pública local o las redes y clústers.

2.4.2. Innovación y Capital Humano

Uno de los factores de competitividad más relevantes es la capacidad endógena de innovar. Las primeras investigaciones de Porter (1990) destacaron a la productividad y la innovación como factores clave de la competitividad.

La capacidad de innovación debe ser dinámica, en el sentido de que requiere una renovación constante, y proporciona una ventaja relevante para la competitividad en comparación con los aspectos estáticos de la producción, como los costos o las ventajas naturales (Fratesi, 2017). En el estudio del crecimiento económico Aghion *et al* (2021) señalan que la acumulación de innovación es una fuente primaria de crecimiento económico. La innovación impulsará el crecimiento económico por medio de la "destrucción creativa", que impulsará constantemente nuevos productos, servicios y tecnologías y por la llegada de nuevas empresas y firmas.

Cuervo (2017) al revisar la historia de las teorías del desarrollo señala que la competitividad se vinculó inicialmente a la teoría de la empresa en la década de 1970, una época en la que el concepto de competitividad fue muy exitoso que impulsó el uso de las teorías de competitividad de la empresa para explicar el desempeño económico de las naciones y regiones. El desplazamiento de las teorías de la competitividad de las empresas a los países (y regiones) implicó cambiar el enfoque del éxito de la empresa hacia la productividad y el bienestar. Esto condujo posteriormente a la inclusión de nuevos factores como la innovación, el capital humano y la distribución del ingreso, los cuales no estaban relacionados anteriormente con la teoría de la competitividad de la empresa, pero eran comunes en las teorías del desarrollo.

Las externalidades positivas generadas por la creación de conocimiento y su difusión son también factores que contribuyen al éxito de una región (Camagni, 2005). La coordinación, el liderazgo y

las asociaciones público-privadas para la construcción de una visión local representan formas de gobernanza que abren el camino a un modelo de desarrollo de abajo hacia arriba, construido a través de herramientas de planificación participativa.

Malecki (2017) afirma que las redes globales de innovación, que son el pilar fundamental de la competitividad, se instalan en lugares que les son atractivos. La competitividad regional es un proceso dinámico, que cambia y se adapta constantemente a través del proceso de aprendizaje. Este proceso es común en las industrias de alta tecnología, que identifican oportunidades y amenazas a través de procesos de investigación y desarrollo.

En América Latina, la educación, las aptitudes y el capital humano y su relación con la actividad económica se pasaron por alto durante varios decenios, y se centró la atención en la estabilidad macroeconómica y la liberalización del comercio. Hoy en día, el capital humano es un reconocido factor clave que promueve el desempeño económico.

2.4.3. Especialización y Clústers

Un factor clave que promueve el crecimiento económico regional y el rendimiento es la existencia de clústers, que corresponden a agrupaciones geográficas de empresas, proveedores, proveedores de servicios o instituciones de un sector económico que están interconectadas por externalidades de diferentes tipos (Porter 1998; 2003). La existencia de clústers determina la forma en que las empresas interactúan y compiten, el tipo y la velocidad de la innovación y los incentivos para la creación de empresas.

Camagni (2005) indica que la especialización no es un requisito para el desarrollo de clústers. La proximidad es necesaria, pero no suficiente, para que surjan procesos sinérgicos. Debe haber, además de la proximidad, una forma de coordinar esfuerzos hacia un objetivo común, a través de la creación de capital relacional. La cooperación entre empresas tiene que avanzar hacia la acción conjunta y el compromiso con el desarrollo local.

La especialización regional en las industrias de servicios puede ser clave tanto para impulsar el desempeño económico como para atraer trabajadores calificados a la región. La especialización productiva es reconocida como uno de los principales factores que influyen en el crecimiento

económico regional en la Unión Europea (Maroto y Cuadrado-Roura, 2013). Las regiones de la Unión Europea que estaban especializadas en sectores dinámicos, como los servicios, tuvieron un crecimiento económico superior a la media del país y también una mayor productividad entre 1980 y 2008. Una característica adicional es que las regiones dinámicas se concentraron en varias grandes capitales y centros financieros europeos.

Garcilazo *et al* (2013) muestran que los países de la OCDE se han especializado en la industria de servicios, principalmente en servicios financieros y empresariales. Los factores críticos para impulsar la productividad en el sector de servicios son mejorar el capital humano, la densidad y la innovación.

En la Unión Europea, los servicios empresariales intensivos en conocimientos tienden a estar más concentrados regionalmente que otras actividades económicas. La condición de ciudad capital, disponibilidad de recursos humanos altamente calificados en las áreas de ciencia y tecnología, capital tecnológico, proximidad geográfica y accesibilidad son factores que favorecen la ubicación de este tipo de servicios en una región (Delgado-Márquez & García-Veloso, 2013; Cuadrado-Roura, 2013).

En América Latina, Márquez *et al* (2013) encuentran que la especialización juega un papel importante en el crecimiento económico regional. En el caso de Chile y Colombia, los patrones de especialización regional parecen seguir los recursos naturales disponibles en la región, a excepción de las regiones que contienen las capitales, Metropolitana y Bogotá, que muestran un patrón de especialización industrializada. En estos países, las exportaciones regionales y la especialización, más que la diversificación de las exportaciones, parecen aumentar el crecimiento regional.

2.5. Midiendo la Competitividad

Hay dos instituciones bien conocidas que miden y comparan la competitividad de los países: el Foro Económico Mundial (WEF) y el Centro Mundial de Competitividad IMD. El WEF publica anualmente el “World Competitiveness Report” que mide la competitividad de 140 países, mientras que el IMD publica un anuario de competitividad mundial que clasifica a 63 países. Ambos informes miden la competitividad a través de series complejas de indicadores agrupados en pilares y factores que se sintetizan en un índice.

2.5.2. Medición de la competitividad regional: experiencias en la Unión Europea

Existe una gran diversidad de enfoques en la medición de la competitividad regional. Esta diversidad responde a la diversidad de interpretaciones de los actuales marcos conceptuales de competitividad regional. Según Annoni y Dijkstra (2017) uno de los mayores problemas para identificar indicadores de competitividad regional es la falta de un marco conceptual claro, lo que no permite la construcción de un índice basado en marcos teóricos robustos.

La Comisión Europea elaboró un Índice de Competitividad Regional (RCI) que se publicó en 2010, 2013, 2016 y 2019. Las mediciones de RCI permiten comparar el atractivo regional para empresas e individuos dentro de los países, así como entre países. Para medir la RCI, la competitividad regional se define como "la capacidad de ofrecer un entorno atractivo y sostenible para que las empresas y los residentes vivan y trabajen" (Dijkstra *et al*, 2011; Annoni y Dijkstra, 2017).

Aiginger y Firgo (2017) establecen que para medir la competitividad debe haber una evaluación tanto de los inputs como de los resultados. La competitividad de los inputs está relacionada con la eficiencia y las capacidades de las regiones y sus factores incluyen los costos, la productividad, la estructura económica y las capacidades. Por otra parte, la competitividad de los resultados es "la capacidad de una región para alcanzar objetivos más allá del PIB", incluyendo así los resultados sociales y medioambientales en la evaluación, además de los resultados económicos.

Utilizando 54 variables, Aiginger y Firgo miden la competitividad en 229 regiones (NUTS 2) en 16 países europeos. Las dimensiones de las capacidades (inputs) se miden a través de costos, la infraestructura, la educación y la innovación, la calidad social e institucional y las capacidades ambientales. La competitividad de resultados es la agregación del pilar de ingresos, sociales y ambientales en un índice de resultados.

Huggins *et al* (2014) desarrollaron un Índice Mundial de Competitividad Regional (WCIR) para 546 regiones utilizando 19 indicadores y siguiendo la metodología de medición del Índice de Competitividad Global del Foro Económico Mundial. Los países se clasifican de acuerdo con su estado de desarrollo (factor, eficiencia e innovación) para determinar el peso de los indicadores en el WCIR. El WCIR incluye a los países latinoamericanos de Colombia y Brasil en la evaluación.

Antes del WCIR, Huggins (2003) desarrolló un índice de competitividad regional para el Reino Unido que permite comparaciones de regiones y localidades diferenciando Competitividad de inputs y resultados.

En España, el Consejo General de Economistas españoles (CGE, 2018) define la competitividad regional como "la capacidad de proporcionar un entorno favorable a las empresas ya sea a través de factores propios del territorio o bien mediante la consecución o ampliación de otros, tangibles o intangibles, que refuercen y consoliden su base competitiva, teniendo como objetivo último la mejora del bienestar de su población."

Una premisa teórica importante es que el GCA supone que la competitividad regional no es directamente medible, porque la definición del concepto es "abstracta y multidimensional, con factores no determinados de forma exhaustiva y sin una forma funcional conocida" (CGE, 2018). No obstante, el GCE reconoce que la competitividad de dos regiones puede compararse utilizando un conjunto de indicadores que actúan como variables proxy de la competitividad regional. En consecuencia, para superar el problema de no tener una forma funcional bien conocida de competitividad, y aun así poder estimar y comparar la competitividad regional, el ICREG mide variables que se supone que están correlacionadas con la competitividad regional.

2.6. Medición de la Competitividad Regional en América Latina

Hay varias mediciones de la competitividad regional en América Latina. En general, las mediciones de competitividad regional en América Latina cubren la escala más grande de la división político- administrativa del país.

Otra característica de las mediciones de competitividad regional existentes en América Latina es que todas ellas clasifican regiones dentro del país. Por lo tanto, no existe ninguna investigación que compare la competitividad regional entre países. Sin embargo, existe un índice de desarrollo regional llamado "IDERE LATAM" que compara 182 regiones latinoamericanas en 8 países (Argentina, Brasil, Colombia, Chile, El Salvador, México, Paraguay y Uruguay) utilizando un conjunto comparable de indicadores que se basan en el índice de desarrollo humano de Amartya Sen (Rodríguez y Vial, 2020). El análisis comparativo de esta índice muestra que existen altas desigualdades regionales en América Latina, que los mayores niveles de desarrollo se encuentran en los centros urbanos y capitales nacionales, y que Chile y Uruguay muestran mayores niveles, en general, de desarrollo.

En la Tabla 1 se resumen las mediciones de competitividad regional para Argentina, Colombia, Chile, México y Perú. Una de las primeras características de las mediciones de competitividad en América Latina es el hecho de que la mayoría de los países tienen más de una institución que la mide simultáneamente.

En Chile, Colombia y Perú, los resultados de las regiones más y menos competitivas son similares entre diferentes mediciones, a pesar de las grandes diferencias en las metodologías, teorías de apoyo y conjunto de indicadores utilizados en cada índice.

El hecho de que diferentes mediciones de competitividad arrojen resultados similares en Chile, Colombia y Perú apoya la idea de que la competitividad puede evaluarse indirectamente midiendo un conjunto de indicadores relacionados con la competitividad (CGE, 2018) y que los resultados de diferentes índices arrojarán resultados similares.

Estos resultados sugieren que la adición de grandes conjuntos de indicadores no necesariamente producirá resultados diferentes de las mediciones anteriores, por lo tanto, la medición debe

centrarse en la obtención de un conjunto mínimo de indicadores que se relacionen con los factores clave de la competitividad regional.

Tabla 1: Índices de Competitividad en América Latina: Bases Teóricas y Principales Resultados

País	Nombre del Índice	Autor/Institución	Base Teórica	Regiones de Mayor Ranking	Regiones de Menor Ranking
Argentina	Índice de Competitividad Provincial	Bolsa de Comercio de Córdoba	La competitividad regional se basa en la definición del Departamento de Desarrollo Regional de Chile (SUBDERE): "Capacidad o potencial del sistema económico de una determinada región para alcanzar mayores niveles de ingreso per cápita de manera sostenida".	1. Ciudad Autónoma de Buenos Aires 2. Tierra del Fuego 3. La Pampa 4. San Luis	21. Catamarca 22. Chaco 23. Corrientes 24. Jujuy
Colombia	Escalafón de competitividad	CEPAL	La definición implícita de competitividad que mide el índice reúne estructuras, dinámicas y logros de una región que entrelazan el crecimiento económico, la innovación, la conectividad, el bienestar de su población y la gobernanza del territorio. Esta definición se inscribe en una visión multidimensional, más allá del PIB (Krugman, 1994; Stiglitz et al., 2009), y entrega una visión panorámica y amplia del desarrollo relativo de cada departamento.	1. Cundinamarca/Bogotá 2. Antioquia 3. Santander 4. Caldas 5. Atlántico (2019)	30. Vichada 31. Guainía 32. Vaupés (201)
Colombia	Índice de Competitividad departamental (IDC)	Consejo privado de Competitividad – Universidad de Rosario	Se basa en la definición de competitividad del Foro Económico Mundial: "conjunto de instituciones, políticas y factores que determinan el nivel de productividad de un país".	1. Bogotá 2. Antioquia 3. Valle del Cauca 4. Santander 5. Risaralda (2020)	25. Chocó 26. Guainía 27. Vichada (2020)
Chile	Índice de Desarrollo Regional - IDERE	El Instituto Chileno de Estudios Municipales de la Universidad Autónoma de Chile	Medición del desarrollo regional desde una perspectiva multidimensional, similar al índice de Desarrollo Humano (IDH) elaborado por el PNUD.	1. Metropolitana 2. Magallanes 3. Valparaíso 4. Antofagasta (2017)	15. Araucanía 14. Maule 13. Aysén 12. Arica y Parinacota
Chile	Índice de Competitividad Regional-ICORE	Centro de Estudios en Economía y Negocios de la Universidad del Desarrollo	Es una medición de la capacidad competitiva de las regiones y da cuenta de los factores que pueden permitir una productividad sistemáticamente superior a la de otras regiones. El ICORE refleja las diferencias relativas en las condiciones estructurales de las regiones que pueden influir significativamente en su productividad y, a la vez, influyen en la competitividad de las empresas que se ubican en ellas. El aprovechamiento de las condiciones regionales por parte del sector público y privado puede permitir alcanzar y sostener mayores niveles de vida.	1. Metropolitana 2. Magallanes 3. Valparaíso 4. Aysén (2015)	15. Arica y Parinacota 14. Los Ríos 13. Araucanía 12. Atacama

Mexico	Índice de Competitividad Estatal	IMCO	Se define competitividad como la capacidad de las ciudades, estados o países de generar, atraer y retener talento e inversiones. Tanto el talento como la inversión tienden a ir hacia los lugares donde es posible obtener mejores retornos económicos y sociales. Así, en un estado atractivo para el talento y la inversión se puede esperar un alto nivel de productividad en las empresas y en las personas, y por su estrecho vínculo también se pueden esperar altos niveles de prosperidad y bienestar.	1. Ciudad de México 2. Querétaro 3. Nuevo León 4. Aguascalientes (2018)	29. Michoacán 30. Oaxaca 31. Guerrero 32. Chiapas
Mexico	Índice de Competitividad Urbana	IMCO	El índice mide la capacidad de las ciudades mexicanas para atraer y retener inversiones y talento. En las ciudades, como en los países y en los estados, el nivel de productividad de las empresas y de las personas, así como su prosperidad y bienestar, están estrechamente vinculados al acervo local de capital físico y humano. Además, tanto el talento como la inversión tienden a gravitar hacia los lugares donde pueden obtener los mejores retornos económicos y sociales. Por ello, una ciudad competitiva - que consistentemente resulta atractiva para el talento y la inversión- es una ciudad que maximiza la productividad y el bienestar de sus habitantes.		
Perú	Índice de Competitividad Regional	Consejo Nacional de Competitividad	Basada en la definición del Foro Económico Mundial: “el conjunto de instituciones, políticas y factores que determinan el nivel de productividad de un país”	1. Lima 2. Moquegua 3. Ica 4. Arequipa (2013/14)	24. Huancavelica 23. Loreto 22. Huánuco
Perú	Índice de Competitividad Regional INCORE	Instituto Peruano de Economía	El INCORE intenta replicar la metodología usada para el calcular el Índice Global de Competitividad del Foro Económico Mundial.	1. Lima 2. Arequipa 3. Moquegua 4. Ica (2018)	19. Ayacucho 18. ICA 17. Ucayali
Perú	Índice de Competitividad Regional	CENTRUM - Universidad Católica del Perú	La administración de recursos y capacidades para incrementar sostenidamente la productividad empresarial y el bienestar de la población de la región.	1. Lima metropolitana 2. Moquegua 3. Tacna 4. Arequipa (2018)	26. Huancavelica 25. Amazonas 24. Ayacucho

Fuente: Basado en fuentes oficiales

2.6.3. Técnicas de Medición

La Tabla 2 presenta indicadores, factores, pilares y métodos utilizados para componer índices de competitividad regional en América Latina. El análisis comparativo de estos índices permite identificar el siguiente conjunto de factores o pilares comunes de competitividad: eficiencia y productividad de las empresas, infraestructura regional, capital humano, capacidad tecnológica e innovación.

Otra característica común entre estas mediciones es que todas las clasificaciones de competitividad utilizan conjuntos de indicadores normalizados. La mayoría de los procedimientos de normalización utilizan el método de escalado "min-max". El *Índice de Competitividad Regional* (Consejo Nacional de Competitividad, 2013) para Perú, utiliza valores mínimos y máximos históricos para normalizar cada indicador, esto permite comparar valores normalizados entre años para cada indicador porque los cambios en el indicador normalizado reflejan cambios del valor real del indicador.

Una diferencia importante entre escalar y la normalizar es que los valores de escalado no cambian la distribución de la variable que escala, a diferencia de la normalización, que puede cambiar la distribución de la variable normalizada.

Después de normalizar o escalar, los valores se agregan utilizando diferentes técnicas de ponderación para crear un único valor indexado para cada región. Hay cuatro técnicas principales para agregar valores:

1. Promediar los valores de todos los indicadores o pilares (INCORE-Perú, *Índice Competitividad Regional-Perú*) dando el mismo peso, y por lo tanto importancia, a todos los indicadores.
2. Asignar diferentes pesos a cada indicador mediante el uso de análisis de componentes principales (PCA) o análisis factorial (FA).
3. Utilizando diferentes ponderaciones en función del grado de desarrollo de la región. Esta técnica se basa en el Índice de Competitividad Global del WEF (Schwab, 2017). Esta técnica se eliminó

en el Informe de Competitividad Global del WEF de 2018 bajo la lógica de que bajo la cuarta revolución industrial "todos los factores de competitividad tendrán una influencia similar en la competitividad de los países, independientemente de su nivel de ingresos" (Schwab, 2018).

4. Consultar con un panel de expertos o realizar encuestas y asignar diferentes pesos a cada componente en función de las opiniones de los expertos o los resultados de las encuestas.

Un problema importante de la comparación de regiones en América Latina es la disponibilidad de indicadores comparables, ya que pocos de ellos se construyen utilizando fuentes y metodologías similares. Además, la variabilidad en el tamaño de las regiones administrativas es enorme; hay regiones en América Latina, como Sao Paulo, Río de Janeiro o el Distrito Federal de México que tienen poblaciones más grandes que países enteros (CEPAL, 2015). Además, al comparar diferentes países hay una serie de factores, como las instituciones, patrones del mercado e innovación, la especialización industrial, los factores culturales, que difieren entre países y regiones, y que pueden ser un factor distorsionador al comparar el rendimiento (Smith, 2001). Para reducir este problema, la mejor práctica sería utilizar un conjunto de medidas, en lugar de un único indicador o medida.

Teniendo en cuenta la coherencia de la fuente y la metodología, sólo unos pocos indicadores son comparables, entre ellos los indicadores que provienen de censos de población, encuestas de hogares, encuestas de empleo y cuentas nacionales. Estos indicadores suelen ser construidos por los Institutos Nacionales de Estadística de cada país, que utilizan las mismas normas y metodologías. En el caso de las cuentas nacionales, la mayoría de los países de América Latina las miden a través de su Instituto Nacional de Estadística, pero en Chile y Ecuador, los Bancos Centrales son responsables de estos datos (Buitelaar *et al*, 2015). Todas estas instituciones siguen métodos internacionales de normalización y se basan en fuentes similares.

Estos hechos sugieren que para obtener una medida de competitividad regional el esfuerzo debe efectuarse en la obtención de un conjunto limitado de indicadores comparables que maximicen su eficacia como medidas de desempeño. PCA y FA permiten reducir el número de indicadores al eliminar indicadores que no agregan poder explicativo a las variables dependientes. Además, estas

técnicas permiten maximizar el valor y la eficacia al reducir la dimensionalidad del conjunto de datos.

Para obtener indicadores comparables es necesario adoptar un enfoque de normalización. A partir de resultados de índices de competitividad anteriores, el enfoque más utilizado es el método de escalado "min-max". Otras técnicas de normalización no han mostrado beneficios adicionales. Además, el uso de valores mínimos y máximos históricos permitirá comparar valores normalizados y su evolución en series temporales.

Tabla 2: Índices de Competitividad en América Latina: Indicadores, Normalización y Métodos de Agregación

País	Nombre del Índice	Cobertura Temporal	Escala/Número de Regiones	Indicadores	Número de Pilares	Descripción de Pilares	Método de Normalización	Método de Agregación
Argentina	Índice de Competitividad Provincial	2007-2012	24 regiones (23 Provincias y Ciudad Autónoma de Buenos Aires)	72 indicadores, de los cuales 16 provienen de una encuesta especialmente diseñada para el índice.	7 factores	Factor Personas, Factor Empresas, Factor Gobierno, Factor Recursos Naturales y Medio Ambiente, Factor Infraestructura, Factor Innovación, Ciencia y Tecnología y Factor Resultados Económicos	Estandarizada por el método Mínimo y Máximo (X- Max) / (Mín-Máx)	La ponderación de las variables dentro de cada factor se obtiene de un "análisis consensado de todos los integrantes del grupo de trabajo y de consultas a profesionales idóneos en el tema" (Bolsa de Comercio de Córdoba, 2013). Los 7 factores tienen la misma ponderación.
Colombia	Escalafón de competitividad	2000-2019	32 departamentos		5 factores	a) Economic strength: size of the market, productive structure, associations and entrepreneurship, trade and financial services. b) Infrastructure and logistics: roads, ports, airports, and digital networks. c) Wellbeing and human capital: education, health, social structure, and housing services. d) Science, technology, and innovation: investment on science and technology, scientific production, and superior education. e) Institutions and public management: public management, government finances, security, and transparency.	Estandarizada por el método Mínimo y Máximo (X- Max) / (Mín-Máx)	Análisis de Componentes Principales (ACP)

Colombia	Índice de Competitividad departamental	2013-2020 (8 versiones)	Bogotá y 32 departamentos.	102 variables	13 pilares agrupados en los siguientes factores: Condiciones básicas, Capital Humano, eficiencia de mercado y ecosistema de innovación	<p>A) Condiciones básicas:</p> <ol style="list-style-type: none"> 1. Instituciones 2. Infraestructura 3. Adopción de la tecnología de la información 4. sostenibilidad <p>B) Capital Humano</p> <ol style="list-style-type: none"> 5. Salud 6. Educación y formación terciarias <p>C) Eficiencia del mercado</p> <ol style="list-style-type: none"> 7. Entorno empresarial 8. mercado de trabajo 9. Sistema financiero 10. Tamaño del mercado <p>D) Ecosistema de innovación:</p> <ol style="list-style-type: none"> 11. Sofisticación y diversificación 12. Innovación y dinámica de la empresa 	El puntaje de los departamentos asignado a cada indicador resulta de la aplicación de una transformación max-min, la cual no solo normaliza los datos, sino que mantiene tanto el ordenamiento de los departamentos como la distancia relativa. (X-min)/(max-min). El puntaje varía entre 0 y 10.	Para el índice 2020: Promedios simples de las variables normalizadas en cada pilar. Ponderación igual para cada uno de los 13 pilares. Para el 2018 y anteriores: los departamentos se clasifican según su estado de desarrollo en cuatro categorías teniendo en cuenta el PIB per cápita, excluyendo las actividades mineras y energéticas, y el grado de complejidad de la producción. Los departamentos menos desarrollados tienen una mayor ponderación de los factores básicos y los más desarrollados tienen una mayor ponderación de los factores de eficiencia e innovación.
Chile	Índice de Desarrollo Regional - IDERE	2016-2019 (3 versiones)	15 regiones	33 indicadores	7 dimensiones	Educación, salud, bienestar socioeconómico, actividad económica, conectividad, seguridad y, sustentabilidad y medio ambiente.	Normalizada por el método Mínimo y Máximo (X- Max) / (Mín-Máx)	Los pesos de cada dimensión respondieron a la moda observada en las respuestas de una segunda consulta a expertos mediante encuesta en línea. Así, la ponderación de cada dimensión es la siguiente: Educación, 17,5%; Salud, 17,5%; Bienestar Socioeconómico, 17,5%; Actividad Económica, 17,5%; Conectividad, 10%; Seguridad, 10%; Sustentabilidad y Medio Ambiente, 10%.
Chile	Índice de Competitividad Regional- ICORE	1999-2015 (12 versiones)	15 regiones	65 indicadores	7 dimensiones	<ul style="list-style-type: none"> • Persona • Gestión empresarial y calidad del empleo • Innovación – Ciencia y Tecnología • Infraestructura y Capacidad • Entorno económico y Financiero • Inversión Pública y Seguridad • Inserción Comercial 	Normalizada por el método Mínimo y Máximo (X- Max) / (Mín-Máx)	Promedios simples de las variables normalizadas en cada dimensión. Igual ponderación a cada dimensión
México	Índice de Competitividad Estatal	2006 - 2020 (8 versiones)	32 regiones (Estados)	97 indicadores	10 sub-índices	I. Sistema de Derecho confiable y objetivo; II. Manejo sustentable del medio ambiente; III. Sociedad incluyente, preparada y sana; IV. Sistema político estable y funcional; V. Gobiernos eficientes y eficaces VI. Mercado de factores; VII. Economía estable; VIII. Sectores precursores; IX. Aprovechamiento de las relaciones	Las variables seleccionadas para cada estado se estandarizaron en una escala de cero a 100 en función de los valores que presentan respecto al resto de la muestra. Así, el valor más bajo de la muestra toma el valor de cero, mientras que el más alto toma el valor de 100. Los demás valores toman una	La base del índice son los indicadores de inversión y talento. El resto de los indicadores pertenecientes a los 10 subíndices son comparados contra los primeros para poder establecer relaciones que permitan orientar el diseño de políticas públicas. La construcción del índice está en función y gira en torno a los primeros, y por lo mismo, los llamamos

						internacionales; y X. Innovación de los sectores económicos.	calificación entre cero y 100 en proporción a la escala utilizada.	variables ancla. Todos los indicadores tienen el mismo peso dentro de la base de datos. Los pesos de los subíndices se calculan a partir de Regresión por Componentes Principales. Para llevar a cabo el cálculo, se toman como base las calificaciones obtenidas en cada indicador agrupadas por subíndice y se toma como variable dependiente el promedio simple de las variables de inversión y talento. Esta técnica ayuda a identificar qué tanta varianza de las variables ancla está explicada por las variables que componen a cada subíndice
México	Índice de Competitividad Urbana	2007 - 2018 (6 versiones)	73 ciudades	120 indicadores	10 sub-índices	I. Sistema de Derecho confiable y objetivo; II. Manejo sustentable del medio ambiente; III. Sociedad incluyente, preparada y sana; IV. Sistema político estable y funcional; V. Gobiernos eficientes y eficaces VI. Mercado de factores; VII. Economía estable; VIII. Sectores precursores; IX. Aprovechamiento de las relaciones internacionales; y X. Innovación de los sectores económicos.	Las variables seleccionadas para cada estado se estandarizaron en una escala de cero a 100 en función de los valores que presentan respecto al resto de la muestra. Así, el valor más bajo de la muestra toma el valor de cero, mientras que el más alto toma el valor de 100. Los demás valores toman una calificación entre cero y 100 en proporción a la escala utilizada.	La asignación de los pesos por indicador se hizo en dos etapas. En primer lugar, el 50% del peso de la calificación se calculó a través de proceso de asignación de pesos (budget allocation process). En éste se consultó a los expertos del IMCO en cada materia para que asignaran a todos los indicadores valores de 0.1, 0.5 o 1, en función de su nivel de relevancia para la competitividad de la ciudad. En segundo lugar, el 50% del peso se asignó con base en la varianza de cada indicador. Se premió a aquellas variables con comportamientos más estables para evitar sobrerreacciones en el ranking causadas por movimientos abruptos de los indicadores. Los subíndices se ponderan por Regresión por Componentes Principales utilizando como variables dependientes al talento e inversión.
Perú	Índice de Competitividad Regional	2007/2008 - 2013/14 (7 versiones)	24 regions	58 indicadores	8 pilares	Institucionalidad, infraestructura, salud, educación, innovación y ambiente) y pilares-resultado de la competitividad ó pilares output (evolución sectorial y desempeño económico)	Estandarizada por el método Mínimo y Máximo históricos (X-Max histórico) / (Mín histórico-Máx histórico). Esto permite que los cambios en el indicador normalizado reflejen cambios en el indicador absoluto.	El peso de los indicadores en la construcción del índice varía según el nivel de desarrollo que tiene la región, la que es medida a través del PIB por habitante.

Perú	Índice de Competitividad Regional INCORE	2018 (6 versiones)	25 regiones (Incluye Lima and Provincias. Callao se incluye en Lima)	45 indicadores	6 pilares	Entorno Económico, Laboral, Educación, Salud, Infraestructura, Instituciones	Para cada indicador se calculan puntajes para cada región y se le asigna un valor de diez a aquella región que presenta el mejor desempeño, un valor de cero a aquella región con el peor desempeño y se interpola el valor correspondiente para las demás regiones.	Pilares son el promedio simple de los puntajes obtenidos en cada indicador. índice de competitividad para cada región es el promedio simple del valor de los seis pilares (igual ponderación cada pilar)
Perú	Índice de Competitividad Regional	2010-2016 (5 versiones)	26 regiones (Incluye Lima área Metropolitana and Lima región)	90 variables	5 pilares	Economía, empresas, gobierno, infraestructura y personas.	Primero se utiliza el resultado estándar y luego conversión a escala para facilitar la interpretación. El resultado estándar es el número de desviaciones estándar que un resultado ocupar por bajo o por sobre la media= $(X - Media) / DS$	Promedio de los valores de cada pilar. Igual ponderación para cada pilar.

Fuente: Basado en fuentes oficiales

2.7. Medición de la Competitividad Regional: el Marco Teórico

Las definiciones modernas de competitividad regional han avanzado de los principios centrados en la economía que prevalecieron en los años 1980 y 1990, a un concepto holístico que reconoce que el objetivo de la competitividad regional es aumentar el bienestar a través de la productividad. El objetivo de aumentar el bienestar a través de la productividad es también lo que separa la competitividad regional de otros enfoques puramente económicos y, a la vez, lo que separa la competitividad regional de los conceptos de desarrollo social que se centran casi por completo en el bienestar, dejando atrás las cuestiones económicas.

Desde una perspectiva práctica, el marco conceptual de la competitividad regional permite una comprensión amplia de las diferencias en el desempeño regional. En el pasado, las diferencias en el desempeño regional han sido abordadas por modelos de crecimiento endógeno (Romer, 1994), que ubican el capital humano, innovación y conocimiento como motores clave del crecimiento, además de los factores tradicionales de capital y trabajo (Huggins, *et al* 2014; Huggins y Thompson, 2017).

Según Huggins y Thompson (2017), una diferencia importante entre los modelos de crecimiento endógeno y los modelos de competitividad es que los modelos de crecimiento endógeno buscan explicar el crecimiento pasado. Por el contrario, los modelos de competitividad también buscan medir el potencial de crecimiento futuro, incorporando los factores explicativos adoptados por las teorías del crecimiento como el trabajo, el capital, la tecnología, la inversión en capital humano, y la productividad. Por lo tanto, los modelos de competitividad se basan implícitamente en los modelos de crecimiento endógenos y buscan predecir resultados potenciales.

Existe una gran diversidad de enfoques en las mediciones de competitividad regional latinoamericanas. Esta diversidad refleja la diversidad en la interpretación de los marcos conceptuales de competitividad regional (Annoni y Dijkstra, 2017).

Las definiciones modernas de competitividad regional abordan objetivos económicos y de bienestar, e incorporan la idea de un entorno regional que permita el logro de dichos objetivos.

De estas definiciones, se derivan las siguientes cualidades y características de las regiones competitivas:

La primera característica es la idea de que la región ofrece un *milieu* para que las empresas alcancen un cierto nivel de rendimiento. En otras palabras, las regiones competitivas ofrecen un entorno que aumenta la productividad de las empresas.

En segundo lugar, la sostenibilidad es una condición básica para lograr la competitividad, en el sentido de que permite un alto rendimiento sostenido para las empresas. Esto implica que el medio ambiente o *el medio* ambiente no pueden estar compuestos por factores a corto plazo o condiciones específicas en el tiempo y, por el contrario, deben incluir condiciones duraderas y sostenibles.

En tercer lugar, una región competitiva necesita ofrecer condiciones atractivas tanto para las empresas como para los residentes; la región tiene que ser lo suficientemente atractiva para que los trabajadores vivan en esa región.

En cuarto lugar, las regiones competitivas tienen ciertas condiciones favorables (entorno) que permiten entregar un elevado desempeño, pero también es necesario que estas regiones competitivas estén efectivamente alcanzando ese resultado positivo en términos de productividad y bienestar. Además, el bienestar es un resultado que involucra aspectos sociales, económicos y ambientales.

En consecuencia, para el propósito y los objetivos de esta tesis, la competitividad regional se define como "*la capacidad de una región para entregar de manera sostenible objetivos económicos, sociales y ambientales a sus ciudadanos y trabajadores*" (Aiginger et al, 2013; Aiginger y Vogel, 2015; Aiginger y Firgo, 2017; Annoni y Dijkstra, 2017).

3. Metodología

3.1. Definiciones y Metodología

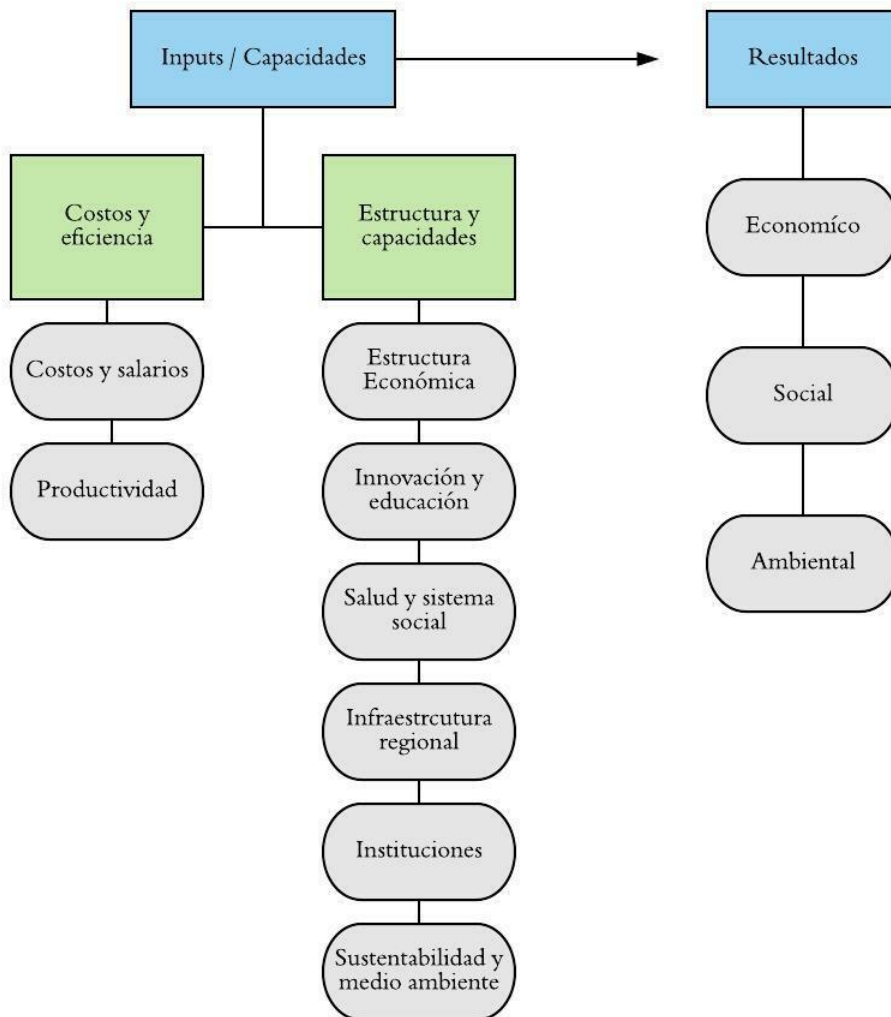
La competitividad regional se define *como la capacidad de una región para alcanzar de manera sostenible los objetivos económicos, sociales y ambientales de sus ciudadanos y trabajadores.* (Aiginger *et al*, 2013; Aiginger & Vogel, 2015; Aiginger & Firgo, 2017, Annoni & Dijkstra, 2017).

Para medir la competitividad regional en Chile, Colombia y México se construye un conjunto de indicadores regionales. El conjunto de indicadores fue seleccionado para permitir la comparabilidad la competitividad y el desempeño regionales entre países. Las variables se normalizan utilizando el método "min-max" y utilizando mínimos y máximos históricos para todas las regiones lo que permite incorporar la evolución de los indicadores a lo largo del tiempo (OCDE, 2008).

Chile, Colombia y México muestran niveles similares en rankings de competitividad en el Informe de Competitividad Global del Foro Económico Mundial (Schwab, 2018). Además, México y Chile son los dos únicos países de la OCDE en América Latina. Adicionalmente, estos tres países disponen de datos estadísticos suficientes para obtener los indicadores de competitividad regional.

La figura 1 muestra el modelo de competitividad regional. Este modelo de competitividad regional distingue los Inputs de los Resultados reflejados el trabajo de Aiginger & Firgo (2017) y Huggins & Thompson (2017).

Figura 1. Modelo de Competitividad Regional



Fuente: Basado en Aiginger & Firgo (2017) y Huggins & Thompson (2017)

Los inputs son aquellos factores que crean un entorno atractivo y sostenible para las empresas y los residentes y que constituyen una capacidad potencial de producir un resultado competitivo.

Hay dos tipos de inputs. El primer tipo de insumos corresponde a los que conducen a la "competitividad de bajo nivel": costo y eficiencia (Aiginger *et al*, 2013; Aiginger & Vogel, 2015, Malecki, 2017). El segundo tipo de inputs son factores complejos que conducen a la "competitividad de alto nivel" (Aiginger & Vogel, 2015; Malecki, 2017). Este tipo de elementos

están relacionados con la estructura económica de la región y sus capacidades, incluidas las características físicas de la región, así como el tejido social, las instituciones, las redes, y la innovación (Aiginger & Firgo, 2017; Huggins & Thompson, 2017)

Los componentes de la competitividad de resultados son los niveles reales alcanzados de desempeño y bienestar. Siguiendo una definición integral de bienestar, el resultado abarca al desempeño económico, social y ambiental de la región.

La competitividad de los inputs se mide a través de los siguientes factores: costo y eficiencia, estructura regional, estructura económica, innovación y educación, salud y sistema social, e instituciones (ecuación 1). No se identificaron variables regionales comparables entre países para factores de sostenibilidad y medio ambiente.

$$(1) \text{Input Index}_i = \frac{1}{6} \text{Eff}_i + \frac{1}{6} \text{Infras}_i + \frac{1}{6} \text{Ec Struct}_i + \frac{1}{6} \text{Educ}_i + \frac{1}{6} \text{Health}_i + \frac{1}{6} \text{Instit}_i$$

Donde:

Input Index = Competitividad de Inputs para la región i

Eff = Factor Eficiencia y costos

Infras = Factor Infraestructura regional

Ec Struct = Factor Estructura Económica

Educ = Factor Innovación y Educación

Health = Factor Saluds Y Sistema Social

Instit = Factor Instituciones

La competitividad de los resultados se mide a través de la media geométrica de los factores de resultados sociales, económicos y ambientales como se presenta en la ecuación 2. Dado que los factores ambientales, sociales y económicos son necesarios e igualmente importantes para lograr resultados de competitividad, la media geométrica se utiliza para dar la misma importancia a todos los factores relacionados con los resultados. Si uno de los componentes tiende a 0, el índice general tenderá a 0, es decir, no permite compensar el valor medio aumentando los valores de los otros componentes cuando uno de ellos tiende a 0.

$$(2) \text{ Results Index}_i = \sqrt[3]{\text{Economic}_i * \text{Social}_i * \text{Environmental}_i}$$

Donde:

Results Index = Índice de Resultados Competitivos de la región i

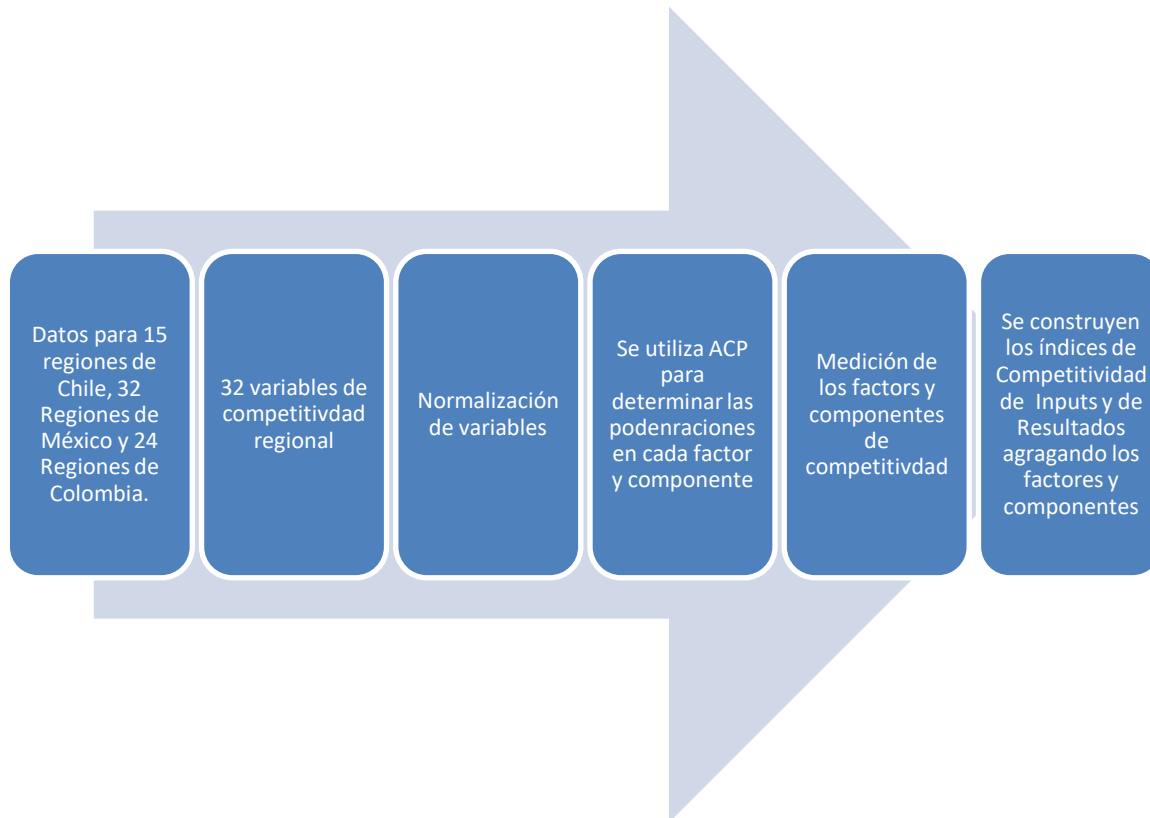
Economic = Componente Resultados Económicos

Social = Componente Resultados Sociales

Environmental = Componente Resultados Ambientales

Siguiendo las recomendaciones de la OCDE (2008) para los índices compuestos, las variables utilizadas para medir la competitividad regional se ponderan mediante el Análisis de Componentes Principales (ACP) para cada factor y cada componente. El ACP da mayor ponderación a las variables que explican la mayor parte de la variabilidad del conjunto de datos. Además, permite identificar patrones ocultos en el conjunto de datos y qué variables están correlacionadas (Kassambara, 2017). La Figura 2 muestra el peso obtenido a través del ACC para cada variable dentro de cada factor de Competitividad de Insumos. La Figura 3 muestra el peso obtenido a través del PCA para cada variable dentro de cada componente de Competitividad de Resultados. La Figura 4 resume los pasos metodológicos para construir el Índice de Competitividad de Insumos y el Índice de Competitividad de Resultados.

Figura 2: Pasos metodológicos para construir los índices de competitividad



Source: author

Las tendencias de convergencia para la competitividad se miden siguiendo el trabajo de Royuela & García (2015), quienes prueban la convergencia no solo para las variables económicas sino también para las variables sociales en las regiones colombianas.

Una vez que se mide el índice de competitividad de insumos y resultados para los años 2008 y 2017, se utiliza un modelo econométrico para encontrar evidencia de qué factores tienen la mayor influencia en los cambios en el índice de competitividad de resultados para el período 2008-2017. Dado que los datos regionales se agrupan por países, los coeficientes del modelo se estiman

utilizando un modelo lineal mixto ajustado por máxima verosimilitud a fin de controlar el efecto país. En este modelo, los efectos fijos corresponden a las variables dependientes en cada estimación y los efectos aleatorios se asignan a la intersección del país como se muestra en la ecuación (3) y la ecuación (4).

La ecuación (3) muestra la relación entre los cambios en el índice de competitividad de resultados para la región i del país j entre 2017 y 2008 y sus factores determinantes. El valor del intercepto aleatorio varía para cada país α_{ij} según un término de error aleatorio ϵ_{ij} que se muestra en la ecuación (4). β_{ij} y γ_{ij} son coeficientes fijos con un término de error aleatorio μ_{ij} . La variable *Results index_{ij}* corresponde al valor del 2008 del índice de competitividad de resultados que se incluye para probar β -convergencia entre regiones para los resultados de competitividad (Barro & Sala-i-Martin, 1992). La variable *Input Index_{ij}* corresponde al valor del 2008 del índice de competitividad de input. Además, se incluye la variable binaria *Capital_{ij}* para identificar el efecto de la regiones que alojan una ciudad capital en la competitividad de los resultados.

$$(3) \quad \Delta Results\ index_{ij} = \alpha_{ij} + \beta_{ij} Results\ Index_{ij} + \gamma_{ij} Inputs\ Index_{ij} + \delta_{ij} Capital_{ij} + \mu_{ij}$$

$$(4) \quad \alpha_{ij} = \alpha_{0j} + \epsilon_{ij}$$

3.2. Datos y fuentes

Las fuentes de datos y las variables utilizadas para construir los índices de competitividad regional se presentan en la Tabla 3. El conjunto de datos incluye 32 variables para 15 regiones de Chile, 32 regiones de México y 24 regiones de Colombia para los años 2008 y 2017. Se presentan los resultados para un total de 71 regiones. De las 33 regiones de Colombia, 9 carecen de la información para ser procesada a través de ACP (Amazonas, Arauca, Casanare, Guainía, Guaviare, Putumayo, San Andrés y Providencia, Vaupés y Vichada).

Table 3. Variables y Fuentes

Número de variable	Nombre de Variable	Unidad de Medición	Fuente		
			Chile	México	Colombia
Inputs					
Inputs – Costo y Eficiencia					
1	PIB por trabajador dólares precios corrientes	Dólar PPP	Estimación basada en datos del Banco Mundial, Banco Central de Chile e INE (1)	Estimación basada en datos del Banco Mundial (1)	Estimación basada en datos del Banco Mundial (1)
2	Salario Mínimo real	Precios constantes en dólares 2018 PPP (Nivel Nacional)	OECD	OECD	OECD
3	Salario mínimo medio en relación con los salarios medios de los trabajadores a tiempo completo	Ratio (Nivel nacional)	OECD	OECD	OECD
Inputs – Estructura Regional					
4	Acceso a Internet de banda ancha	% de hogares	OECD	OECD	DANE
5	Densidad	Número de personas por kilómetro cuadrado	Basado en población y área	Basado en población y área	Basado en población y área
Inputs – Estructura Económica					
6	PIB por área	dólares PPP	Estimación basada en datos del Banco Mundial	Estimación basada en datos del Banco Mundial	Estimación basada en datos del Banco Mundial
7	Índice de Especialización	índice 0-1	Basado en PIB regional	Basado en PIB regional	Basado en PIB regional
8	Industria manufacturera	% del sector en PIB regional	Banco Central de Chile	INEGI	DANE
9	Servicios Financieros	% del sector en PIB regional	Banco Central de Chile	INEGI	DANE
10	Servicios inmobiliarios	% del sector en PIB regional	Banco Central de Chile	INEGI	DANE
11	Servicios personales (educación y salud) y servicios profesionales	% del sector en PIB regional	Banco Central de Chile	INEGI	DANE
12	Administración Pública	% del sector en PIB regional	Banco Central de Chile	INEGI	DANE
Inputs- Innovación y educación					
13	Tasa de Analfabetismo	%	Encuesta CASEN	INEGI	Terridata DANE
14	Años de Educación	años	Encuesta CASEN	INEGI	DANE

15	Asistencia a educación terciaria	%	Encuesta CASEN	INEGI	Terridata DANE
16	Asistencia a Educación secundaria	%	Encuesta CASEN	INEGI	Terridata DANE
17	Asistencia a educación primaria	%	Encuesta CASEN	INEGI	Terridata DANE
18	PCT patentes por millón de habitantes	Recuento fraccionario; por inventor y año de prioridad	OECD	OECD	Banco Mundial (solo a nivel nacional)
Inputs- Salud y sistema social					
19	Esperanza de vida al nacer	Años	OECD	OECD	OECD
20	Tasa de Mortalidad Infantil	Número de muertes de menores de 1 año por sobre 1,000 nacidos	OECD	OECD	OECD
21	Razón de dependencia, tercera edad	% población de 65+ sobre población 15-64	OECD	OECD	OECD
Inputs- Instituciones					
22	Tasa de homicidio	Número de homicidios por cada 100,000 habitantes	OECD	OECD	OECD
23	Índice de capital social	Índice 0-1 (nivel nacional)	Índice de prosperidad - Legatum Institute	Prosperity index - Legatum Institute	Prosperity index - Legatum Institute
24	Índice de percepción de la corrupción	Índice 0-1 (nivel nacional)	Transparency international	Transparency international	Transparency international
Resultados - Económico					
25	PIB regional por habitante en dólares corrientes	dólares PPP	Estimación basada en datos del Banco Mundial	Estimación basada en datos del Banco Mundial	Estimación basada en datos del Banco Mundial
26	Tasa de crecimiento del PIB regional en los últimos 5 años	%	Banco Central de Chile / INE	INEGI	DANE
Resultados - Ambiental					
27	Contaminación atmosférica PM2.5	Nivel promedio en µg/m³ expuestos a la población	OECD	OECD	OECD
28	Consumo de energía renovable	% del total de consume de energía (nivel nacional)	Banco Mundial	Banco Mundial	Banco Mundial
Resultados- Social					
29	Pobreza	%	Encuesta CASEN	CONEVAL	Terridata DANE
30	Brecha de empleo (diferencia hombre-mujer)	puntos porcentuales	Encuesta CASEN	INEGI	Terridata DANE
31	Tasa de participación laboral	%	Encuesta CASEN	INEGI	Terridata DANE
32	Tasa de Desempleo	%	Encuesta CASEN	OECD	Terridata DANE

Source: Author

1: El PIB regional se estimó utilizando el PIB del país en dólares corrientes en PPA del Banco Mundial y ponderando los valores de la distribución regional del valor agregado bruto dentro de los países de acuerdo a las fuentes oficiales de los países.

4. Resultados

4.1. Índices de Competitividad Regional de Inputs y Resultados

La Tabla 4 muestra el ranking del Índice de Competitividad de Inputs y el Índice de Competitividad de Resultados para el año 2017

Las regiones de mayor ranking para el Índice de Competitividad de Inputs corresponden a regiones que alojan la capital de cada país: Bogotá (Colombia), Distrito Federal (México) y Metropolitana (Chile). El resto de las regiones mayor ranking del Índice de Competitividad de Inputs están en Chile.

Para el Índice de Competitividad de Resultados, las regiones de mayor ranking son Aysén (Chile), Magallanes (Chile) y Bogotá (Colombia). Los rankings de competitividad de resultados son mixtos entre regiones de Chile y Colombia, mientras que las regiones de México muestran, en general, niveles más bajos del Índice de Competitividad de Resultados.

Tabla 4. Ranking de Competitividad Regional de Inputs y Resultados 2017

Ranking Input	Ranking Resultados	País	Región	Ranking Input	Ranking Resultados	País	Región
1	3	Colombia	Bogotá	37	53	México	Tamaulipas
2	49	México	Distrito Federal	38	43	México	Yucatán
3	7	Chile	Metropolitana	39	25	Colombia	Quindío
4	5	Chile	Antofagasta	40	66	México	Tabasco
5	8	Chile	Tarapacá	41	39	Colombia	Magdalena
6	18	Chile	Arica y Parinacota	42	71	México	Morelos
7	2	Chile	Magallanes	43	11	Colombia	Boyacá
8	9	Chile	Valparaíso	44	45	México	Nayarit
9	26	Chile	Biobío	45	46	México	Campeche
10	32	Chile	Coquimbo	46	62	México	Hidalgo
11	19	Chile	Atacama	47	65	México	Puebla
12	12	Chile	Los Lagos	48	54	México	San Luis Potosí
13	22	Chile	Araucanía	49	35	Colombia	Cesar
14	13	Chile	Los Ríos	50	29	Colombia	Bolívar
15	28	Chile	Maule	51	38	Colombia	Norte Santander
16	16	Chile	O'Higgins	52	50	México	Sinaloa
17	1	Chile	Aysén	53	58	México	Guanajuato
18	24	Colombia	Atlántico	54	40	Colombia	Huila
19	6	Colombia	Santander	55	37	Colombia	Sucre
20	42	México	Nuevo León	56	20	Colombia	Tolima
21	10	Colombia	Antioquia	57	21	Colombia	Meta
22	48	México	Aguascalientes	58	57	México	Zacatecas
23	44	México	Coahuila de Zaragoza	59	68	México	Veracruz de Ignacio de la Llave
24	30	México	Quintana Roo	60	41	México	Chihuahua
25	69	México	Querétaro	61	51	Colombia	Córdoba
26	17	Colombia	Risaralda	62	52	México	Colima
27	36	México	Sonora	63	61	México	Michoacán de Ocampo
28	14	Colombia	Valle	64	70	México	Chiapas
29	4	Colombia	Cundinamarca	65	15	Colombia	Nariño
30	63	México	México	66	23	Colombia	Cauca
31	59	México	Tlaxcala	67	67	México	Oaxaca
32	55	México	Jalisco	68	47	Colombia	Caquetá
33	27	México	Baja California Sur	69	33	Colombia	La Guajira
34	56	México	Durango	70	64	México	Guerrero
35	34	México	Baja California	71	60	Colombia	Choco
36	31	Colombia	Caldas				

Fuente: Autor

Los mapas 1 a 3 muestran los resultados de los rankings del Índice de Competitividad de Inputs y el Índice de Competitividad de Resultados para Chile, Colombia y México en el año 2017. La paleta de colores varía en cinco categorías según el valor del Índice de Inputs y Resultados, y los valores son fijos para los tres países.

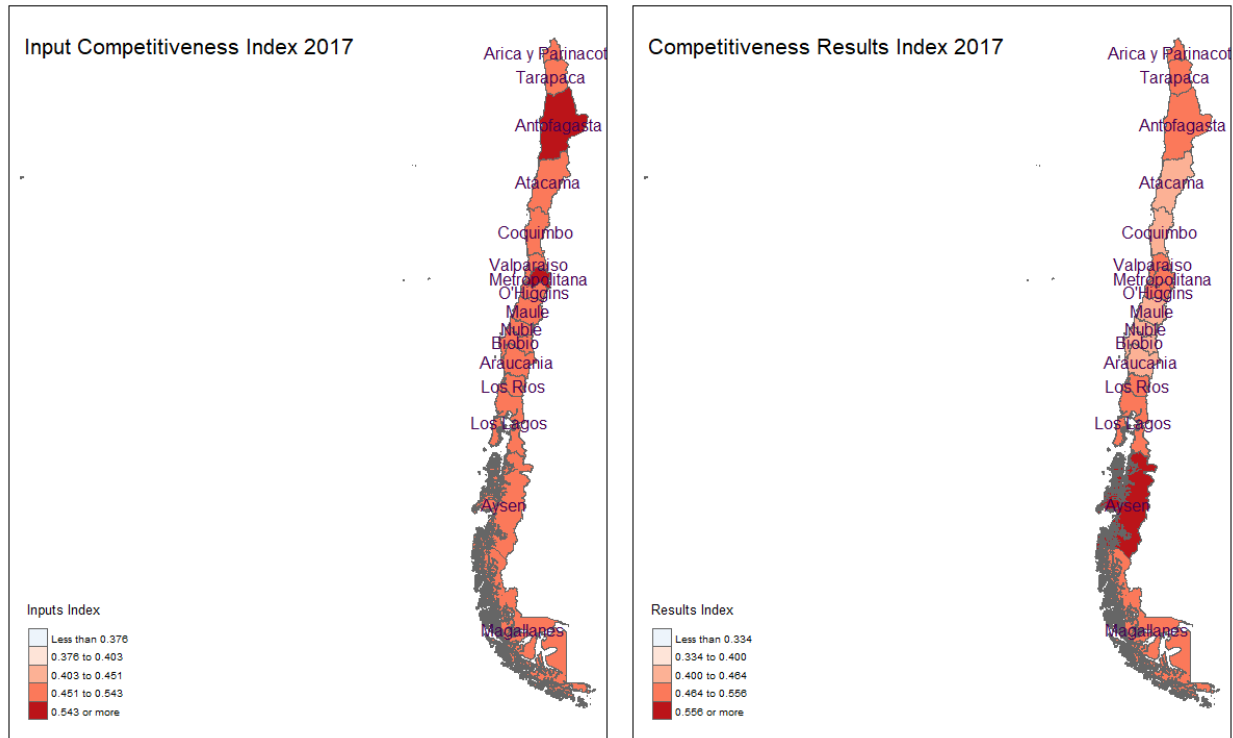
Las regiones chilenas presentan puntajes más altos, en general, para ambos índices (mapa 1) ya que no hay regiones que caigan en las categorías más bajas. Así, la situación general de las regiones en Chile parece seguir los requisitos para ser consideradas regiones competitivas bajo la definición de esta tesis, ya que los valores de ambos índices de competitividad regional, inputs y resultados, son elevados.

Muchas regiones de Colombia poseen valores de competitividad de la categoría más baja, especialmente en el Índice de Competitividad de Inputs (mapa 2). Sin embargo, las regiones de Colombia parecen tener buenos resultados competitivos en 2017 lo que podría ser el resultado de la competitividad de inputs altamente elevada en el pasado.

Las regiones de México también se encuentran en los valores de categoría más bajos de competitividad, pero esto es mucho más severo para el Índice de Competitividad de Resultados que para el Índice de Competitividad de Inputs (mapa 3). Por lo tanto, las regiones tienen la capacidad y el potencial para alcanzar un rendimiento competitivo, pero no son capaces de lograrlos al año 2017.

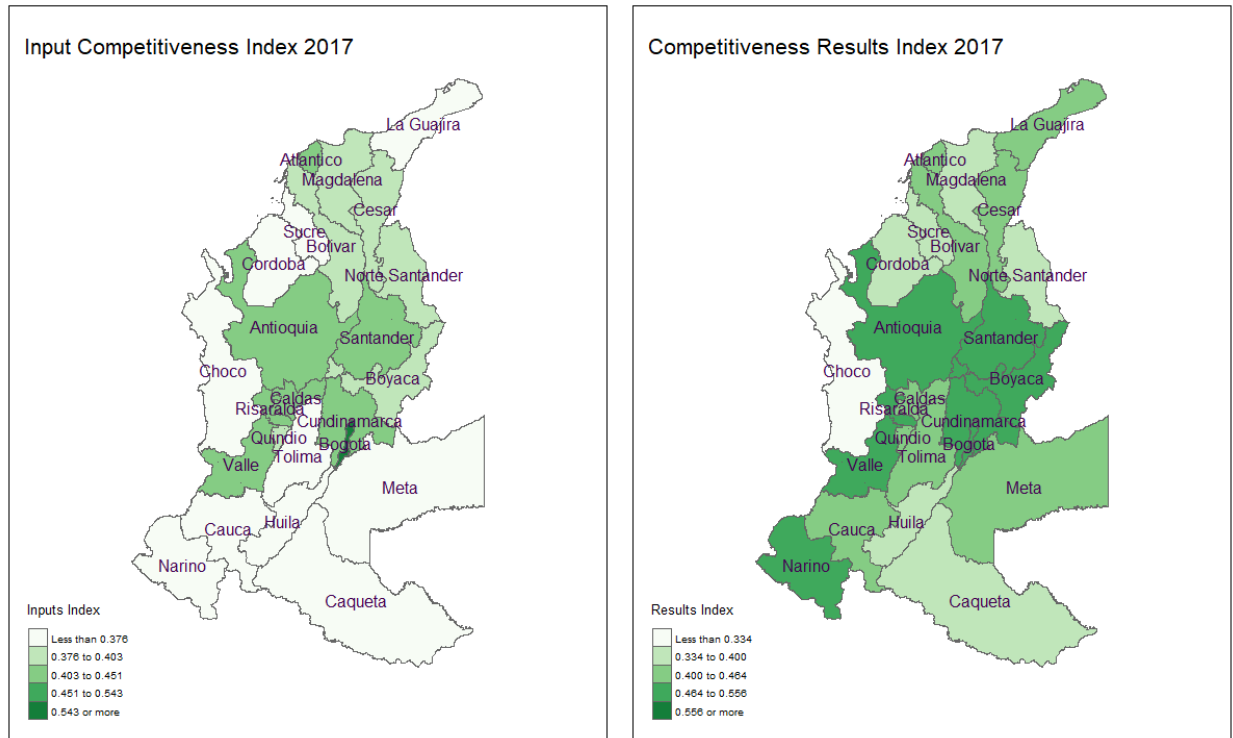
En el caso de Chile, dado que la categoría de competitividad más baja no está presente en 2017, la brecha de competitividad entre las regiones de mayor y menor ranking es menor que la de Colombia y México. Así, las desigualdades de competitividad regional, medidas a través de los rankings de Competitividad de Inputs y Resultados, son menores en Chile.

Mapa 1: Chile. Rankings del Índice de Competitividad de Inputs y Resultados por región para el 2017.



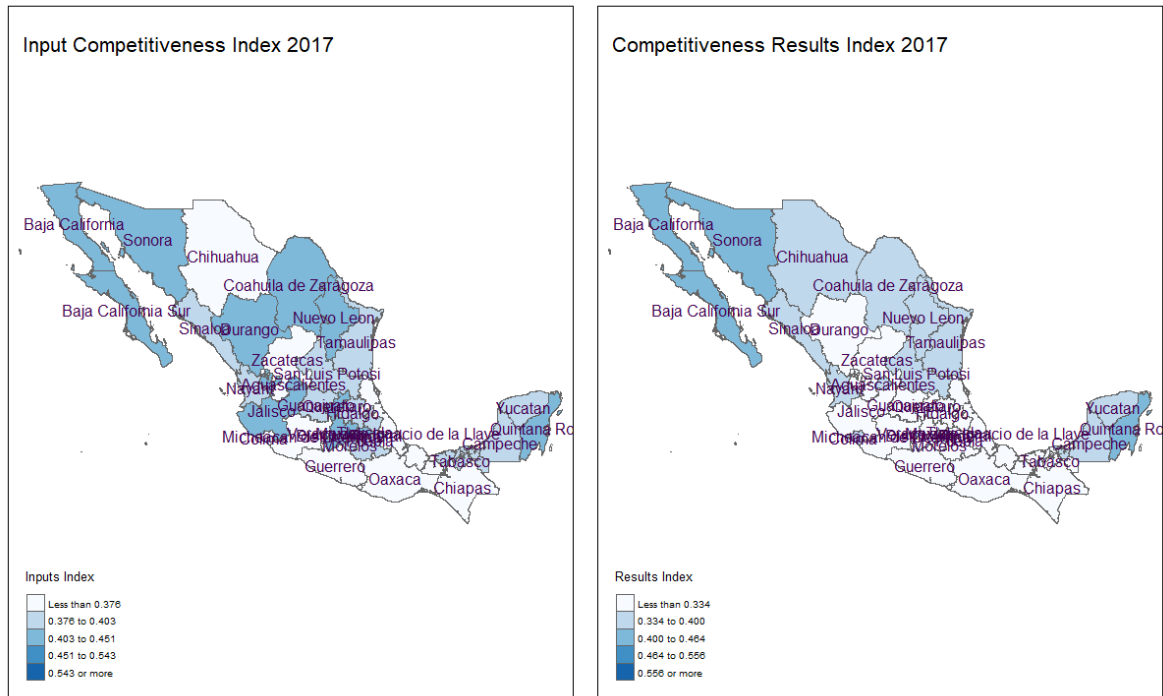
Fuente: Autor

Mapa 2: Colombia. Rankings del Índice de Competitividad de Inputs y Resultados por región para el 2017.



Fuente: Autor

Mapa 3: México. Rankings del Índice de Competitividad de Inputs y Resultados por región para el 2017.



Fuente: Autor

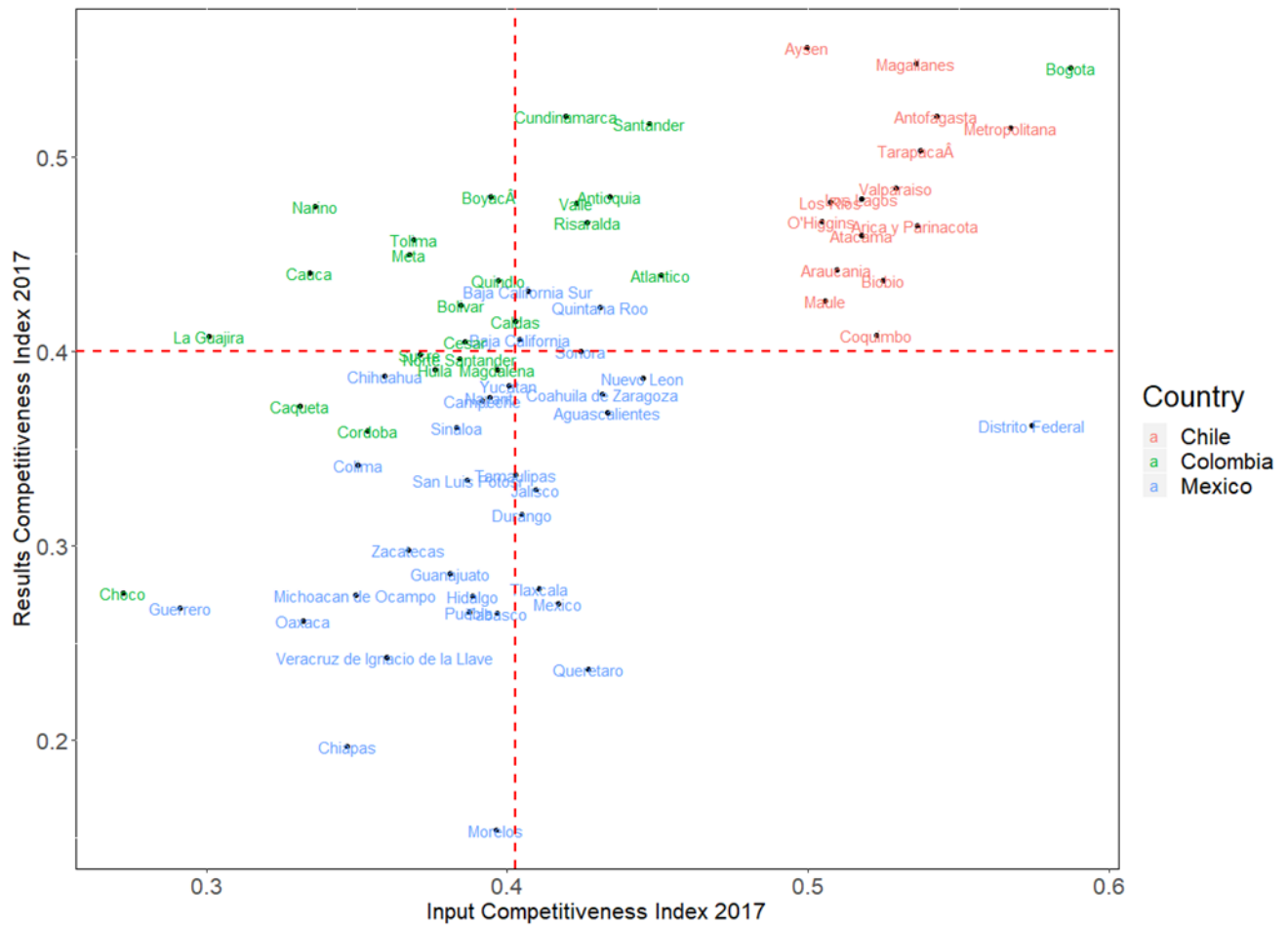
4.2. Tendencias de la Competitividad Regional y el Vínculo entre Inputs y Resultados

El gráfico 3 muestra los resultados del índice de competitividad de resultados y de inputs 2017. Las líneas rojas muestran la puntuación media de los dos índices. Las regiones de Chile se agrupan en torno a altos niveles de competitividad tanto en inputs como en resultados, junto con siete regiones de Colombia y tres regiones de México. La agrupación de las regiones competitividad regional en torno a los países sugiere que hay un efecto país que influye en las puntuaciones generales.

La mayoría de las regiones que presentan niveles por debajo de la media de Competitividad de Inputs y Resultados son de México. Chocó de Colombia, presenta niveles inusualmente bajos de Competitividad de Inputs y Resultados en 2017 junto con las regiones mexicanas de Guerrero, Chiapas, Oaxaca, Morelos y Veracruz de Ignacio de la Llave.

Por otro lado, las tres regiones que contienen las capitales nacionales de cada país tienen el mayor nivel de Competitividad de Inputs en el 2017. Sin embargo, la región Metropolitana se ubica entre otras regiones de Chile, mientras que en el caso de *Bogotá* (Colombia) y *Distrito Federal* (México) se alejan de los niveles de sus respectivos países (ver gráfico 3). Bogotá muestra altos niveles tanto de competitividad de resultados como de inputs. El DF muestra altos niveles de competitividad de los inputs.

Gráfico 3. Índice de Competitividad de Resultados 2017 vs Índice de Competitividad de Inputs 2017



Fuente: Autor

El gráfico 4 muestra para cada país las puntuaciones medias para cada factor y componente de competitividad, y para los índices de competitividad de inputs y resultados. Las diferencias en la Competitividad de inputs entre países se explican por los factores de Infraestructura Regional, Innovación y Educación, e Instituciones. Por otro lado, las diferencias de competitividad de los resultados se explican por los componentes ambientales y sociales.

En promedio, Chile muestra un mayor puntaje relativo de Competitividad de Inputs, y esto se debe específicamente a mayores puntajes en factores de Infraestructura e Instituciones Regionales.

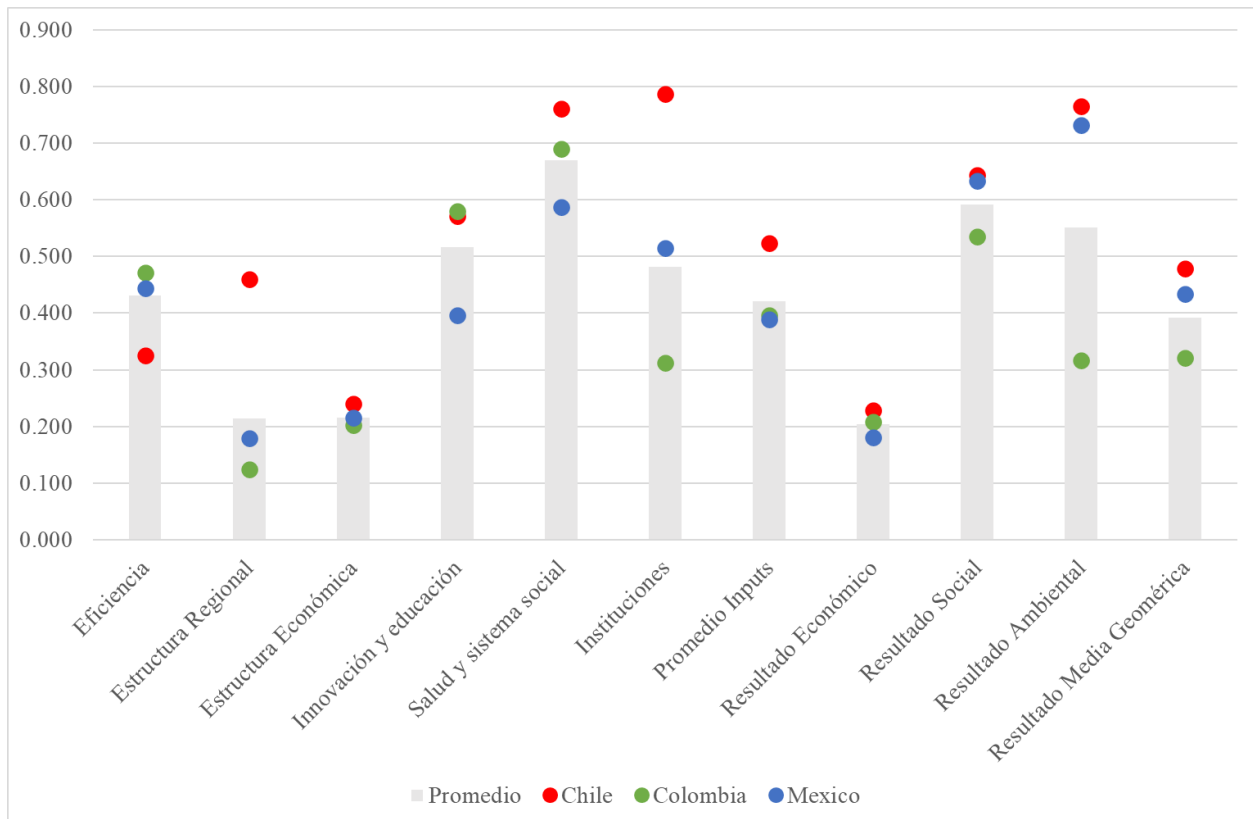
Tanto México como Colombia tienen puntajes medios de Competitividad de Inputs similares, y puntajes relativamente bajos en comparación con Chile.

En México, el factor innovación y educación muestra el puntaje relativo más bajo, mientras que en Colombia el factor instituciones muestra el puntaje relativo más bajo.

Los puntajes del Índice de Competitividad de Resultados son similares entre México y Chile, pero son relativamente más bajos para Colombia. Las mayores brechas entre países se observan en el Componente de Resultados Ambientales. Específicamente Colombia muestra el puntaje relativo más bajo en el Componente de Resultados Ambientales.

Los componentes económico y social no muestran grandes brechas entre los tres países. Sin embargo, México muestra puntajes por debajo del promedio para el componente de resultados económicos y, Colombia muestra puntajes por debajo del promedio para el componente de resultados sociales.

Gráfico 4: Puntajes Promedio para los Pilares e Índices de Competitividad por país en 2017



Fuente: Autor

El gráfico 5 muestra la variación en el índice de competitividad de resultados entre 2008-2017 y los niveles iniciales del índice de competitividad de inputs en 2008 por región. La mayor variación del índice de competitividad de resultados entre 2008-2017 se observa en las regiones chilenas de Magallanes, Arica y Parinacota, Tarapacá y Los Ríos. Por otro lado, todas las regiones de Colombia muestran una disminución en el índice de competitividad de resultados. Las regiones mexicanas muestran valores mixtos de avance y retroceso.

Las regiones con niveles más altos de competitividad de input en 2008 tienen un aumento más alto de su nivel de competitividad de resultados entre 2008-2017. El coeficiente de correlación entre estas dos variables es 0,52.

Estos resultados sugieren que existe una relación positiva entre los niveles de competitividad de Input y los cambios en la competitividad de resultados, por lo que unos niveles más altos de competitividad de los inputs regionales podrían aumentar la variación del índice regional de competitividad de los resultados.

El gráfico 6 muestra el Índice de Competitividad de resultados entre 2008-2017 y los niveles de competitividad de resultados 2008. El coeficiente de correlación entre estas dos variables es -0,43.

La tendencia del gráfico muestra que aquellas regiones con mayores niveles iniciales de Índice de Competitividad de Resultados tuvieron menores incrementos en el Índice de Competitividad de Resultados entre 2008-2017, lo que sugiere una tendencia de convergencia entre 2008 y 2017.

Gráfico 5. Cambios en el Índice de Competitividad de Resultados 2017/2008 vs Índice de Competitividad de Inputs 2008

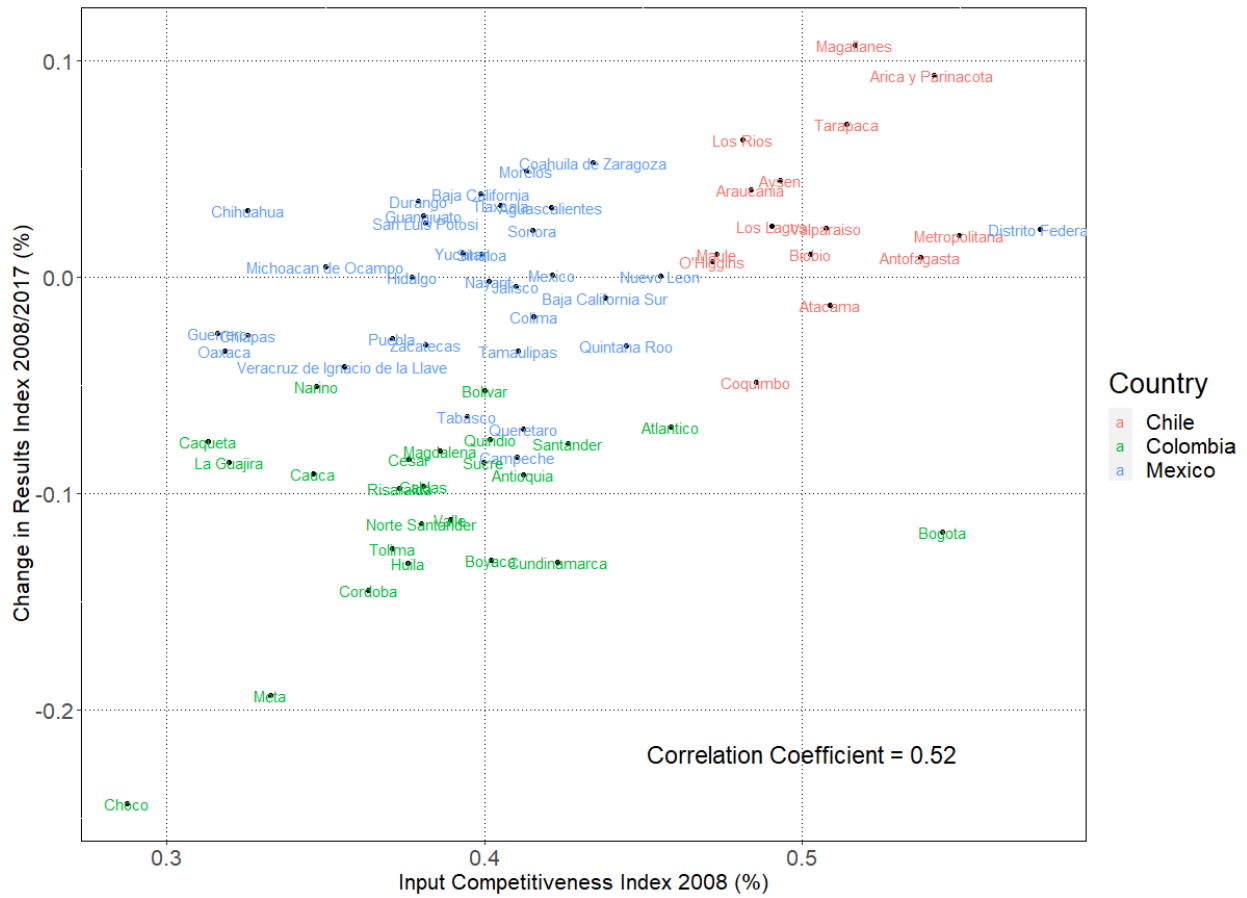
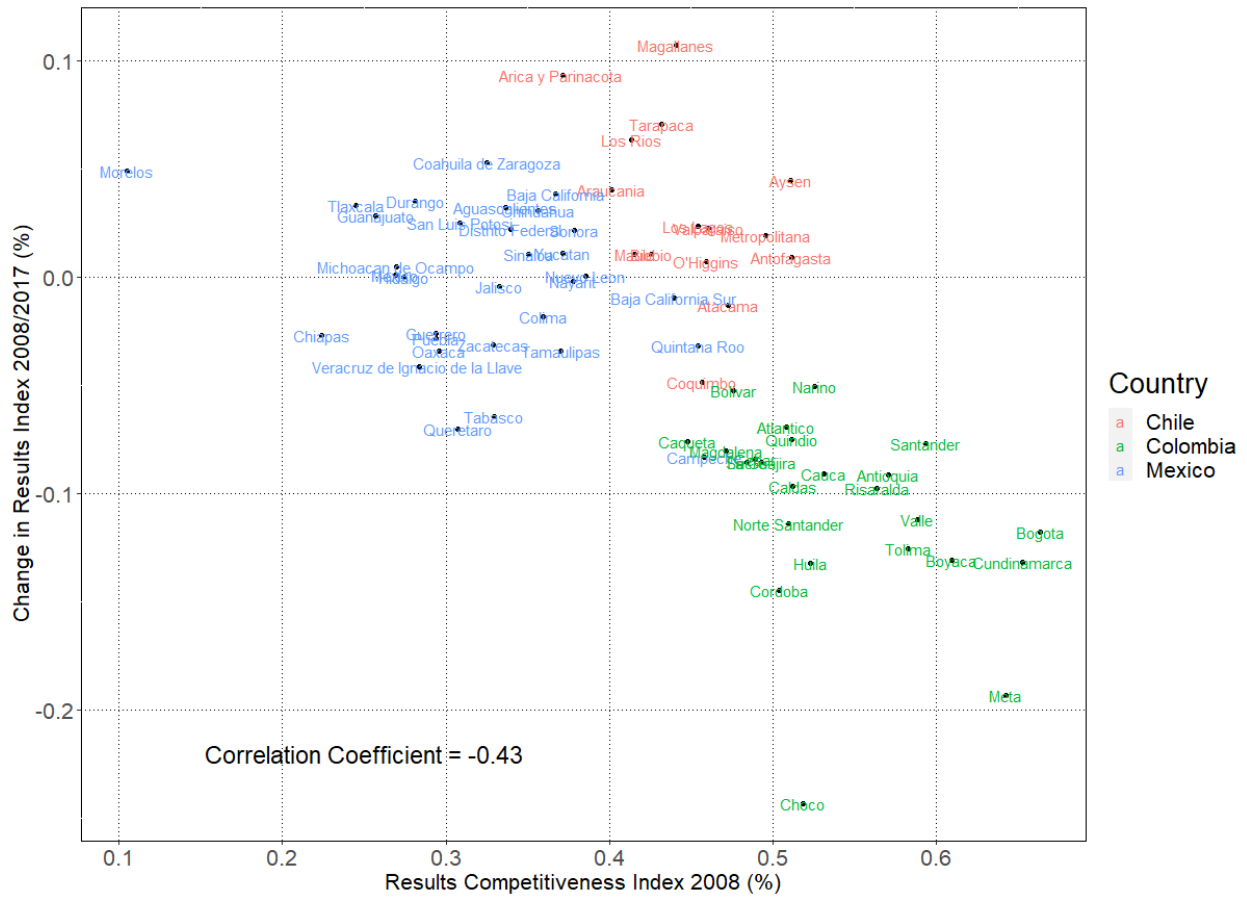


Gráfico 6. Cambios en el Índice de Competitividad de Resultados 2017/2008 vs Índice de Competitividad de Resultados 2008



La Tabla 5 muestra los coeficientes de variación (CV) del Índice de competitividad de resultados para los años 2008 y 2017 por país y para todas las regiones. En 2017, se observan menores niveles de CV para competitividad de resultados en Colombia, México y todas las regiones, lo que respalda la tendencia de convergencia observada en el gráfico 6. La disminución del CV se explica por los componentes económicos y ambientales que muestran una disminución del CV al 2017.

La dispersión del índice de competitividad de resultados en Chile es mayor en 2017 que en 2008, lo que sugiere una tendencia de divergencia que se explica por el aumento del CV en el componente de resultados económicos.

Table 5: Coeficiente de Variación (CV) para índice de Competitividad de Resultados y sus Componentes

Componente	Chile		Colombia		Mexico		Todas	
	2008	2017	2008	2017	2008	2017	2008	2017
Componente Económico	0.052	0.055	0.074	0.051	0.047	0.037	0.101	0.050
Componente Social	0.079	0.079	0.097	0.108	0.131	0.131	0.106	0.121
Componente Ambiental	0.147	0.083	0.085	0.101	0.059	0.059	0.284	0.231
Índice de Competitividad de Resultados	0.040	0.043	0.070	0.068	0.060	0.059	0.114	0.090

4.3. Cambios en la competitividad de resultados y sus factores inductores

La Tabla 6 muestra los resultados de regresión estimados utilizando un modelo de efectos mixtos de intercepto aleatorios para los países y efectos fijos para todas las demás variables explicativas. El uso de intercepto aleatorio permite controlar los "efectos del país" en el modelo. La variable dependiente es la variación del Índice de Competitividad de Resultados entre 2008 y 2017.

El modelo (1) evalúa la influencia del Índice de Competitividad de Resultados inicial y el efecto del Índice de Competitividad de Insumos de 2008. Ambos factores son significativos para determinar los cambios en el Índice de Competitividad de Resultados entre 2008 y 2017. El nivel inicial del Índice de Competitividad de Insumos aumentó el cambio en el índice de competitividad de resultados. Por otro lado, los mayores niveles del Índice de Competitividad de Resultados 2008 arrojan menores incrementos en el índice de resultados, mostrando un patrón de convergencia en este índice entre 2008 y 2017.

El modelo (2) agrega una variable binaria para las regiones que contienen una ciudad capital nacional con el fin de determinar la importancia de esta característica en esas tres regiones en particular: Metropolitana en Chile, Distrito Federal (DF) en México y Bogotá en Colombia. La variable binaria para Ciudad capital es significativa, lo que sugiere que las regiones que contienen ciudades capitales mostraron una variación significativamente menor en el Índice de Competitividad de Resultados entre 2008 y 2017.

Modelo (3) evalúa los factores individuales de competitividad de inputs. El modelo muestra significancia sólo para el factor "Salud y Sistema Social" y para el índice de competitividad de resultados de 2008.

El modelo (4) agrega la variable binaria para las regiones que contienen ciudades capitales al modelo (3), mostrando significancia sólo para el factor "salud y sistema socia" y el nivel 2008 del índice de competitividad de resultados, al igual que en el modelo (3).

Los resultados generales sugieren que los cambios en la competitividad de resultados entre 2008 y 2017 se explican por el nivel del Índice de Competitividad de Resultados en el 2008 y por el nivel de del Índice de Competitividad de Insumos en el 2008.

Adicionalmente, los modelos 3 y 4 permiten identificar como factores significativos al "salud y sistema social" y el modelo 2 identifica a las regiones que posee una ciudad capital como significativas sobre la variable dependiente.

De acuerdo con el criterio de Akaike y bayesiano, el modelo que combina el valor más bajo para ambos criterios es (2), por lo tanto, este sería el modelo con mayor potencia explicativa de los cuatro modelos. La particularidad de este modelo es que incluye el Índice de Competitividad de Inputs en su conjunto, no separado en factores individuales, y que incluye la variable binaria de "Ciudad Capital".

El hecho de que en el modelo (2) el nivel inicial del Índice de Competitividad de Inputs sea significativo, en su conjunto, es una indicación de que las mejoras en la competitividad de resultados pueden requerir de un enfoque sistémico para lograr avances.

El hecho de que regiones que alojan ciudades capitales en el modelo (2) tuvieron variaciones significativamente menores del Índice de Competitividad de Resultados entre 2008 y 2017 puede estar vinculado a la ley de rendimientos decrecientes, ya que estas regiones ya poseen inicialmente alta densidad, tamaño del mercado y altos niveles de concentración de la población y la producción.

Tabla 6: Resultados Modelo Lineal Mixto

Variable Dependiente: Variación 2008/2017 del Índice de Competitividad de Resultados				
Linear Mixed Model fit by Maximum Likelihood				
	(1)	(2)	(3)	(4)
Índice Competitividad de Resultados 2008	-0.3500***	-0.4020***	-0.3307***	-0.3176***
<i>Error Estándar</i>	<i>0.0627</i>	<i>0.0359</i>	<i>0.0679</i>	<i>0.0684</i>
Índice de Competitividad Input 2008	0.4272***	0.7081***		
<i>Error Estándar</i>	<i>0.0874</i>	<i>0.0705</i>		
Costos y Eficiencia 2008			-0.35764	-0.4080
<i>Error Estándar</i>			<i>0.3166</i>	<i>0.3171</i>
Infraestructura Regional 2008			-0.00224	0.0588
<i>Error Estándar</i>			<i>0.0583</i>	<i>0.0795</i>
Instituciones 2008			-0.06931	-0.0633
<i>Error Estándar</i>			<i>0.046</i>	<i>0.0460</i>
Educación e Innovación 2008			0.05739	0.0498
<i>Error Estándar</i>			<i>0.0539</i>	<i>0.0538</i>
Salud y Sistema Social 2008			0.2367***	0.2326***
<i>Error Estándar</i>			<i>0.0682</i>	<i>0.0677</i>
Estructura Económica 2008			0.0502	0.0792
<i>Error Estándar</i>			<i>0.0936</i>	<i>0.0963</i>
Ciudad Capital		-0.0664***		-0.0350
<i>Error Estándar</i>		<i>0.0226</i>		<i>0.0313</i>
Intercepto	-0.0275	-0.031***	-0.0193	-0.0192
<i>Error Estándar</i>	<i>0.0125</i>	<i>0.0040</i>	<i>0.0238</i>	<i>0.0239</i>
Número de observaciones	71	71	71	71
R cuadrado marginal	0.573	0.750	0.658	0.660
R-cuadrado condicional	0.686	0.750	0.881	0.884
Criterio Akaike	-263.395	-267.283	-267.884	-267.118
Criterio Bayesiano	-252.081	-253.707	-245.257	-242.228

Códigos de Significancia: '***' 0.01, '**' 0.05, '*' 0.1, ' ' 1. Valores del error estándar en cursivas.

4.4. Regiones de Mayor Ranking de Competitividad y Categorías

Dado que existen dos índices de competitividad: la competitividad de inputs y resultados, las regiones de mayor competitividad pueden presentar un ranking alto para ambos índices de competitividad o para un sólo uno. Por lo tanto, las regiones de mayor ranking se seleccionan y dividen según los tres casos posibles que se detallan a continuación.

Caso 1: Alta Competitividad de Inputs / Alta Competitividad de Resultados

Este caso representa las regiones que son competitivas bajo la definición de esta tesis, al tener la capacidad (inputs) competitiva y por lograr un resultado competitivo para los residentes y trabajadores de la región, en términos económicos, sociales y ambientales.

La Tabla 7 muestra regiones seleccionadas para el Caso 1. Los valores en rojo se presentan cuando un factor de inputs o un componente de resultados tiene un valor inferior a la media de todas las regiones. Los valores en azul representan un valor máximo para ese factor o componente.

La mayoría de las regiones que tienen niveles superiores para ambos tipos de competitividad son de Chile. Sólo Bogotá, que aloja la capital de Colombia, tiene rankings elevados para ambos tipos de competitividad.

En cuanto a la competitividad de los insumos, el factor de eficiencia está por debajo del promedio de todas las regiones seleccionadas de Chile y justo por encima del promedio de Bogotá. Este resultado sugiere que estas regiones no basan su competitividad en los bajos costos, sino más bien en factores como la innovación, la educación o la salud.

Todas las regiones tienen niveles altos en los factores de “innovación y educación” y factores de “salud y sistema social”. Bogotá tiene el nivel más alto en el factor “infraestructura regional” de toda la muestra de regiones.

Bogotá (Colombia), Metropolitana (Chile) y Valparaíso (Chile), son regiones que constituyen polos económicos cruciales dentro de sus países, Bogotá y Metropolitana alojando la capital, y por

ende, servicios críticos y la región de Valparaíso, albergando los principales puertos chilenos (Valparaíso y San Antonio), y una amplia variedad de servicios turísticos. Del mismo modo, Antofagasta (Chile) y Tarapacá (Chile) son regiones altamente competitivas que se especializan en la minería, específicamente en la extracción de cobre, la principal exportación de Chile.

Tabla 7. Caso 1: Alta Competitividad de Inputs / Alta Competitividad de Resultados

Región País	Bogotá	Metropolitana	Antofagasta	Tarapacá	Valparaíso	Todas las regiones			
	Colombia	Chile	Chile	Chile	Chile	Mean	St Dev	Max	Min
Ranking Inputs	1	3	4	5	8				
Ranking Resultados	3	7	5	8	9				
Eficiencia	0.45	0.32	0.37	0.33	0.32	0.43	0.06	0.50	0.31
Infraestructura Regional	0.81	0.52	0.50	0.49	0.49	0.21	0.18	0.81	0.02
Estructura económica	0.34	0.31	0.16	0.19	0.23	0.21	0.04	0.37	0.14
Innovación y educación	0.56	0.67	0.64	0.58	0.64	0.52	0.13	0.88	0.10
Salud y Sistema social	0.79	0.80	0.81	0.86	0.71	0.67	0.09	0.86	0.32
Instituciones	0.56	0.78	0.78	0.78	0.79	0.48	0.20	0.80	0.00
Resultado Económico	0.23	0.24	0.39	0.28	0.22	0.20	0.05	0.39	0.07
Resultado Social	0.87	0.75	0.64	0.71	0.65	0.59	0.12	0.89	0.18
Resultado Ambiental	0.80	0.76	0.57	0.65	0.81	0.55	0.23	0.86	0.04

Caso 2: Alta Competitividad de Inputs / Baja Competitividad de Resultados

El caso 2 corresponde a regiones que tienen alto nivel de competitividad de inputs pero que carecen de resultados de competitividad. Este caso podría representar a regiones que no han sido capaces de transferir su capacidad competitiva a un resultado competitivo para sus ciudadanos y empresas.

En la Tabla 8 se presentan regiones seleccionadas para el Caso 2. En general, estas regiones muestran altos niveles en el factor “innovación y educación”, el Distrito Federal de México, tiene el mayor valor de este factor entre todas las regiones. Por otro lado, Nuevo León, presenta puntajes por debajo del promedio en muchos factores, pero puntajes relativamente altos en “innovación y educación” y “salud y sistema social”.

Tabla 8. Caso 2: Alta Competitividad de Inputs / Baja Competitividad de Resultados

Región País	DF	Arica Parinacota	y Biobío	Nuevo Leon	Atlántico	Todas las regiones			
	Mexico	Chile	Chile	Mexico	Colombia	Mean	St Dev	Max	Min
Ranking Inputs	2	6	9	20	18				
Ranking Resultados	49	18	26	42	24				
Eficiencia	0.49	0.32	0.32	0.48	0.44	0.43	0.06	0.50	0.31
Infraestructura Regional	0.68	0.44	0.46	0.16	0.29	0.21	0.18	0.81	0.02
Estructura económica	0.37	0.28	0.27	0.21	0.23	0.21	0.04	0.37	0.14
Innovación y educación	0.88	0.61	0.57	0.69	0.56	0.52	0.13	0.88	0.10
Salud y Sistema social	0.67	0.77	0.74	0.76	0.66	0.67	0.09	0.86	0.32
Instituciones	0.35	0.79	0.79	0.36	0.53	0.48	0.20	0.80	0.00
Resultado Económico	0.31	0.22	0.18	0.27	0.21	0.20	0.05	0.39	0.07
Resultado Social	0.70	0.63	0.57	0.61	0.67	0.59	0.12	0.89	0.18
Resultado Ambiental	0.22	0.73	0.81	0.35	0.62	0.55	0.23	0.86	0.04

Caso 3: Baja Competitividad de Inputs / Alta Competitividad de Resultados

El caso 3 representa regiones que muestran altos niveles de competitividad de resultados a pesar de tener bajos niveles de competitividad de inputs. Este caso podría representar regiones que han podido obtener resultados competitivos debido a factores que no están relacionados con los inputs de competitividad, ó regiones que tuvieron alta competitividad de inputs en el pasado y no han podido mantener esos altos niveles en el 2017.

La Tabla 9 muestra las regiones seleccionadas para el Caso 3. Este tipo de regiones tienen altos niveles de competitividad de resultados, a pesar de no contar con los inputs de competitividad para lograr este resultado. Algunas de estas regiones pueden estar obteniendo transferencias de otras regiones, por ejemplo, en el caso de Aysén y Magallanes, existe una elevada presencia y apoyo del gobierno central chileno, ó en el caso de Cundinamarca, dónde podría haber externalidades positivas obtenidas por su proximidad a la capital del país, Bogotá.

Tabla 9: Caso 3: Baja Competitividad de Inputs / Alta Competitividad de Resultados									
Región	Aysén	Cundinamarca	Magallanes	Santander	Baja California Sur	Todas las regiones			
País	Chile	Colombia	Chile	Colombia	Mexico	Mean	St Dev	Max	Min
Ranking Inputs	17	29	7	19	33				
Ranking Resultados	1	4	2	6	27				
Eficiencia	0.32	0.44	0.33	0.45	0.47	0.43	0.06	0.50	0.31
Infraestructura Regional	0.39	0.21	0.50	0.23	0.18	0.21	0.18	0.81	0.02
Estructura económica	0.25	0.18	0.26	0.19	0.15	0.21	0.04	0.37	0.14
Innovación y educación	0.50	0.49	0.60	0.57	0.59	0.52	0.13	0.88	0.10
Salud y Sistema social	0.79	0.63	0.73	0.67	0.77	0.67	0.09	0.86	0.32
Instituciones	0.74	0.56	0.80	0.58	0.27	0.48	0.20	0.80	0.00
Resultado Económico	0.26	0.21	0.25	0.23	0.29	0.20	0.05	0.39	0.07
Resultado Social	0.77	0.89	0.78	0.81	0.68	0.59	0.12	0.89	0.18
Resultado Ambiental	0.85	0.77	0.86	0.73	0.41	0.55	0.23	0.86	0.04

5. Conclusiones

5.1. Preguntas de Investigación

5.1.1 Pregunta 1.1. ¿Cuál es la definición de región competitiva? ¿Qué características específicas tiene una región competitiva? ¿Hay regiones competitivas en América Latina? ¿Hay elementos comunes entre las regiones competitivas de América Latina?

Definición y características de la competitividad regional

La competitividad regional es *"la capacidad de una región para cumplir de manera sostenible los objetivos económicos, sociales y ambientales a sus ciudadanos y trabajadores"*. Regiones competitivas ofrecerán un "entorno" que impulse la productividad de las empresas.

Adicionalmente, una región competitiva necesita ofrecer condiciones atractivas tanto para las empresas como para sus residentes; la región tiene que ser atractiva para que los trabajadores permanezcan en esa región. Regiones atractivas ofrecen mayor bienestar para su población y sus trabajadores, y esto implica tener buenos resultados económicos, sociales y ambientales. Además, para que una región sea verdaderamente competitiva debe poseer las "capacidades" y los "resultados" competitivos. De la misma forma, la sostenibilidad es una condición mínima para lograr la competitividad porque permitirá un elevado rendimiento de manera sostenida para las empresas.

Siguiendo la definición, la competitividad regional puede evaluarse midiendo "factores de capacidades competitivas ó inputs" y "componentes de resultados competitivos".

Los factores de entrada permiten a la región ofrecer entorno atractivo y sostenible para que se asienten las empresas y los residentes y constituyen una "capacidad potencial" de producir un resultado competitivo.

Hay dos tipos de factores de entrada o inputs. El primer tipo de factores de inputs corresponde a los que conducen a la "competitividad de bajo nivel": bajos costos y eficiencia. El segundo tipo de

factores de inputs es de mayor complejidad y conduce a una "competitividad de alto nivel". Entre ellos se encuentran la infraestructura regional, estructura económica, innovación, educación, salud, sistema social e instituciones.

Por otro lado, los componentes de resultados competitivos son los niveles reales de rendimiento y bienestar que la región logró. Siguiendo una definición integral de bienestar, el resultado competitivo abarca componentes asociados al desempeño económico, social y ambiental de la región.

En resumen, las regiones que son competitivas bajo la definición de esta tesis son aquellas que tienen altos niveles tanto de competitividad de "Inputs" como de "Resultados", ya que son regiones que poseen la capacidad (inputs) de generar bienestar a través de la productividad y que además logran un resultado efectivo para los habitantes de la región en términos económicos, sociales y ambientales (resultados).

Regiones Competitivas en América Latina

Algunas regiones competitivas en América Latina son Bogotá (Colombia), región Metropolitana (Chile), Antofagasta (Chile), Tarapacá (Chile) y Valparaíso (Chile). Todas estas regiones tienen elevados puntajes en los índices de competitividad de inputs y resultados en el 2017. No existen regiones de México en esta categoría, ya que la región de mayor ranking, el Distrito Federal, no posee altos puntajes para el índice de Competitividad de Resultados, y por lo tanto, no puede ser considerada competitiva bajo la definición de competitividad esta tesis.

Las regiones chilenas presentan mayores niveles, en general, de Competitividad de Inputs y Resultados en comparación a las regiones de Colombia y México.

Los puntajes más altos del índice de Competitividad de Inputs en América Latina se encuentran en las regiones alojan la capital de cada país: Bogotá en Colombia, DF en México y Metropolitana en Chile. El resto de las regiones de mayor ranking para el Índice de Competitividad de Inputs corresponden principalmente a regiones de Chile.

Por otro lado, las regiones con los niveles más altos del índice de Competitividad de Resultados son Bogotá (Colombia), Aysén (Chile) y Magallanes (Chile), estas regiones muestran los mayores

niveles de indicadores sociales, económicos y ambientales en el 2107. Los rankings del Índice De Competitividad de Resultados más altos se distribuyen entre regiones de Chile y Colombia, y las regiones de México muestran, en general, rankings más bajos del Índice de Competitividad de Resultados.

Varias regiones de Colombia se encuentran entre los rankings más bajos de competitividad, y esta situación se acentúa más en el Índice de Competitividad de Inputs. Esto indica que las regiones de Colombia tienen buenos resultados competitivos, a pesar de no tener las más altas capacidades competitivas, lo que podría explicarse por un alto desempeño competitivo en el pasado, anterior al período estudiado.

Estos resultados son similares a las tendencias generales observadas por Rodríguez y Vial (2020) en el Índice de Desarrollo Regional para América Latina (IDERE LATAM), donde identifican a las regiones que alojan polos urbanos y capitales como las que tienen índices de desarrollo más alto, y a Chile con mayores niveles de desarrollo regional, en general, en comparación con otros países, incluyendo Colombia.

Varias regiones de México también se encuentran en los rankings más bajos de competitividad, aunque a diferencia de Colombia, esta situación se acentúa más en el Índice de Competitividad de Resultados. Las regiones en México tienen las capacidades competitivas potenciales para alcanzar un buen desempeño competitivo, pero aún no son capaces de lograr esos resultados.

En el caso de Chile, como la categoría de competitividad más baja no está presente en el 2017, la brecha de competitividad entre las regiones de mayor y menor ranking es menor que la de Colombia y México. Así, las desigualdades en términos de competitividad regional, medidas a través de los índices de Competitividad de Inputs y Resultados, son menores en Chile.

5.1.2. Pregunta 2. ¿Qué mejora el desempeño económico regional, el bienestar social y la sostenibilidad medioambiental? ¿Cómo se miden estos aspectos?

El avance en competitividad regional se mide a través de la variación entre 2008 y 2017 del Índice de Competitividad de Resultados, que permite resumir el desempeño económico, bienestar social y sostenibilidad ambiental de una región.

Niveles iniciales de competitividad de Inputs

Las regiones con niveles iniciales más altos de Índice de Competitividad de Inputs arrojaron mayores avances en el Índice Competitividad de Resultados. Los resultados econométricos indican que el nivel del Índice de Competitividad de Insumos del 2008 de una región fue significativo en el aumento del Índice de Competitividad de Resultados entre 2008 y 2017. Esto es importante ya que las regiones que inicialmente tenían niveles más altos de Competitividad de Inputs tuvieron un mayor progreso en los resultados económicos, sociales y ambientales y, por lo tanto, un mayor progreso en el bienestar de la población.

Regiones que alojan Capitales

Las tres regiones que alojan capitales presentan un comportamiento atípico tanto en los niveles de competitividad como en su dinámica entre 2008 y 2017. Las tres regiones que contienen las capitales nacionales de cada país tienen niveles inusualmente altos de competitividad en comparación con otras regiones de sus respectivos países. Adicionalmente, las regiones que alojan una ciudad capital tuvieron una variación significativamente menor del Índice de Competitividad de Resultados entre 2008 y 2017. En el caso del Índice de Competitividad de Inputs, estas tres regiones presentaron niveles muy altos del Índice de Competitividad de los Inputs en 2008, pero el progreso en este indicador fue relativamente menor en comparación a las otras regiones de sus respectivos países.

Este hecho puede estar vinculado a la ley de rendimientos decrecientes, ya que estas regiones inicialmente poseían altos niveles de Índice de Competitividad de Resultados, alta densidad, tamaño del mercado, altos niveles de concentración de la población y la producción. Sin embargo, la verificación de esta teoría requerirá más investigación y estudio específicos.

La comparabilidad de regiones entre países tendría más sentido cuando se comparan regiones altamente competitivas, como Distrito Federal (México), Bogotá (Colombia) y Metropolitana (Chile), que compiten por capital, trabajadores calificados e inversión extranjera.

El hecho de que Bogotá y el Distrito Federal muestren niveles inusualmente altos de competitividad de inputs y resultados, en relación con las otras regiones de sus respectivos países, puede ser una señal de que están compitiendo de una manera diferente a las otras regiones de esos países. Siguiendo esta lógica, las regiones que tienen capitales, debiesen ser consideradas casos atípicos dentro de sus países, ya que no representan la realidad general de la mayor parte de otras regiones, especialmente en el caso de Colombia y México.

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Las regiones que poseen niveles de competitividad media y baja se agrupan en torno a las medias nacionales, y esto es una indicación de que estas regiones pueden no estar compitiendo de la misma manera que lo hacen las regiones altamente competitivas. Para este tipo de regiones, la comparación de la competitividad regional dentro del país podría ser más adecuada para identificar los factores asociados a la competitividad regional.

Estas las tendencias generales descritas para la competitividad de los inputs y los resultados sugieren que existe un marcado efecto país y que la competitividad puede verse fuertemente influida por los factores nacionales. Estos resultados son consistentes con la revisión de la literatura que considera al entorno o “milieu” un factor crítico en el éxito o el estancamiento de una región (Esser *et al*, 1996; Porter, 1998; Camagni, 2003; Bochma, 2010; Polesse, 2020).

Convergencia de la Competitividad de Resultados

Los resultados de la investigación muestran la existencia de una tendencia convergente en el Índice de Competitividad de Resultados, ya que el coeficiente de variación de este índice disminuyó entre 2008 y 2017 para toda la muestra de regiones. Los componentes económicos y ambientales son los que explican la mayor parte de la reducción de la dispersión entre 2008 y 2017.

Los resultados econométricos también sugieren una tendencia de convergencia regional del Índice de Competitividad de Resultados en el período 2008-2017, ya que las regiones con niveles iniciales más bajos de Índice de Competitividad de Resultados crecieron más en comparación con las regiones con niveles más altos, lo que les permitió avanzar más rápido en su nivel de competitividad de resultados. Esta situación puede estar vinculada a una ley de retornos decrecientes en aquellas regiones que ya cuentan con altos niveles del Índice de Competitividad de Resultados. Sin embargo, la confirmación de esta teoría requiere más investigación y estudio específico.

5.2.3. Pregunta 3. 1. ¿Qué factores promueven la competitividad regional? ¿Estos factores son elementos endógenos ó externos a la región? ¿Varían los factores que impulsan la competitividad de una región a otra?

Factores Endógenos

Los factores relacionados con la infraestructura regional, la innovación y la educación, y las instituciones presentan una mayor variación en el período estudiado, y explicarían la mayoría de las diferencias regionales de competitividad de Inputs.

El factor de competitividad de Inputs que tiene más incidencia sobre los cambios en el Índice de Competitividad de Resultados es el "Salud y Sistema Social". Este factor se mide a través de los siguientes indicadores: esperanza de vida al nacer, tasa de mortalidad infantil y tasa de dependencia de las personas de edad.

Las regiones especializadas en sectores de exportación son regiones altamente competitivas. Ejemplos de este tipo de regiones son Antofagasta (Chile) y Atacama (Chile) especializadas en el sector minero exportador. Estas regiones poseen altos niveles de indicadores tanto para la competitividad de Inputs como de Resultados.

Factores externos

Algunos factores externos pueden aumentar los niveles del Índice De Competitividad de Resultados en ciertas regiones. Aysén (Chile), Cundinamarca (Colombia) y Magallanes (Chile)

son regiones que tienen altos niveles de Competitividad de Resultados, a pesar de tener bajos niveles de Competitividad de Inputs. Estas regiones no son consideradas competitivas bajo la definición adoptada por esta tesis, ya que no poseen las capacidades competitivas para avanzar o mantener los niveles de Competitividad de Resultados sin la existencia de factores externos, como el apoyo del gobierno central en el caso de Aysén y Magallanes ó por las externalidades positivas asociadas a la proximidad a la ciudad capital en el caso de Cundinamarca.

5.2.4. Pregunta 4. • Se sabe que la innovación y la tecnología son factores clave en la promoción de la competitividad regional; ¿se aplica esto también a la competitividad regional en América Latina? ¿Qué tipo de factores de innovación han tenido éxito?

Las regiones competitivas, es decir, las regiones que alcanzan altos niveles de competitividad tanto de Inputs como de Resultados poseen también altos valores en indicadores asociados a los factores de Innovación y Educación en 2017.

En cuanto a la competitividad de Inputs, el factor “Eficiencia” está por debajo del promedio para todas las regiones seleccionadas de Chile y justo por encima del promedio de Bogotá en 2017. Esto sugiere que las regiones altamente competitivas no basan su competitividad en insumos de "bajo nivel", sino en insumos complejos como la innovación, la educación o la estructura económica.

Los resultados econométricos indican que otros factores de competitividad de insumos además de "Salud y Sistema Social" no aumentaron significativamente el Índice de Competitividad de Resultados entre 2008 y 2017. Sin embargo, los resultados econométricos también muestran que el Índice de Competitividad de Inputs en su conjunto aumentó significativamente el Índice de Competitividad de Resultados. Este resultado sugiere que el impulso de la competitividad tiene éxito cuando es como un esfuerzo sistemático y que comprende a todos los factores de competitividad de inputs, y no solo factores individuales. En otras palabras, avanzar en los Resultados Competitivos requiere de una mejora en todos los factores relacionados con la Competitividad de Inputs, incluyendo la innovación y la tecnología.

Las implicaciones en la formulación de políticas son importantes, ya que la promoción sistemática de las capacidades competitivas en las regiones menos aventajadas sería crucial para elevar el desempeño económico, social y ambiental en esas regiones, aumentando así el bienestar de su población.

5.2. Preguntas para futuras investigaciones

La existencia de indicadores regionales comparables entre países ayuda a comprender el desempeño regional. Es necesario mejorar la estandarización de las estadísticas regionales en América Latina y aumentar la disponibilidad de indicadores a nivel regional, especialmente aquellos relacionados con factores ambientales e institucionales, los cuales son escasos de encontrar a nivel regional.

Aumentar la cobertura geográfica en la aplicación de los Índices de Competitividad puede ayudar a entender si estos resultados pueden extrapolarse a otros países de América Latina. Investigación en ese sentido consistiría en la construcción de los índices de competitividad para regiones de otros países en el mismo período de estudio 2008-2017.

El estudio en un período de tiempo más largo permitiría obtener más pruebas para demostrar si la dinámica de la competitividad regional se mantiene y permitiría robustecer la evidencia sobre el vínculo observado entre competitividad de Inputs y Resultados. La investigación para esto consistiría en la construcción de los índices de competitividad en un período que va más allá de 2008 - 2017.

La influencia del efecto país sobre la competitividad de los resultados es consistente con Esser *et al* (1996) y Polesse (2020) que afirman que para que las regiones y ciudades tengan éxito debe haber un estado nacional funcional, que comprenda el conjunto de valores, la cultura general, las normas y las instituciones. Se necesita investigación en profundidad sobre estos aspectos para identificar cuáles factores específicos nacionales tienen una mayor influencia en la competitividad regional.

En síntesis, un análisis más detallado de los factores que impulsan la competitividad, incluidas las regiones de otros países de América Latina y en un período de tiempo más largo, aumentará la

robustez de las conclusiones y aumentaría la comprensión del efecto país, de las capacidades competitivas y de las características generales de las regiones competitivas en América Latina.