FGV PROJETOS

BRAZIL COMPETITIVE PROFILE

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CONTENT

PRESENTATION

As the Brazilian economy struggles for its reorganization, it is urgent to establish policies which will make the country attractive to foreign investors. The success of these potential investments, moreover, fully depends on a deep knowledge of the country's diversity, of its idiosyncrasies, and of its specific and local productivity potentials.

This study provides sectoral indicators depicting Brazil's competitive profile in detail, examining regions and sectors. Elaborated by FGV Projetos and published by the Financial Times in a special volume, it aims at contributing to an improved understanding of the economic sectors in the country.

The study is the first of a series which will be published every year, and which will be made available to experts, government officials, and interested investors who wish to consult it.

We hope that this unique and impartial work will make an actual contribution to Brazil's economic and social development.

Enjoy the reading!

Cesar Cunha Campos
Director
FGV Projetos

1. INTRODUCTION

I. AN INNOVATIVE APPROACH TO COMPETITIVENESS

The Brazil Competitive Profile is a dynamic multi-level analysis of Brazilian competitiveness, built on a solid base of empirical support, methodological rigor and the latest available data.

This rich knowledge source is designed to go beyond common grounds by highlighting interesting phenomena which may be further investigated through in-depth data analysis and case studies.

The main goal of the project is to draw lessons from the data and spur debate among private and public decision-makers, thus enriching the discussion on Brazil's present and future.

The project relies on benchmarking existing studies of global and country competitive and expanding them in a number of ways, as will be detailed in the following sections.

INNOVATIVE ASPECTS OF THE BRAZIL COMPETITIVENESS PROFILE

1. The data set used to assess the competitiveness of different Brazilian localities is unique in scope and quality. It includes 224 indicators across 14 dimensions which, for reasons of accessibility and analysis, have been organized into 6 key vectors of competitiveness.
2. Beyond the aggregated index which positions micro-regions according to their relative competiveness, the main breakthrough of the study lies in the data presented for each dimension and vector of competitiveness. This enables policy-makers, investors and the general public to identify, for each micro-region, those specific factors which drive and limit its competitiveness. A better understanding of the relative strengths and weaknesses of each locality helps decision-makers to make better use of comparative advantages, identify priorities for improvement, and trace strategies to encourage growth and investment across regions and sectors.
3. The dimensions and their respective indicators are tailored to reflect the issues that matter for the development of Brazil, considering the data available on a consistent basis for the 26 states and the Federal District, as well as for the 5,570 municipalities.
4. Last but not least, it is the first study of its kind that combines macro and micro aspects of competitiveness. On the micro-level it measures and compares the competitiveness of 558 micro-regions. On the macro-level it measures and compares the impact of fiscal burden and exchange rate on the competitiveness of 56 productive sectors. These two units of analysis will be presented in more detail on the following pages.

ANALYTICAL FOCUS I: 558 MICRO-REGIONS

In today's global economy, countries, regions and cities are constantly being watched. Monitoring, benchmarking, and measuring "performance" and "best practices" have assumed key significance for policy-makers and analysts, as well as international organizations such as the World Bank, the IMF and the OECD. More recently, emphasis has been placed on regional competitiveness, mirroring a growing evidence that many of the factors that raise economic productivity are generated at sub-national scales.

In a continent-sized country like Brazil, a regional comparative approach to competitiveness is particularly useful. However, a comprehensive analysis of Brazilian competitiveness across sub-national scales is lacking.

The Brazil Competitive Profile seeks to fill this gap by assessing how different localities in Brazil are developing across different dimensions of competitiveness.

The analysis has been carried out on each of the 5,570 Brazilian municipalities and then aggregated at the level of its 558 micro-regions. A closer look at the territorial division of Latin America's largest country (8,514,000 square kilometers) explains this methodological choice: Brazil is divided into 27 federal units and 5,570 municipalities (or political-administrative regions; see Maps 1 and 2 on the following page) as well as 5 macro-regions and 558 micro-regions (or functional regions; see Maps 3 and 4 on the following page).

Each micro-region is formed by a group of adjacent municipalities and defined by IBGE (the national statistics institute) according to similar characteristics regarding the production structures and social strata of its municipalities. This fact makes the micro-region a more interesting and relevant unit of analysis for foreign and Brazilian investors, as compared to municipalities (which are defined for political reasons rather than socio-economic logic) or federal units. The latter would render the regional competitiveness analysis less accurate, as they include localities that differ substantially in socio-economic characteristics.

The second part of this report (2. Measuring The competitivenessness Of Brazil's 558 Micro-Regions) presents the research approach and first results in the form of maps, rankings and supporting analysis. The micro-regions are ranked in an aggregated index and in accordance with their score per individual dimension and selected component.

Each map is accompanied by a list of the 20 highest-ranking micro-regions. In order to enrich the analysis, the 26 Brazilian states and the federal district are ranked according to individual indicators. For these cases, the 5 best and 5 worst-ranking states are listed.

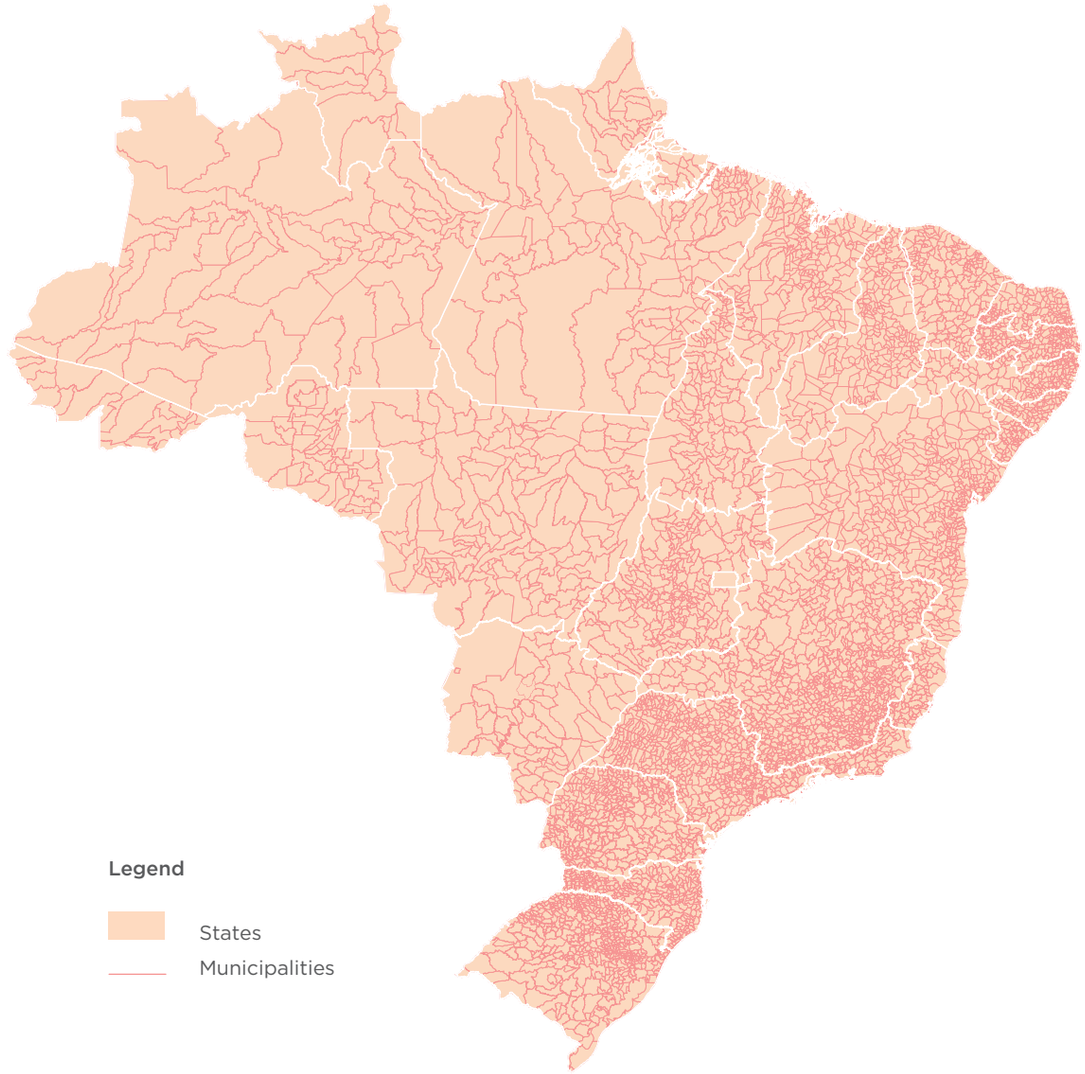
Map 1: Functional regions, 5 Macro-regions

Source: IBGE

Map 2: Political-administrative regions, 27 Federal Units

Source: IBGE

Map 3: Political-administrative regions, 5570 Municipalities



Source: IBGE

Map 4: Functional regions, 558 Micro-regions

Source: IBGE

ANALYTICAL FOCUS II: 56 PRODUCTIVE SECTORS

Brazil is among the countries with the highest business tax burden in the world. According to the OECD, the total commercial tax, as a percentage of its profits, amounted to 69% in 2014. The business tax burden imposed by Brazil's international and regional competitors China and Mexico is lower (64,6% and 52% respectively) and significantly lower in other Latin American countries, such as Chile (28%). A second factor which considerably influences Brazil's international competitiveness is the exchange rate. According to the Open Market Index of the International Chamber of Commerce, Brazil ranked 67 out of 75 countries in 2013. On the other hand, some of its products have recently been integrated into global value chains and contribute to expand import and export volumes. This environment generates a lot of debate about the optimum exchange rate.

In order to advance this debate, the third part of this report (Macro-Economic Variables And Sector competitivenessness) provides investors and policy-makers with a comprehensive analysis of the influence of exchange rate and taxes on the competitiveness of 56 productive sectors of Brazil. All information will be presented in the form of illustrative graphs supported by accessible analysis.

All in all, the Brazil competitiveness Profile offers international and Brazilian investors a source of qualified insights into which regions, states and sectors offer the best opportunities, both overall and in specific areas. At the same time, Brazilian policy-makers find solid evidence for weaknesses, strengths and underlying trends of development which will hopefully be transformed into sustainable policy action and more sound investment decisions.

Before presenting first results for each of the two units of analysis, the concept of competitiveness which guides the analysis will be discussed briefly.

II. DEFINING THE CONCEPT OF COMPETITIVENESS

There have been many definitions for the term "competitiveness" over the years. At face value, it implies not only a potential, a latent ability to compete, but also the presence of circumstances that enable such a capacity to be actualized. This notion of a meeting between a potential and the conditions for its actualization unlocks a common thread among ideas that otherwise risk being linked only by a slight elusive move.

Take the dual issues of exchange rate and tax rate differentials, featured throughout this report: on their own, these could be symptoms of what Paul Krugman diagnosed in 1994 as the "dangerous obsession" of competitiveness – one that could displace sound macro-economic policy. By the same token, however, obsessive measures to increase potential productivity, while important and

particularly urgent in Brazil, are only as effective as the macro-economic environment will allow, as an often-overvalued Real, an uncommonly heavy tax burden and a generally unfavorable business environment pile on effective costs and prices.

Competitivenessness is often contrasted with simple competition by highlighting the commonality of mediating factors across firms. This is not always clear-cut, as even firms competing within a nation prosper together as the business environment and markets evolve. Usually, however, such terms are used to evoke a wider set of common constraints. For example, classical, now-discredited "secular under-development" theories argued that terms of trade were structurally biased against industrial sectors in Latin America, making competitiveness a pure matter of policy. An opposite, extreme "open-economy" view would argue that differentials in productivity drive international trade and prices, thus occupying "competitiveness" wholly, regardless of mediating constraints. Actual macro-economic dynamics aside, these contrasts between extreme views further drive the point that "competitiveness" lies neither entirely in the structural realm of potential productivity, nor in the economic imbalances that would profit from "table-tilting" policies. This is probably also true for a new context in which "competitiveness" has become a popular analytical category: regional economics.

IN FOCUS: REGIONAL COMPETITIVENESS

Harvard professor Michael Porter, noted author on territorial competitiveness, has argued for an "endowment"-oriented approach that closely mirrors the potential-enabling concept presented above. Porter's split between inherited (or exogenous) endowments, such as agricultural and energy resources, and advanced (or endogenous) endowments such as institutions, technology and knowledge, translates into a partition between factors that enable production to compete, and factors that determine latent productivity.

In fact, Porter's theory of advanced endowments allows to zoom into the dynamics of latent productivity. Firstly, counting technological innovation as endowment enables one to see productivity growth as a slow accrual – one that can be driven by pro-business policies, but not jilted by short-term government intervention. Secondly, Porter's characterization of these endowments as "endogenous" connects the competitiveness debate back to growth theory and post-1980s models with endogenous technology, R&D and spill-over effects from human capital. In a multi-regional context, it also raises the question of labor mobility and quality of life differentials.

The nature of Porter's "exogenous factors" is also instructive. This report has mentioned macro-economic issues that might generate an uneven playing field among agents with the same potential productivity. Porter's emphasis on the particular features of the natural environment of a given locality translates, in a more general context, into an emphasis on the structural constraints that would shape the long-term profile of the economy. This also harkens back to macro-economics, namely comparative advantage and Heckscher-Ohlin Theory.

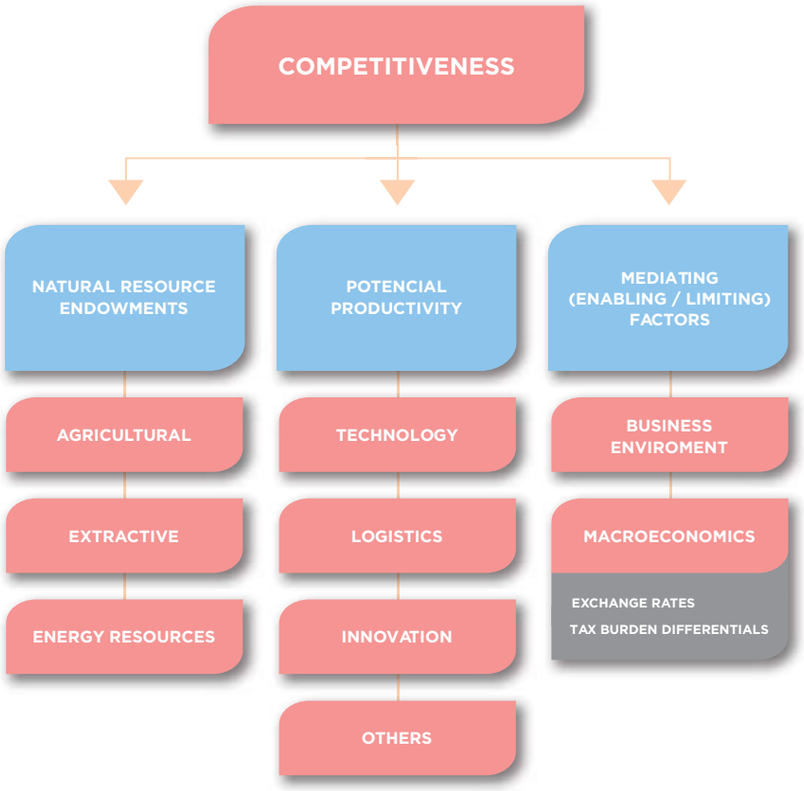
THE OPEN-ENDEDNESS OF COMPETITIVENESS

These links between terms that are both rhetorically charged and highly abstract – such as "competitiveness" – and closely-specified economic theory have clarifying virtues: it is known what is over-simplified about Heckscher-Ohlin theory (for one, purchasing-power parity applies in exchange rates). Linking back to endogenous growth theory also highlights the role of human capital (as in Paul Romer's work) and institutions (as, for example, in Acemoglu, Robinson and North). Ultimately, the fact that such clarifying links have to be teased out from the rhetoric highlights an aspect that is both a weakness and a core strength of competitiveness as an analytical concept: its open-endedness.

On the down side, competitiveness is a vague enough notion that it risks various kinds of abuse as ad-hoc justification for poorly-thought policy, particularly where no metrics are being taken and followed through. At the same time, however, competitiveness is a concept that is closer to actual, concrete questions – particularly at the policy level and investor decision-making level – than to abstract considerations that could make it logically whole.

What makes sectors and regions succeed in a competitiveness situation? Why does a city or a micro-region attract more high-value economic activity rather than its neighbors? Why are certain industries relatively robust in a country (like Brazil) while others fail to get started? While competitiveness is not the whole of the development puzzle, it is a very significant - and often very mysterious - piece at the core of the matter.

Figure 1: Defining the Concept of competitiveness



PART 2: MEASURING THE COMPETITIVENESS OF BRAZIL'S 558 MICRO-REGIONS

I. METHODOLOGICAL NOTE

The Brazil Competitive Profile is based on an innovative methodology which permits us to analyze Brazilian competitiveness from a dynamic point of view, across different levels and dimensions. To define the scope of analysis, identify the dimensions of competitiveness, and construct the indicator data-set, the researchers held thematic meetings from August to December 2014. Internal studies and on-going consultations with the project leaders ensured data-quality monitoring.

The framework underpinning the assessment of the competitiveness of the 558 Brazilian micro-regions consists of 14 dimensions which have been grouped into 6 vectors and comprise a comprehensive set of 224 indicators.

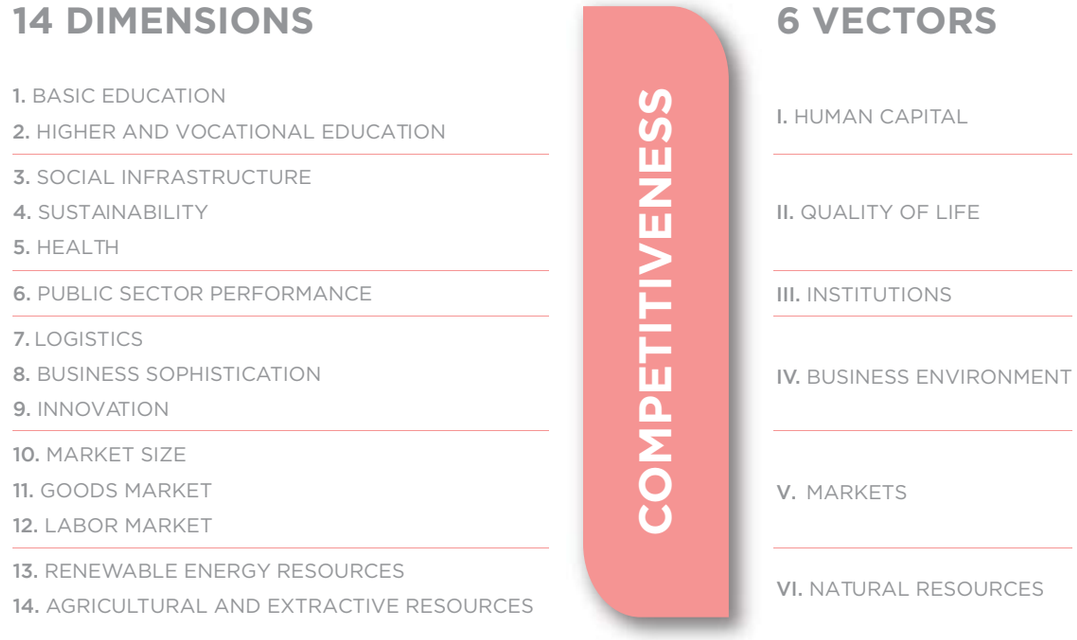
II. ASSESSMENT FRAMEWORK

The 14 dimensions are considered key drivers of competitiveness in Brazil and have been defined based on economic theory, analysis of existing competitiveness indexes and the unique features of the Brazilian economy. Since economic competitiveness is determined by a number of inter-related factors, policies, and institutional capabilities, the 14 dimensions are highly dependent and tend to reinforce each other. For a complete list, see the following page.

The 6 vectors group the dimensions according to macro-enablers of economic competitiveness: institutions, human capital, markets, business environment and natural resources, together with quality of life, a concept that has gained momentum in the more recent debate on the relation between competitiveness and social and environmental sustainability. Dimensions and vectors are displayed on the following page.

For each of the 14 dimensions, a varying number of indicators has been identified which jointly capture the ability of each micro-region to utilize economic, institutional, social and environmental factors to increase productivity, based on quantitative as well as qualitative measures.

Figure 2: Dimensions and Vectors of Brazil's competitiveness



In total, the Brazil competitiveness Profile comprises 224 indicators which have been carefully selected according to the following guidelines:

- Data is freely available from public or private institutions;
- Data is sufficiently up-to-date and can be updated frequently;
- Data is comparable at the local (state or municipal) level; and
- Data stems from certified sources, thus meeting analytical and statistical requirements.

AGGREGATION PROCEDURE

In order to aggregate the massive amount of regional data collected for the different dimensions of competitiveness into a set of scores and rankings, data-science techniques based on Principal Component Analysis were employed, thus using economic logic to help evaluate and calibrate numerical results.

REGIONAL AGGREGATION

Each of the 224 indicators was aggregated to the micro-regional level, using either municipality population, gross domestic product or area as the weighting factor. It is important to note that each Brazilian micro-region corresponds on average to 10 municipalities. This level of aggregation proved to give a satisfactory balance, providing substantial smoothing of outliers and grouping municipalities that individually had insufficient data, while preserving a very satisfactory amount of heterogeneity.

For indicators with only state-level data available, the state's value was taken as representative of all of its micro-regions.

DIMENSION AGGREGATION

In order to produce aggregate scores for each of the 14 dimensions, the indicators on the micro-region level were individually transformed to fit continuous, symmetric distributions as much as possible. These variables were then normalized to mean 0 and variance 1 (z-score) and then averaged together, either with algorithmically assigned weights (using Principal Component Analysis, or PCA) or with equal weights (simple mean), depending on the statistical and analytical properties of the PCA results. The detailed aggregation procedure is described in the Annex of this report.

SCORE AGGREGATION

An important final result of this framework was to produce a global competitiveness score for Brazil's micro-regions, including all 14 dimensions. This score is calculated as a weighed average of the (normalized) scores for each dimension, once more using Principal Component Analysis to assign weights.

For simplicity and ease of understanding, the aggregation of scores for the 6 vectors of competitiveness was performed as a simple mean of dimension scores for each vector's dimensions. The details of this calculation procedure, as well as a detailed list of all indicator descriptions, can be found in the Annex of this report.

In the following section the results of the competitiveness assessment will be presented for different levels and dimensions.

III. RESULTS PER DIMENSIONS

In order to shed light on the dynamics of Brazilian competitiveness, the main results of the assessment will be presented at different levels, in the following order:

- **Results per Dimension:**
  - **Ranking per micro-region:**
    Which are the 20 most competitiveness regions when all indicators of the dimension are considered?
  - **Ranking per state:**
    Which are the 5 most and least competitiveness states when individual indicators are considered?
  - **Interesting phenomena:**
    What interesting phenomena can be observed?
- **Results per Vector:**
  Which are the 20 most competitiveness regions when all dimensions included in the vector are considered?
- **Final Result:**
  Which are the 20 most competitiveness micro-regions when all 224 indicators are aggregated? What are the success factors of the Top 10? And which are the 3 most competitiveness regions of each of the 26 states and the Federal District?

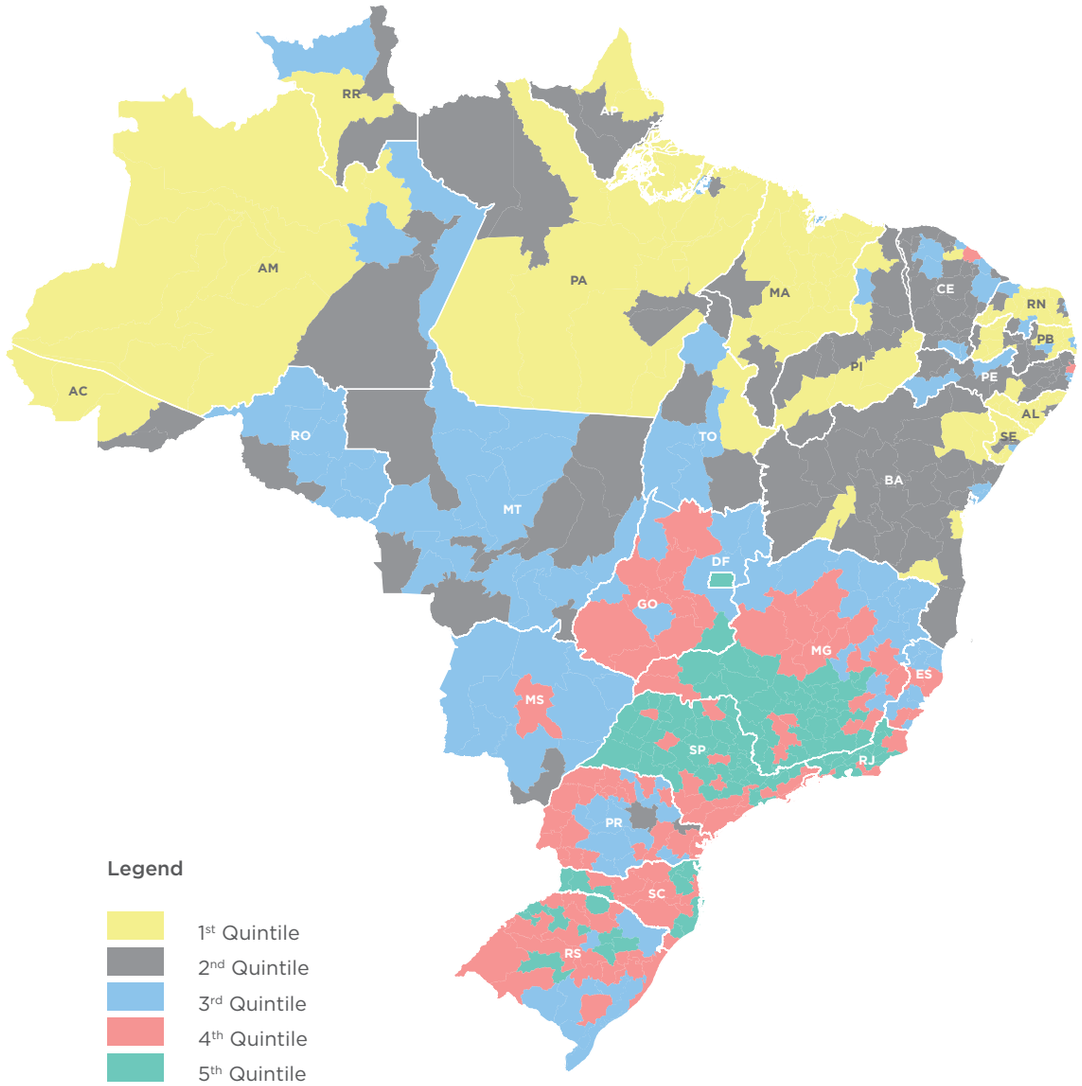
BASIC EDUCATION

The quality of basic education received by the population of each micro-region is an important indicator for its ability to be competitiveness in the global knowledge economy, as it enables individuals to efficiently participate in the labor market and reduces social inequalities. A low level of basic education can become a constraint on business development, with firms finding it difficult to move up the value chain by producing more sophisticated products. This dimension includes **12 indicators** which measure the following aspects considered crucial for a competitiveness basic-education system:

- Primary and secondary school performance
- Class size
- Preparedness for college
- Literacy
- Youth in school at critical age

Approximately 75% of the Top 20 micro-regions in the field of basic education are located in the state of São Paulo, indicating a highly efficient education system. The highest ranking micro-region is Fernandópolis. Among the Southern States, the good quality of its basic-education system provides a competitiveness edge for the state of Minas Gerais. Micro-regions in Pernambuco and Ceará are among the most competitiveness of the Northeast.

Map 5: Brazil map by quintile of Basic Education score



Source: FGV

Table 1: 20 Most competitiveness Micro-regions – Basic Education

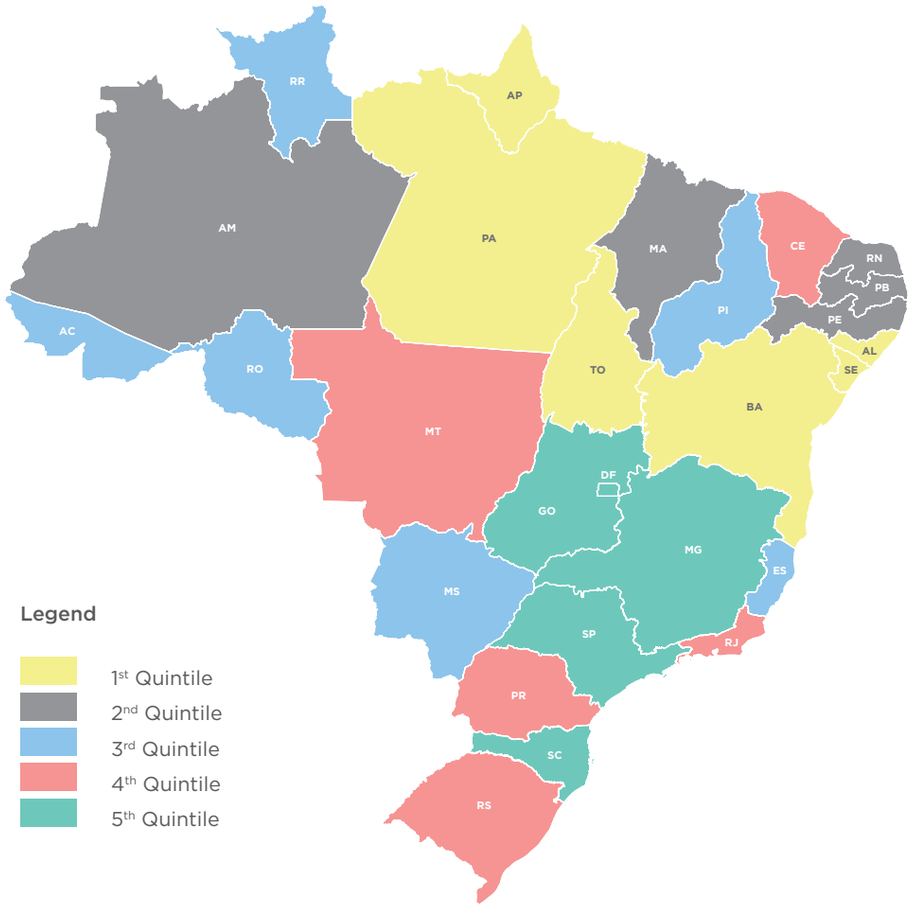
RANK	MICRO-REGION	STATE
1	Fernandópolis	SP
2	Marília	SP
3	Jundiaí	SP
4	São Carlos	SP
5	Jales	SP
6	Araçatuba	SP
7	Conselheiro Lafaiete	MG
8	São José dos Campos	SP
9	Bauru	SP
10	São José do Rio Preto	SP
11	Barbacena	MG
12	Juiz de Fora	MG
13	Catanduva	SP
14	Campinas	SP
15	Itajubá	MG
16	São João da Boa Vista	SP
17	Nova Friburgo	RJ
18	Limeira	SP
19	Guaratinguetá	SP
20	Piracicaba	SP

Source: FGV

YOUTH EDUCATION

When looking at the specific area of youth education, now at state level, São Paulo and Minas Gerais continue to show the best performances, but the Federal District, Goiás and Santa Catarina are also very competitiveness. Six states, from Sergipe, Alagoas and Bahia all the way northwest through Tocantins and Pará as far as Amapá, are seriously lagging behind in their capacity to educate youth capable of determining the economic future and competitiveness.

Map 6: Brazil map by quintile of share of 16-17 years old in school[1]



Source: Censo e IDEB

[1] Data comes from the Basic Education Development Index (IDEB) which monitors student achievement and progression flows at primary and lower -secondary education (4th and 8th grade), as well as the share of 16 and 17-year - olds in school

Table 2: Ranking by share of 16-17 years old in school

1	São Paulo (SP)	23	Sergipe (SE)
2	Minas Gerais (MG)	24	Amapá (AP)
3	Federal District (DF)	25	Pará (PA)
4	Goiás (GO)	26	Alagoas (AL)
5	Santa Catarina (SC)	27	Tocantins (TO)

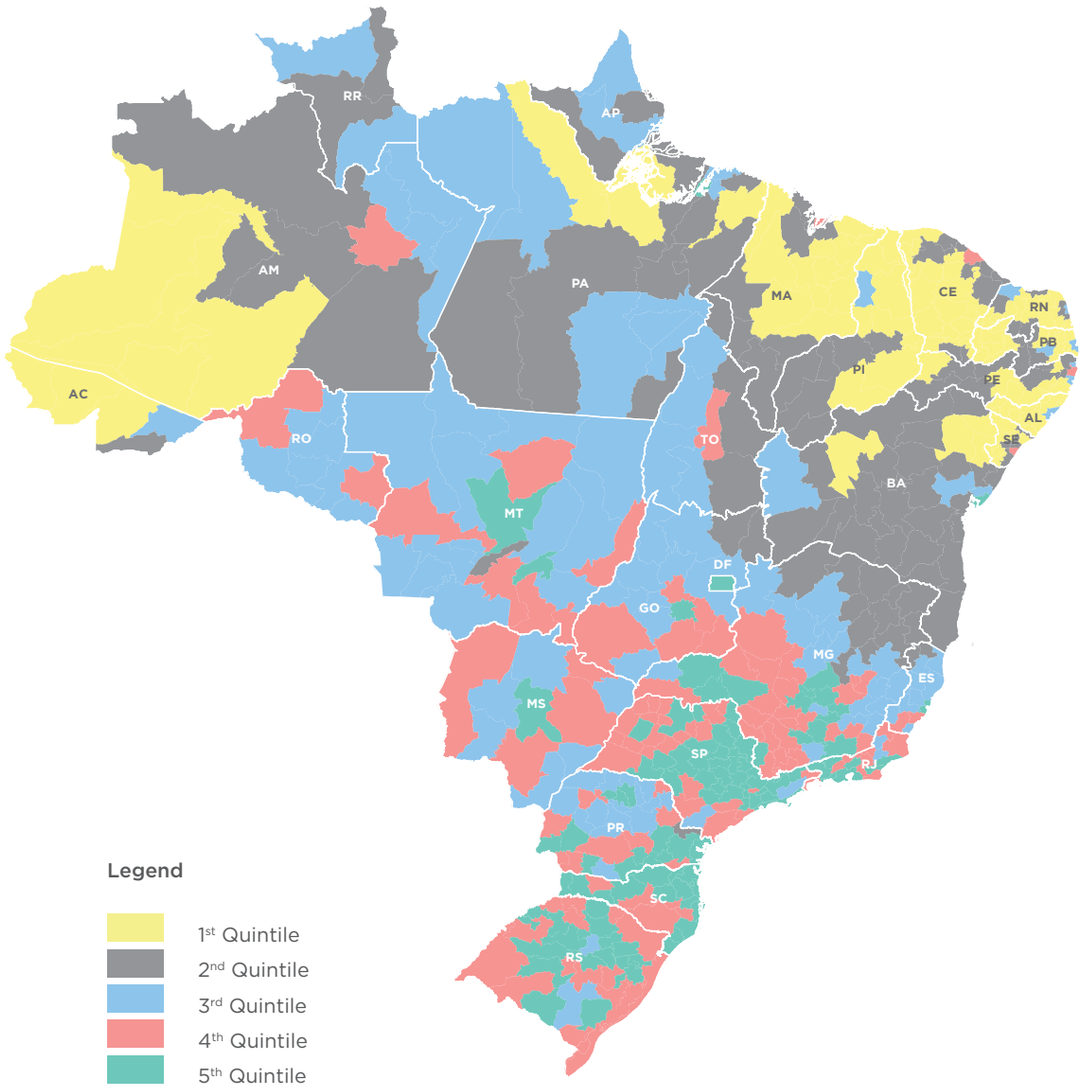
Source: Censo e IDEB

LITERACY

Literacy[2] is crucial for the competitiveness of Brazil´s micro-regions, as it directly impacts upon the labor-market potential of the population. The map shows a gradual deterioration in literacy skills from the Southern to the Northeastern regions, with a heterogeneous Central-West region and some bright stars, such as the region around Manaus in the otherwise under-performing state of Amazonas. The Federal District leads the ranking, followed by the Southern State of Santa Catarina and Rio de Janeiro in the Southeast. Surprisingly, São Paulo occupies a mere 4th place.

[2] Measured as the percentage of the population older than 5 able to read and write

Map 7: Brazil map by quintile of literacy



Source: Censo 2010

Table 3: Ranking by literacy

1	Federal District (DF)	23	Rio Grande do Norte (RN)
2	Santa Catarina (SC)	24	Paraíba (PB)
3	Rio de Janeiro (RJ)	25	Maranhão (MA)
4	São Paulo (SP)	26	Piauí (PI)
5	Rio Grande do Sul (RS)	27	Alagoas (AL)

Source: Censo 2010

INTERESTING PHENOMENA

For a more qualitative analysis of the data, clusters per state are analyzed using Spatial Autocorrelation Analysis, or SAA (see note below). The cluster of micro-regions providing the best basic education is located mostly across states of the Southern and Southeastern regions, although it is notably absent in certain areas of these states. There is an opposing cluster of low basic education encompassing most of the Northern and Northeastern states.

ABOUT THE METHOD:

Spatial Autocorrelation Analysis, or SAA, helps to understand the degree to which one object is similar to other nearby objects. Moran's Index measures spatial autocorrelation and is classified as positive, negative and no spatial auto-correlation.

The question that guides the analysis is as follows: In which micro-regions or states are the clusters with the best (and worst) values located?

The map should be read as follows:

- The blue spots indicate micro-regions with high or positive values of the variable, which have neighbors with high values that are of statistical significance. These clusters have the best values.
- The yellow spots are the micro-regions with low or negative values of the variable with statistical significance. These clusters present the worst values.

SHINING STARS IN BASIC EDUCATION PROVISION

Some interesting facts and figures emerge when the basic-education indicators are analyzed and compared on the municipal level. Firstly, let's look at school quality:

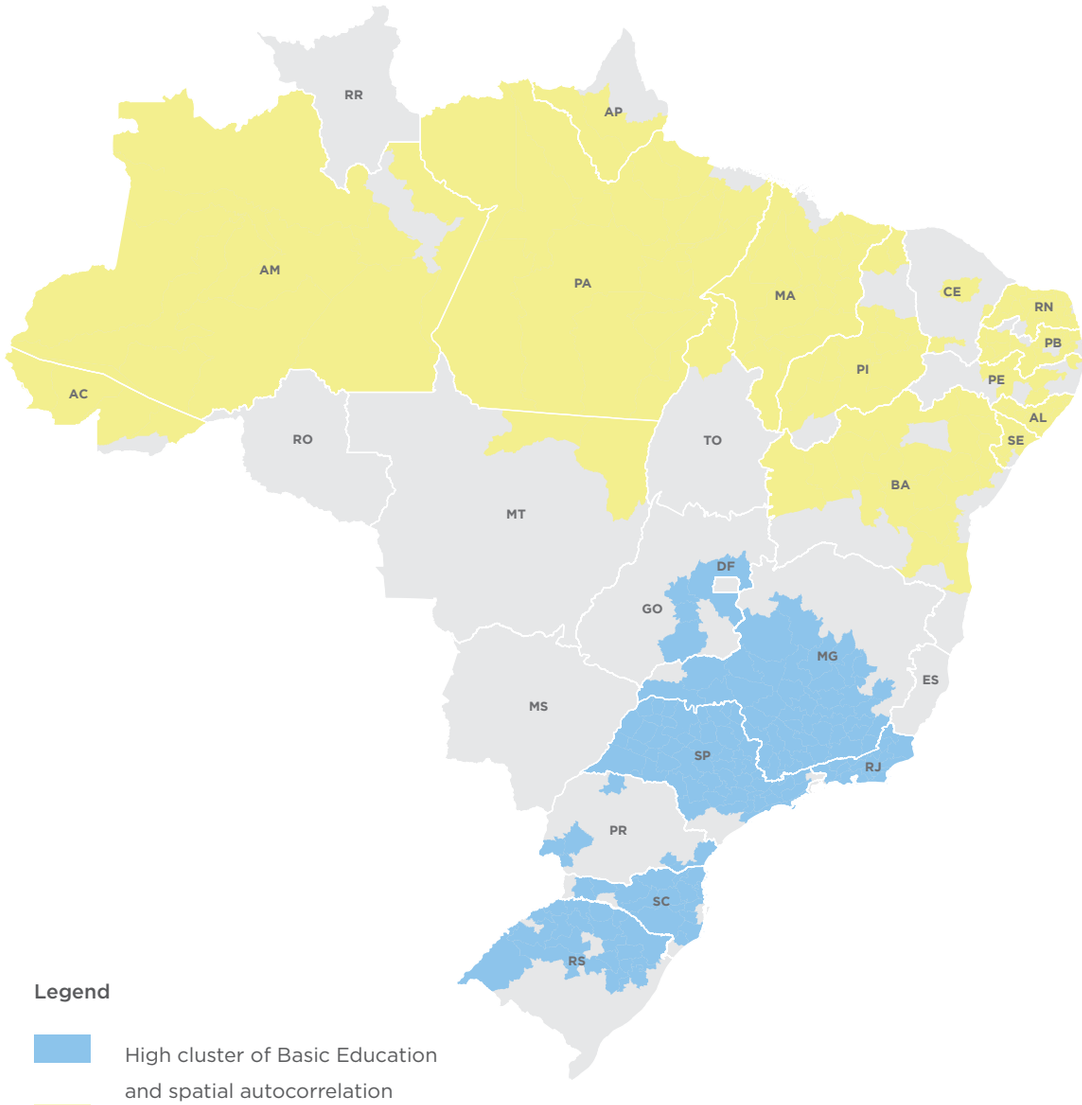
- Of the top 100 municipalities in terms of school quality, some 40% come from the Southeastern state of Minas Gerais;
- The municipality of Tocos do Moji in Minas Gerais is placed 3,784th in per-capita income, but 13th in school-quality ranking;
- Goiás is an emerging state, yet also ranks at the top with strongly performing municipalities like São Luiz do Norte, Ituaçu and Três Ranchos
- Ceará, in the Northeast, is one of the poorest Brazilian states, yet ranks high in terms of school quality (e.g. Mucambo, Sobral, Jericoacoara);

Secondly, a look at mathematics skills:

- Although 6 of the top 10 municipalities in this category come from the Southeastern State of Minas Gerais, the most competitiveness municipality is Palmeira in Santa Catarina, followed by São João da Mata and Itaguara in Minas Gerais;
- Cocal dos Alves, in the state of Piauí (ranking second-last in literacy; see page 29), occupies a brilliant 6th place in average mathematics scores.

What are these municipalities doing differently?

Map 8: Cluster Analysis – Basic Education



Source: FGV

HIGHER & VOCATIONAL EDUCATION

Higher and vocational education of adequate quality is crucial to economies that want to move up the value chain beyond simple production processes and products. It is a major requisite for regional competitiveness, as it produces well-educated workers who are able to adapt to the evolving needs of the production system.

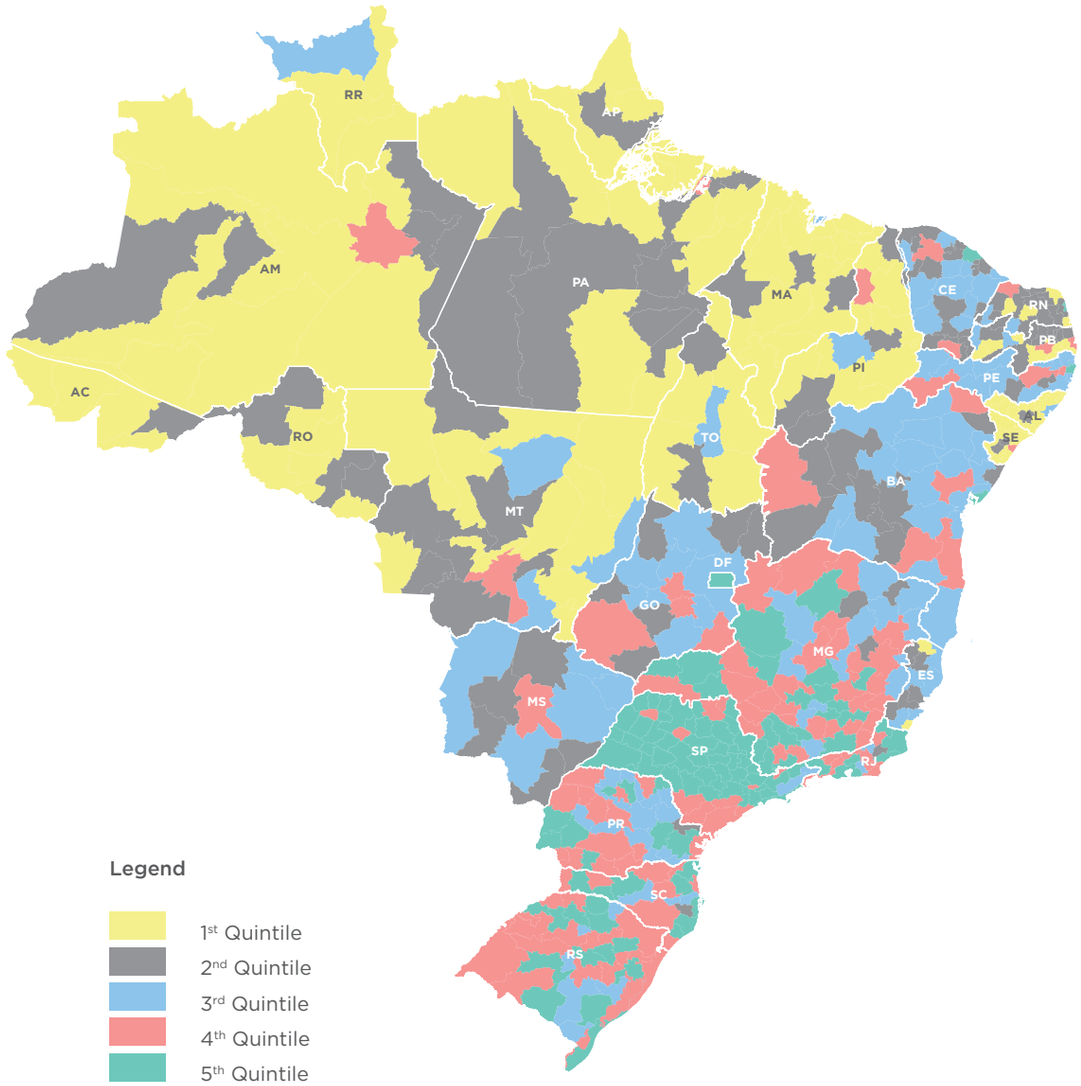
This dimension evaluates the higher and vocational education provisions of each micro-region, including the quality of its technical, undergraduate and postgraduate courses, based on a comprehensive set of **42 indicators** which cover three crucial factors for competitiveness:

- Highly skilled labor
- Quality of academic training
- Ability to attract talent

Just as with basic education, 75% of the top 20 regions in higher and vocational education provision are located in São Paulo, making the state Brazil´s powerhouse of human-capital generation. Once again, Manaus appears as a shining star in the otherwise poorly performing North. Interestingly, ten micro-regions[3] in the top 20, all located in the state of São Paulo, also rank in the top 20 of the basic-education ranking, possibly indicating how good quality of primary and secondary schooling positively affects vocational and higher-education performance.

[3] Fernandópolis, Marília, Jundiaí, São Carlos, São José dos Campos, Bauru, Campinas, Limeira, São José do Rio Preto and Piracicaba.

Map 9: Brazil map by quintile of Higher & Vocational Education score



Source: FGV

Table 4: 20 Most competitiveness Micro-regions – Higher & Vocational Education

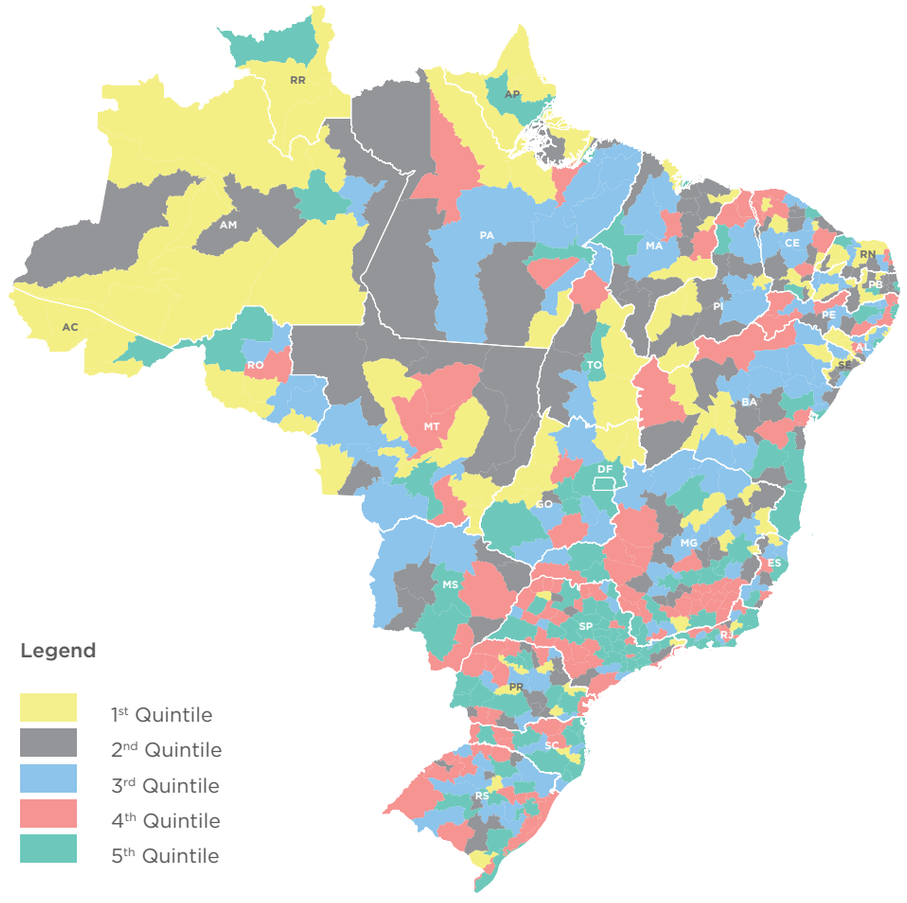
RANK	MICRO-REGION	STATE
1	São Paulo	SP
2	Jundiaí	SP
3	Campinas	SP
4	São José dos Campos	SP
5	Sorocaba	SP
6	Brasília	DF
7	Osasco	SP
8	Marília	SP
9	Belo Horizonte	MG
10	Fernandópolis	SP
11	Limeira	SP
12	Santa Maria	RS
13	Porto Alegre	RS
14	São Carlos	SP
15	Rio de Janeiro	RJ
16	São José do Rio Preto	SP
17	Piracicaba	SP
18	Votuporanga	SP
19	Bauru	SP
20	Ribeirão Preto	SP

Source: FGV

WORKFORCE PREPAREDNESS

In terms of workforce preparedness[4], a rather heterogeneous pattern can be observed. Although the overall ranking sees the Southeastern states on top, some surprises can be observed. The north of Roraima (rank 25th) close to the border of Venezuela, the Rio Branco region in Acre (24th) and the central region of Amapá (26th) are home to competitiveness workforces. Another "bright spot" is the region around Manaus in the state of Amazonas. At the same time, some regions in Southern states of Rio Grande do Sul (6th) and Paraná (5th) rank well below average.

Map 10: Brazil map by quintile of workforce preparedness



Source: RAIS/MTE 2013

[4] Measured as workforce aged 25 to 64 with college degree.

Table 5: Ranking by workforce preparedness

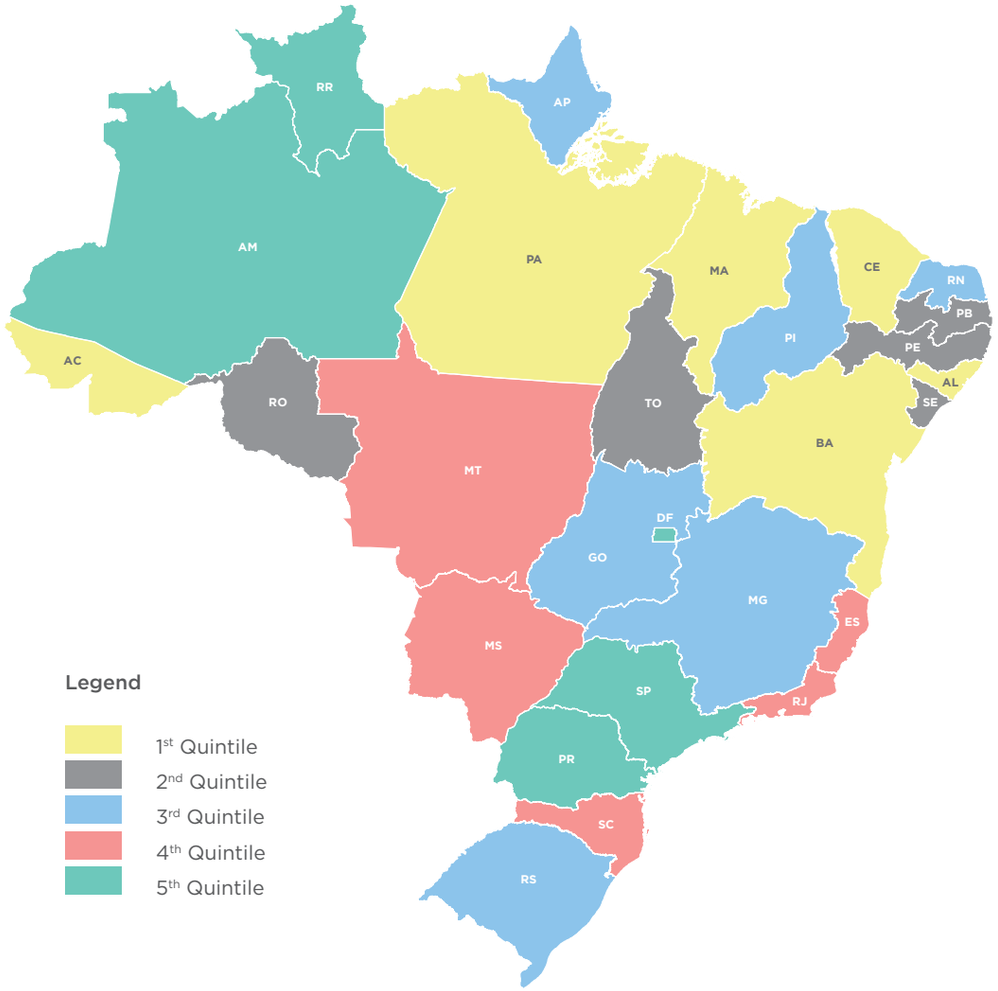
1	Rio de Janeiro (RJ)	23	Maranhão (MA)
2	São Paulo (SP)	24	Acre (AC)
3	Federal District (DF)	25	Rondônia (RO)
4	Minas Gerais (MG)	26	Amapá (AP)
5	Paraná (PR)	27	Tocantins (TO)

Source: RAIS/MTE2013

UNIVERSITY COMPLETION

As expected, the Federal District and the state of São Paulo have the highest numbers of higher-education graduates per 100,000 inhabitants. Two states surprise: Roraima in the far North occupies an excellent 3rd place, while the high rank of the state of Amazonas (5th) can probably be attributed to its relatively low population density. Rio Grande do Sul, although performing well in the overall higher-education ranking, is only average for university completion.

Map 11: Brazil map by quintile of university completion



Source: INEP and IBGE

Table 6: Ranking by university completion

1	Federal District (DF)	23	Acre (AC)
2	São Paulo (SP)	24	Alagoas (AL)
3	Roraima (RR)	25	Ceará (CE)
4	Paraná (PR)	26	Pará (PA)
5	Amazonas (AM)	27	Maranhão (MA)

Source: INEP and IBGE

INTERESTING PHENOMENA

States prioritizing engineering studies

In the global economy, countries and regions rely on skills related to Science, Technology, Engineering and Mathematics (STEM) to deliver world-class competitiveness. In Brazil, a lack of technical and practical engineering skills is the major cause of skill-related problems and it is crucial to build up these skills on the regional and state level. The following rank lists the 5 most successful states in prioritizing engineering studies[5]:

- Santa Catarina (SC)
- Minas Gerais (MG)
- São Paulo (SP)
- Rio de Janeiro (RJ)
- Paraná (PR)

SOCIAL INFRASTRUCTURE

A well-developed social infrastructure is an important factor in determining the location of economic activity, thus increasing productivity, job creation and attractive investment opportunities in Brazil's micro-regions. At the same time, adequate infrastructure contributes to a reduction of societal inequalities, as it enables individuals and businesses to access crucial services and embark on more sustainable income-generating activities. The dimension includes a set of 17 indicators which measure the following aspects:

- Access to information and communication technology
- Access to and affordability of electricity
- Quality of urban transport

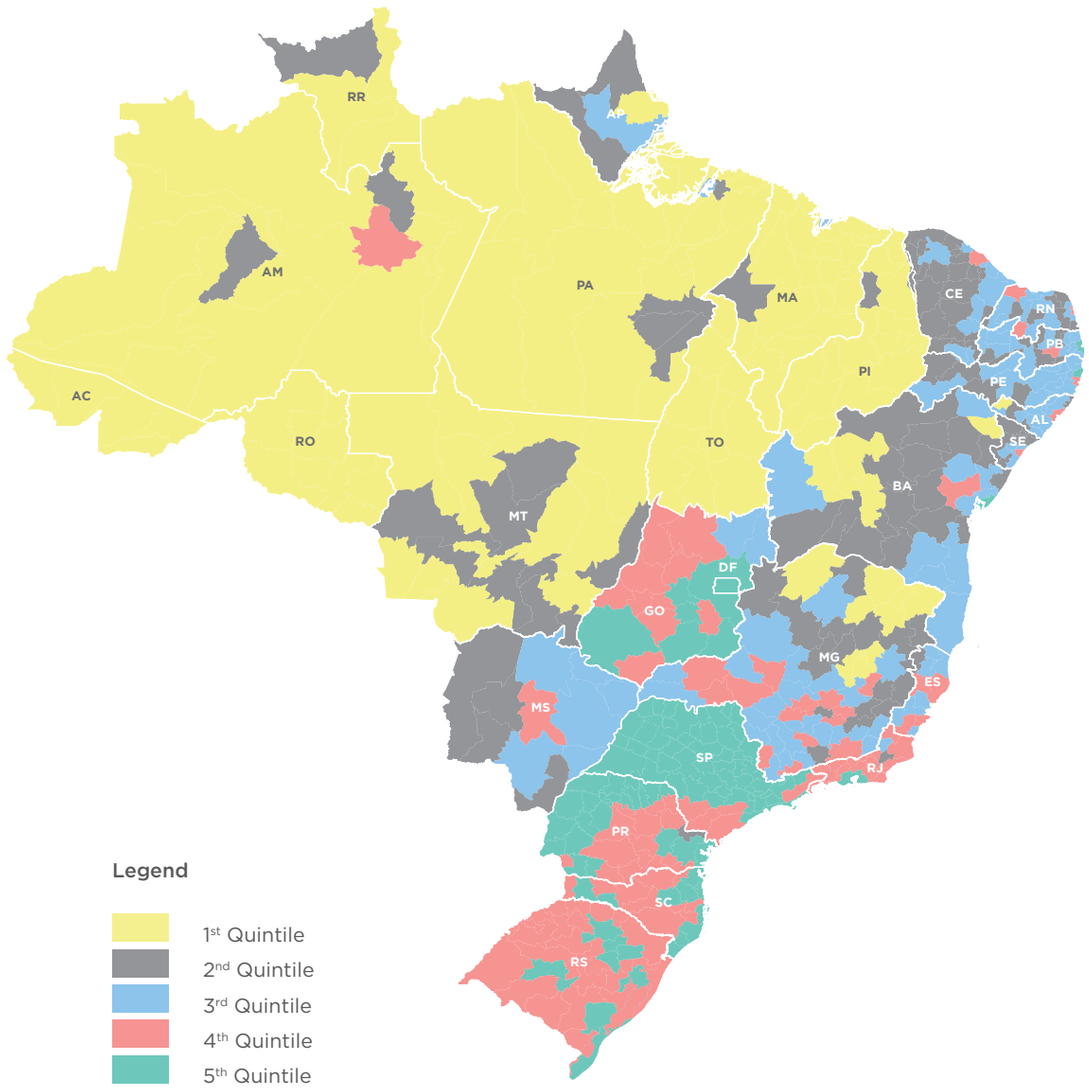
Given the critical importance of a well-developed transport network in a continental and export-dependent country like Brazil, the quality and availability of roads, ports, airports and airways are covered separately in dimension LOGISTICS.

Micro-regions in the South and Southeast have better ICT6 networks, electricity supply and transport systems than Northern regions. Infrastructure development can be highly uneven within states, while the urban areas are benefitting considerably more than the rural areas. The micro-region of Brasília, Brazil's capital city, appears to offer the best social infrastructure to its citizens, followed by São Paulo, Brazil's biggest city. All in all, an impressive 15 of the 20 most competitiveness micro-regions in this dimension are based in the state of São Paulo.

[5] Measured as engineering students as share of total students.

[6] Information and Communications Technology.

Map 12: Brazil map by quintile of Social Infrastructure



Source: FGV

Table 7: 20 Most competitiveness Micro-regions – Social Infrastructure

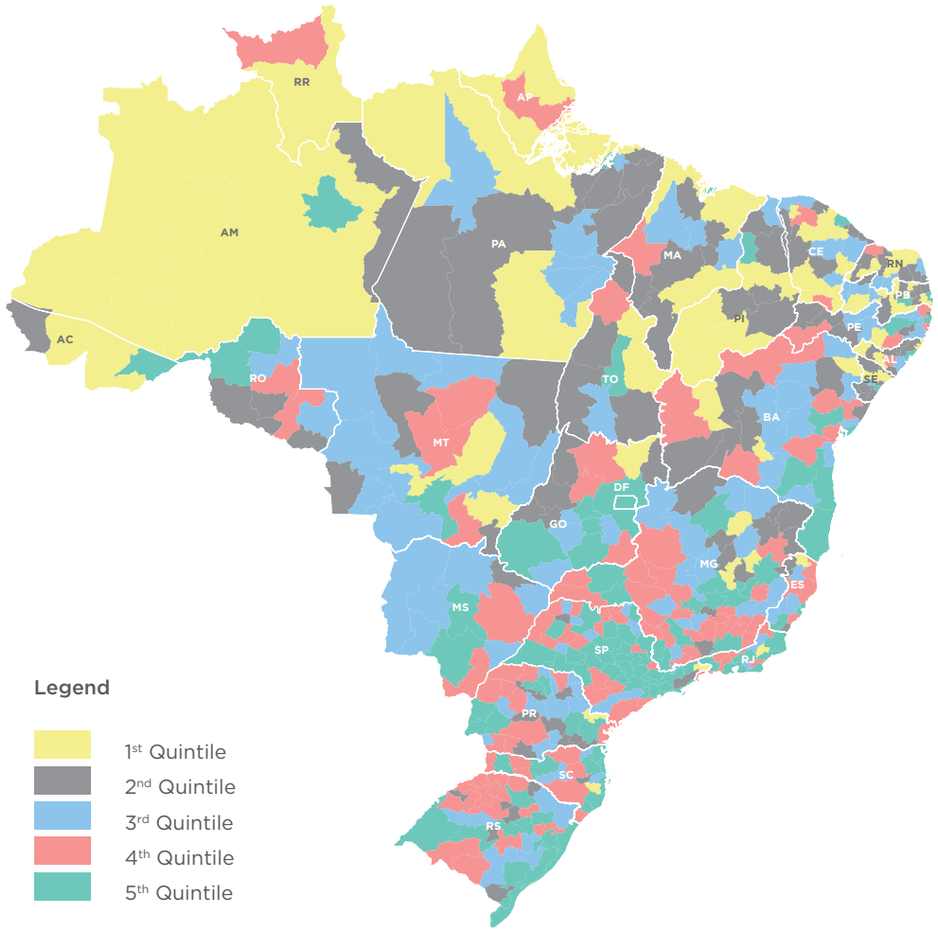
RANK	MICRO-REGION	STATE
1	Brasília	DF
2	São Paulo	SP
3	Campinas	SP
4	Florianópolis	SC
5	Curitiba	PR
6	Santos	SP
7	Maringá	PR
8	Jundiaí	SP
9	Londrina	PR
10	São José dos Campos	SP
11	São Carlos	SP
12	Bauru	SP
13	Ribeirão Preto	SP
14	Rio Claro	SP
15	Osasco	SP
16	Piracicaba	SP
17	Sorocaba	SP
18	São José do Rio Preto	SP
19	Guarulhos	SP
20	Marília	SP

Source: FGV

HOUSEHOLDS WITH PERSONAL COMPUTER WITH INTERNET ACCESS

Country-wide internet penetration is a requirement for participating in global value chains and generating economic growth. This impact is more robust for emerging economies than for industrialized countries[7]. Brazil´s most populous states, São Paulo, Rio de Janeiro and Minas Gerais are among the top 5 when it comes to the number of households with internet access. Penetration rates are generally higher in urban areas.

Map 13: Brazil map by quintile of households with personal computer with internet access



Source: Censo 2010

[7] World Bank, Report on Information and Communication for Development, 2009.

Table 8: Ranking by households with personal computer with internet access

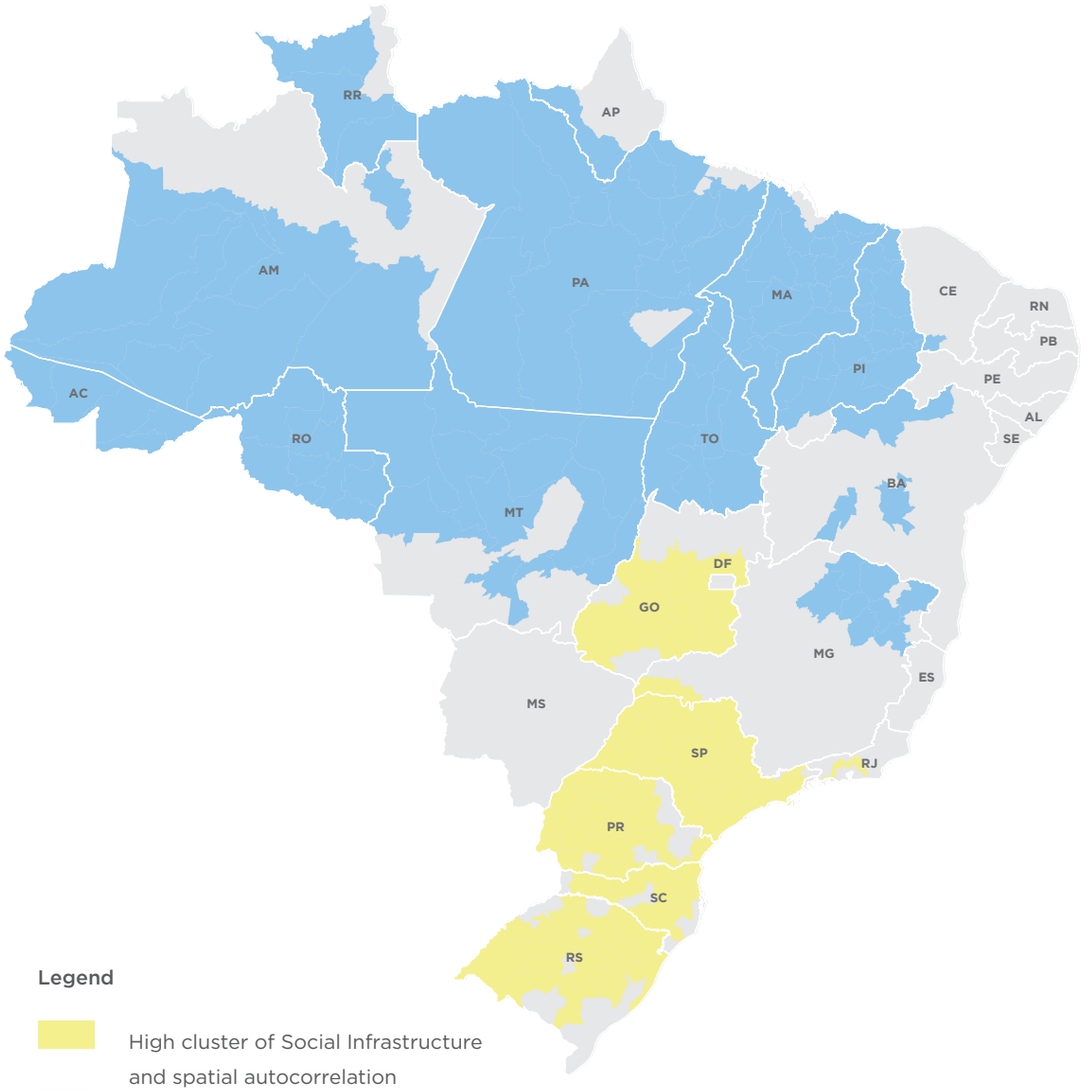
1	Rio de Janeiro (RJ)	23	Piauí (PI)
2	São Paulo (SP)	24	Amapá (AP)
3	Federal District (DF)	25	Acre (AC)
4	Rio Grande do Sul (RS)	26	Roraima (RR)
5	Minas Gerais (MG)	27	Tocantins (TO)

Source: Censo 2010

INTERESTING PHENOMENA

For a more qualitative analysis of the data, clusters per state are analyzed using Spatial Autocorrelation Analysis, or SAA (see note on page 30). As highlighted by the map below, there is a high concentration of social infrastructure in the South, mainly the states of São Paulo, Paraná, Santa Catarina, Rio Grande do Sul and Goiás. Clusters of low social infrastructure prevail in the Northern states and the western Northeast (Maranhão and Piauí), as well as large areas of Mato Grosso and the Northeast of the state of Minas Gerais.

Map 14: Cluster Analysis – Social Infrastructure



Source: FGV

SUSTAINABILITY

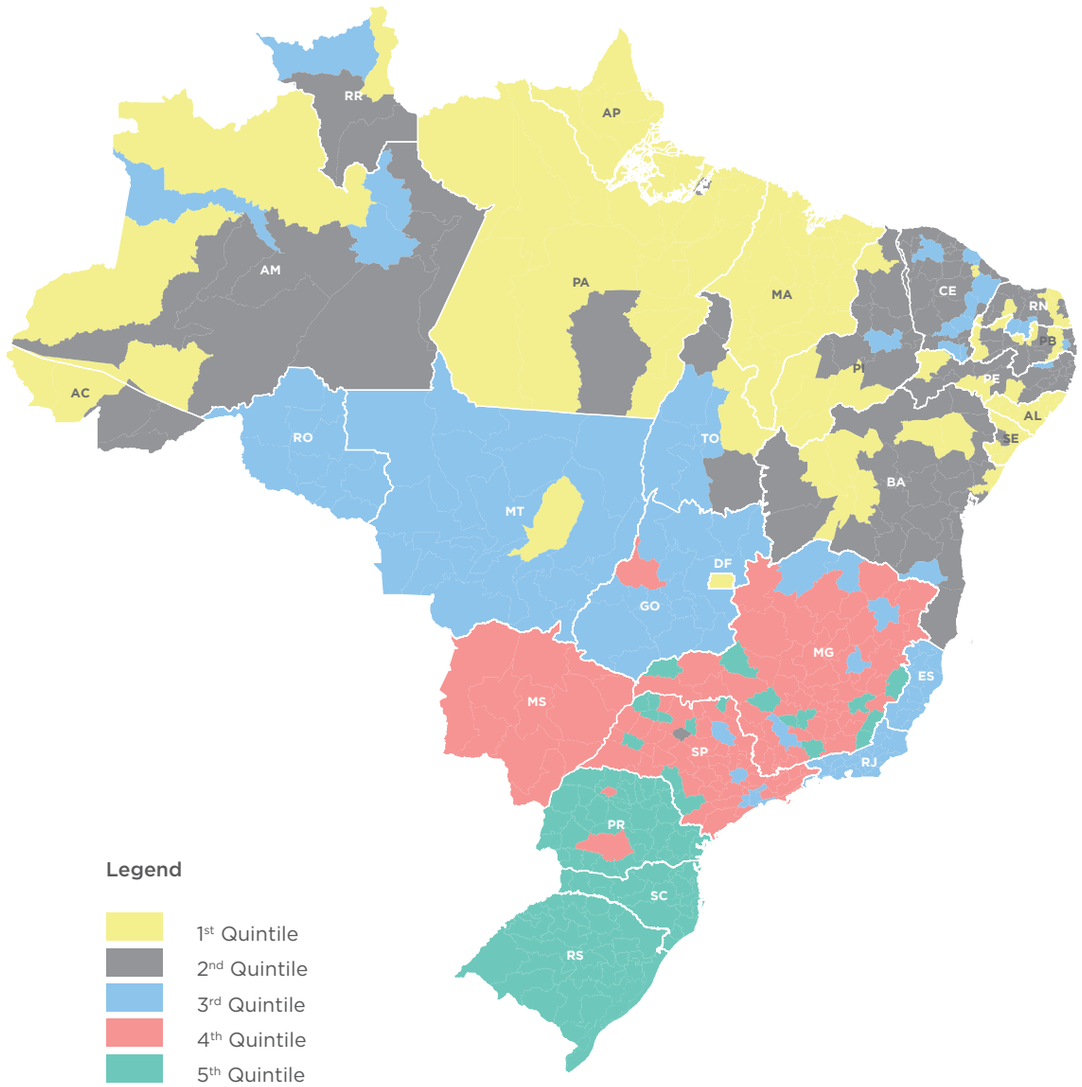
Sustainable and inclusive growth is an important question for Brazil in view of the country's rapid urbanization, population growth, unskilled youth and vast natural resources. There is a clear political need to assure access to adequate housing at reasonable prices for low-wage workers, and to improve the quality of public services, without jeopardizing the ecosystem on which human life depends.

This dimension includes **14 indicators** and evaluates each micro-region according to the following criteria of social sustainability and environmental stewardship:

- Income inequality/Poverty
- Affordability and quality of housing
- Basic sanitation
- Quality of public services
- Biodiversity protection

All Top 20 micro-regions in this dimension are located in Rio Grande do Sul, showing that Brazil´s most Southern state is outperforming the rest of the country in terms of income equality, housing conditions, public services and environmental stewardship. The Northern and Northeastern states exhibit unimpressive progress, with Pará, Maranhão, Amapá, Amazonas and Acre exhibiting particularly low performances.

Map 15: Brazil map by quintile of Sustainability



Source: FGV

Table 9: 20 Most competitiveness Micro-regions – Sustainability

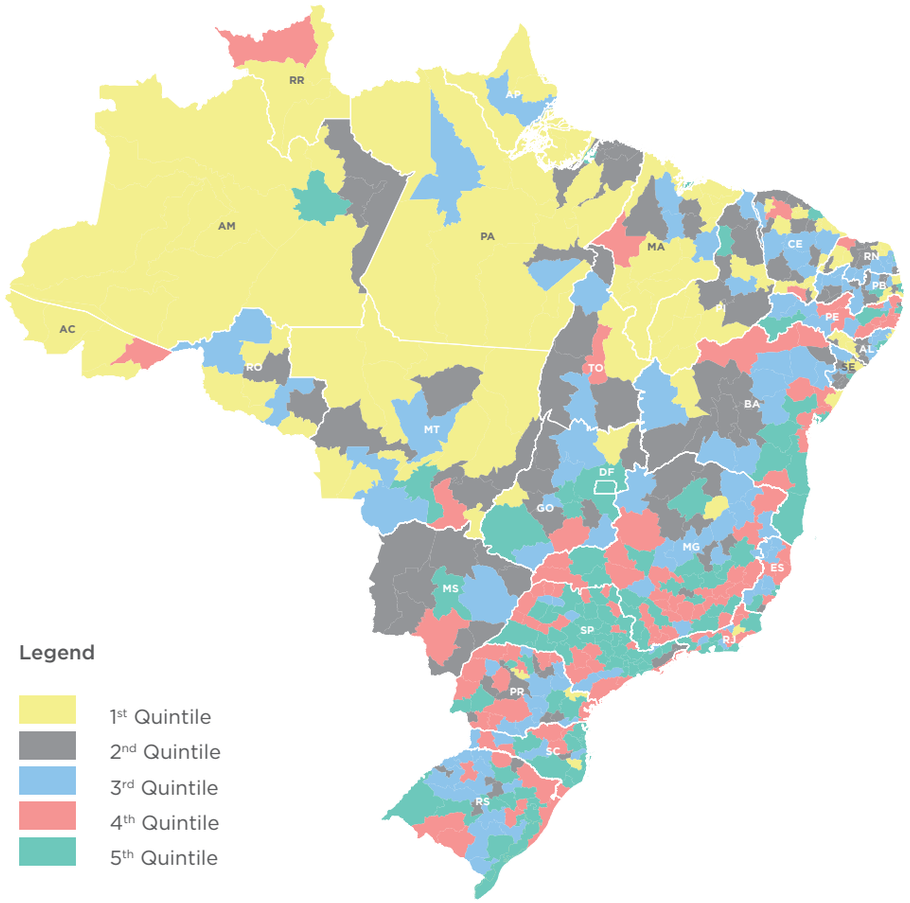
RANK	MICRO-REGION	STATE
1	Jaguarão	RS
2	Serras de Sudeste	RS
3	Cachoeira do Sul	RS
4	Santiago	RS
5	São Jerônimo	RS
6	Campanha Central	RS
7	Lajeado Estrela	RS
8	Erechim	RS
9	Vacaria	RS
10	Campanha Meridional	RS
11	Campanha Ocidental	RS
12	Cerro Largo	RS
13	Caxias do Sul	RS
14	Santo Angelo	RS
15	Sananduva	RS
16	Não-Me-Toque	RS
17	Santa Rosa	RS
18	Montenegro	RS
19	Guaporé	RS
20	Litoral Lagunar	RS

Source: FGV

QUALITY OF HOUSING[8]

Adequate housing is a crucial aspect of social sustainability as it affects health status, access to jobs, and general inclusion in society. Housing conditions tend to be better in the big urban centers of Brazil, and are above average in the states of Rio de Janeiro, São Paulo and the Federal District. The whole North and much of the Northeastern and Central-Western regions perform poorly. Those Northern regions over-performing in higher education and internet access also stand out in the provision of adequate shelter.

Map 16: Brazil map by quintile of quality of housing



Source: FGV

[8] Measured as those housing conditions evaluated as suitable as opposed to unsuitable.

Table 10: Ranking by quality of housing

1	Rio de Janeiro (RJ)	23	Roraima (RR)
2	São Paulo (SP)	24	Tocantins (TO)
3	Federal District (DF)	25	Acre (AC)
4	Rio Grande do Sul (RS)	26	Amapá (AP)
5	Minas Gerais (MG)	27	Rondônia (RO)

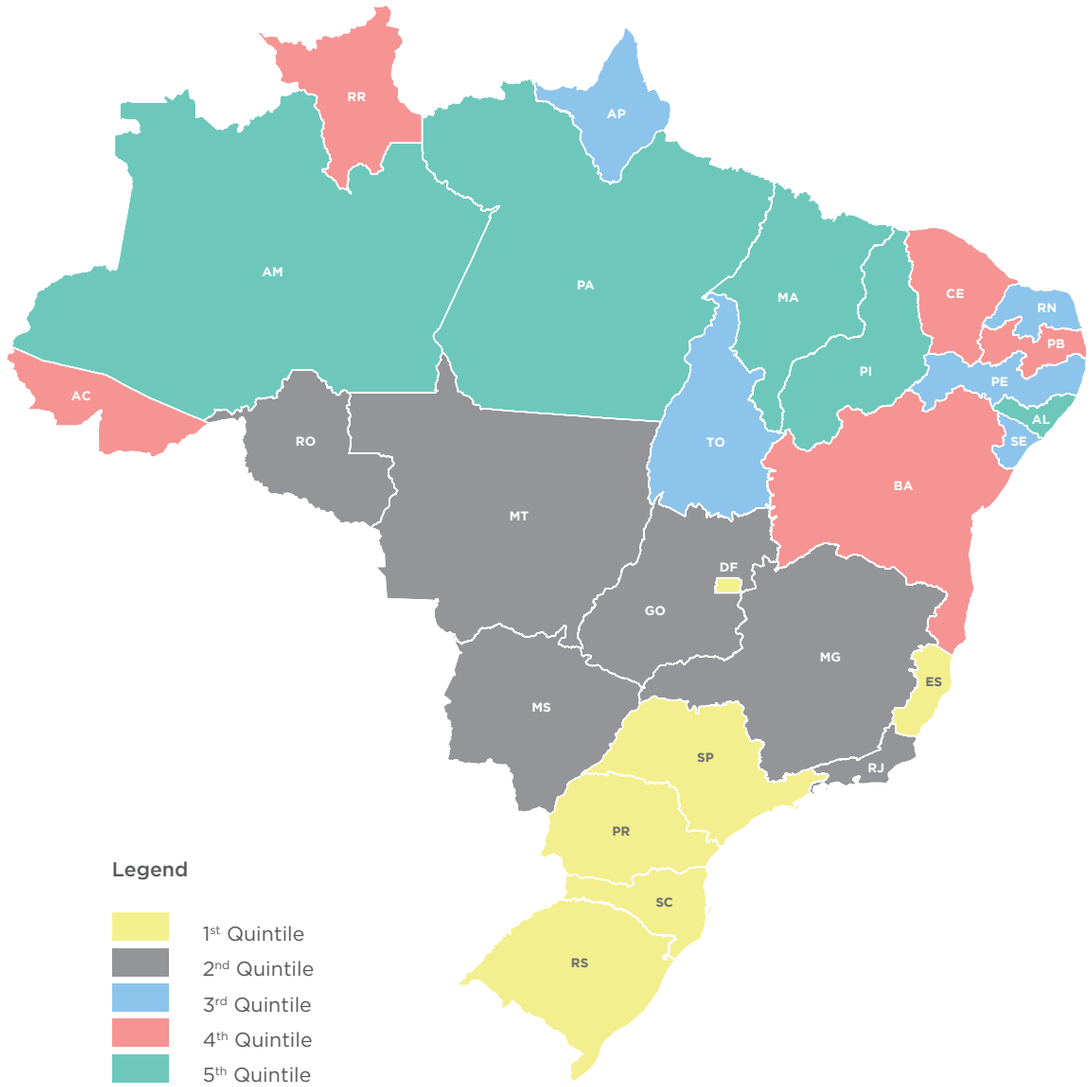
Source: Censo 2010

EXTREME POVERTY

Although Brazil has managed to reduce extreme poverty – the number of people living on less than US$ 1 a day – by 75% between 2001 and 2012[9], ten million Brazilians (5.5% of the population) continue to live in extreme poverty. The issue is clearly dividing the country with the South, Southeast and Central-West reporting the lowest, and the North and Northeast the highest figures for extreme poverty. Three interesting phenomena related to poverty and income inequality will be displayed on the following pages.

[9] Hunger Map 2014, Food and Agriculture Organization of the United Nations.

Map 17: Brazil map by quintile of extreme poverty



Source: MDS

Table 11: Ranking by extreme poverty

1 Maranhão (MA)	23 Rio Grande do Sul (RS)
2 Piauí (PI)	24 Paraná (PR)
3 Amazonas (AM)	25 São Paulo (SP)
4 Alagoas (AL)	26 Federal District (DF)
5 Pará (PA)	27 Santa Catarina (SC)

Source: MDS

INTERESTING PHENOMENA

Affordability of housing in metropolitan regions

While the state of São Paulo does not struggle with extreme poverty, its metropolitan region has the worst rent-to-income ratios of all metropolitan regions in Brazil, indicating housing market dysfunctions and, possibly, policy failures. Shelter is a major cost in most family budgets and housing costs affect disposable income, access to jobs, health status and general inclusion in society.

1. São Paulo
2. Rio de Janeiro
3. Federal District
4. Rio Grande do Norte
5. Bahia

Income inequality

Social disparities are generally higher in the poorest states, but they are greatest in the nation's capital Brasília where income at the top of the pyramid is 22 times higher than income at the bottom. In the next most unequal states the difference is 16-19.

Quality of public transport systems – Metropolitan Areas

The low quality and increasing price of public transport was one of the main issues that drove the Brazilian population to the streets in 2013. It is interesting, therefore, to compare how the population of Brazil´s metropolitan areas perceives the provision of public transport.

Worst	Best
1. Federal District	1. Curitiba
2. Belém	2. Porto Alegre
3. Salvador	3. Fortaleza
4. São Paulo	4. Recife
5. Goiânia	5. Rio de Janeiro

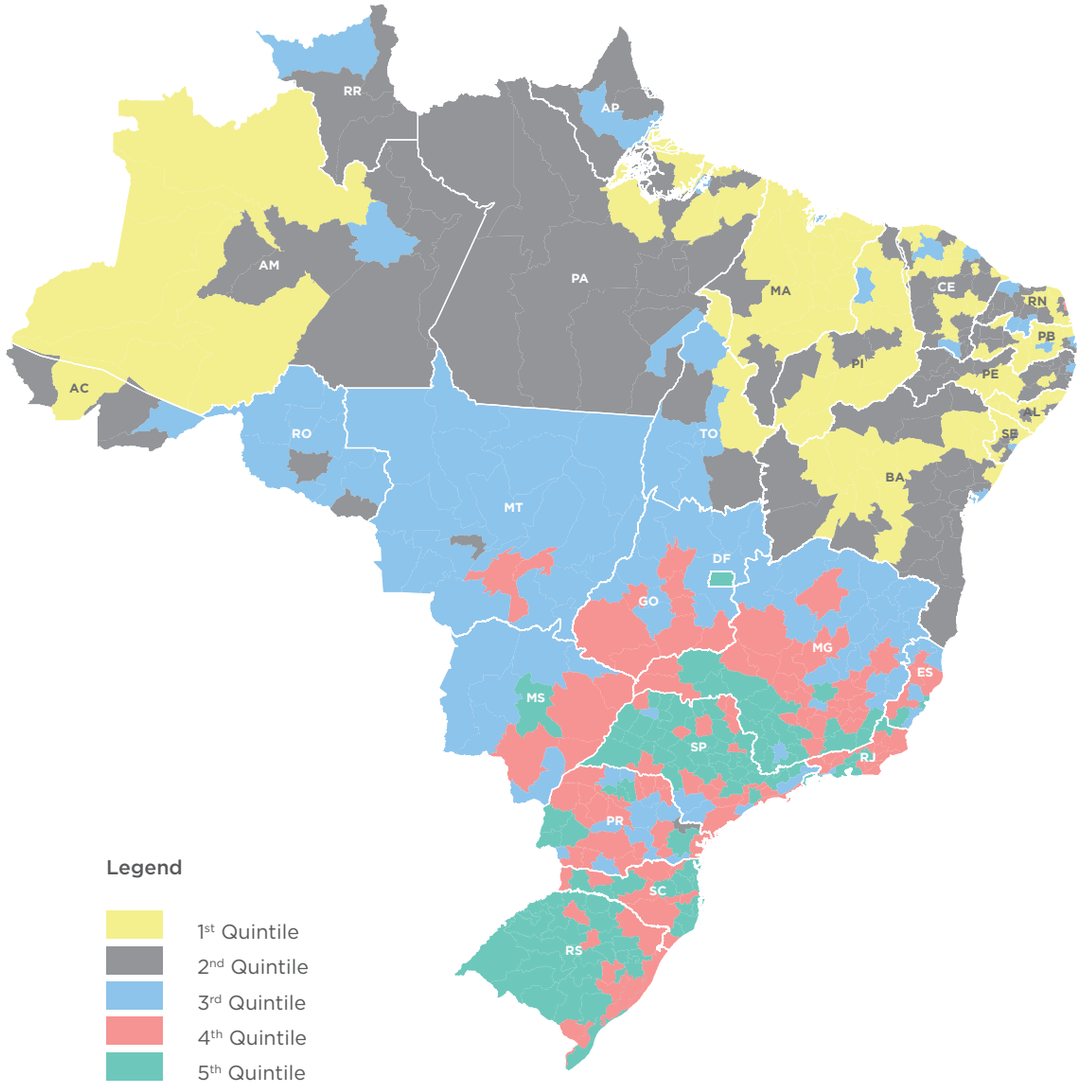
HEALTH

A healthy work-force which is able to work at maximum levels of efficiency is a requisite for the productivity of companies, whereas sick and therefore weak or absent workers can cause significant losses to businesses. In the IMD World competitiveness Yearbook of 2014, Brazil ranked number 59 out of 60 countries for the health-infrastructure indicator. In order to shed light on the issue, this dimension measures the accessibility and quality of public health services based on a set of **15 indicators** related to the following aspects:

- Access to health services
- Quality of public health services
- Self-rated health

Just as with poverty, a sharp divide can be observed between the South and North of the country. The micro-regions which offer the best health services are based in the two most populous states: São Paulo and Minas Gerais. Rio Grande do Sul also performs well. The states of Amazonas, Maranhão, Bahia and Piauí seriously under-perform.

Map 18: Brazil map by quintile of Health



Source: FGV

Table 12: 20 Most competitiveness Micro-regions – Health

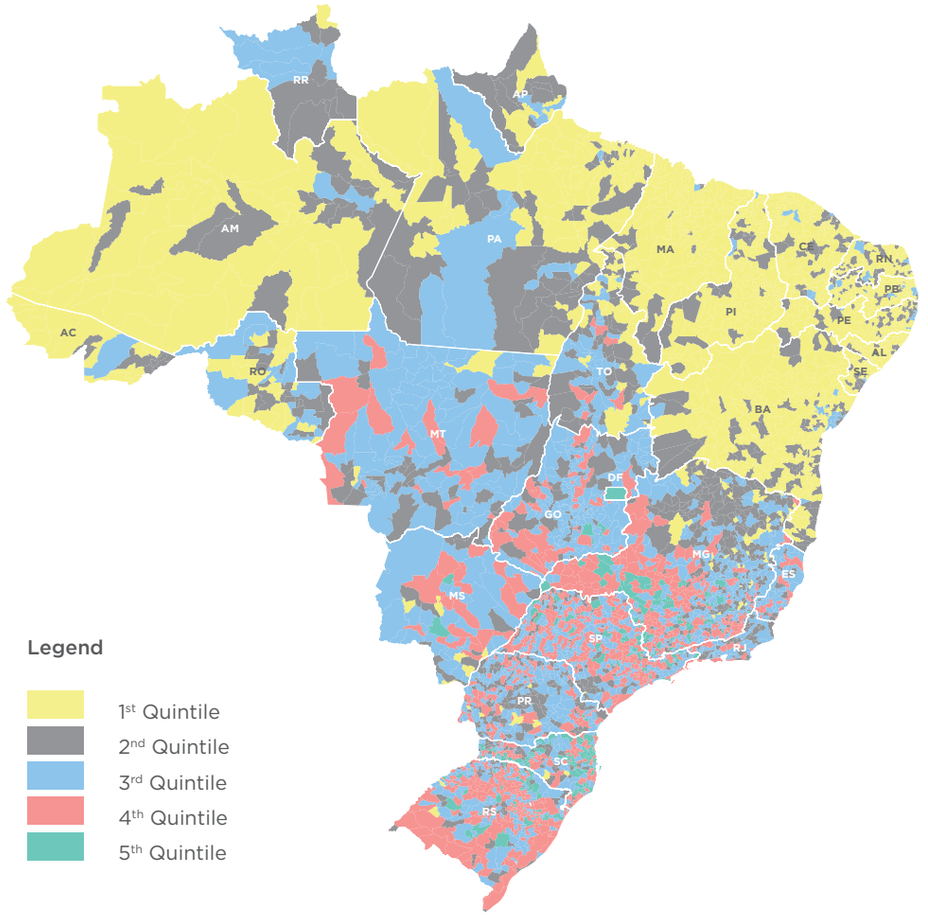
RANK	MICRO-REGION	STATE
1	Barretos	SP
2	Tupã	SP
3	Passo Fundo	RS
4	Barbacena	MG
5	Jaú	SP
6	São João da Boa Vista	SP
7	Moji Morim	SP
8	Marília	SP
9	Porto Alegre	RS
10	Uberlândia	MG
11	Piauí	MG
12	Blumenau	SC
13	Passos	MG
14	Sananduva	RS
15	Serrana	RJ
16	Cruz Alta	RS
17	Ijuí	RS
18	Cerro Largo	RS
19	Botucatu	SP
20	Florianópolis	SC

Source: FGV

LIFE EXPECTANCY

The map on the left displays life expectancy at birth per state, where the South and North report the highest and lowest average life expectancy, respectively. The map on the right zooms into the Southeastern region, showing that the states of São Paulo and especially Minas Gerais acccount for a relatively high life expectancy. However, people live longest, on average, in the Federal District and in Santa Catarina. Interestingly, the five cities with the highest life expectancy are to be found in Santa Catarina: Blumenau, Brusque, Balneário Camboriú, Rio do Sul and Rancho Queimado.

Map 19: Brazil map by Life Expectancy at Birth



Source: FGV

INTERESTING PHENOMENA

Medical hubs of Brazil

Two of Brazil's poorest states, Rondônia in the North and Piauí in the Northeast region, are among those with the highest number of hospital beds per population. Rio Grande do Sul leads the ranking, followed by Rio de Janeiro, Goiás and the Federal District .

1. Rio Grande do Sul
2. Rio de Janeiro
3. Goiás
4. Federal District
5. Rondônia/Piauí

Depressed states

The poorest states have smaller incidence of depression. Based on the perception of 55 to 65-year-old Brazilian citizens, people in Amapá, Acre, Alagoas, Pará and Maranhão are less depressed than those living in the well-off states of Rio Grande do Sul, Santa Catarina, Minas Gerais, Paraná and Goiás. The Medical Hub – Rio Grande do Sul – is most depressed.

1. Rio Grande do Sul
2. Santa Catarina
3. Minas Gerais
4. Paraná
5. Goiás

PUBLIC SECTOR PERFORMANCE

Proper **public-sector management** is critical for ensuring trust in a micro-region's business environment and in this way determining its competitiveness. It has a crucial influence on investment decisions and the organization of production and plays a key role in the ways in which societies distribute the benefits and bear the costs of development strategies and policies.

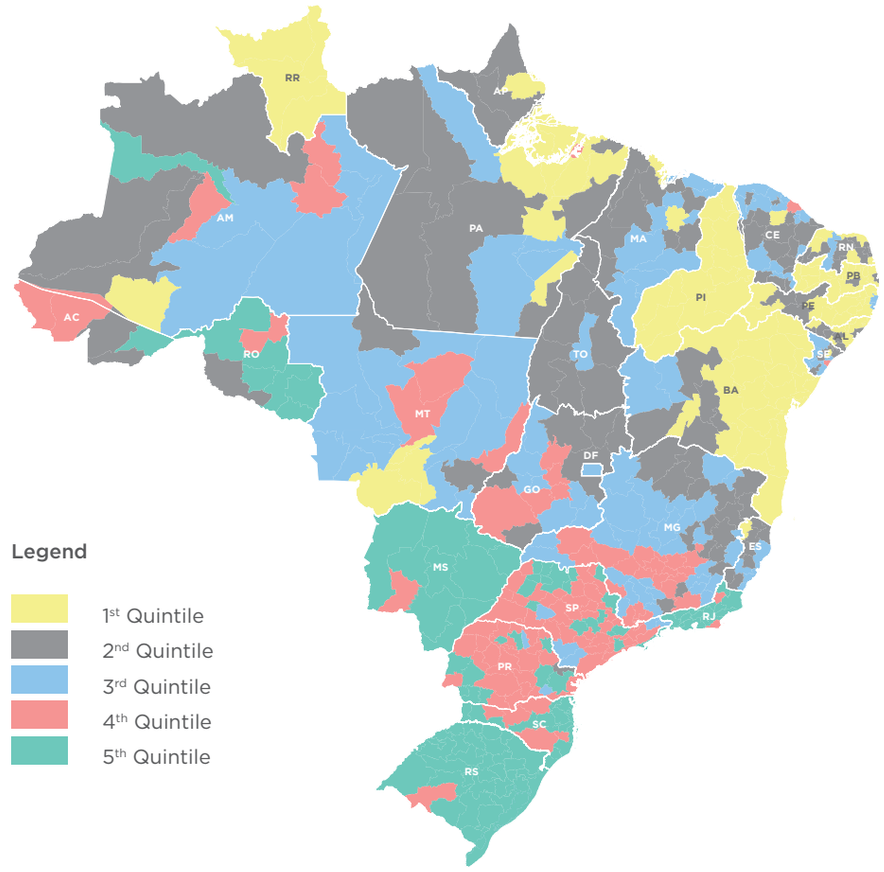
This dimension measures the ability of the government of each region to provide a legal and administrative framework within which individuals, firms and governments interact effectively to generate and distribute wealth, while promoting the security of the population.

The dimension includes a set of **9 indicators** which measure the following aspects:

- Management of public finances
- Performance of the judicial system
- Conditions of public safety

Eighteen of the top 20 micro-regions with the best public-sector performance are located either in Rio Grande do Sul (13th) or Rio de Janeiro (5th). Although they do not appear among the best 20 micro-regions, Mato Grosso do Sul and, surprisingly, Rondônia show strong overall performances. The bright spots in the states of Amazonas, Acre and in the region of Fortaleza in Ceará are worthy of note.

Map 20: Brazil map by quintile of Public Sector Performance



Source: FGV

Table 13: 20 Most competitiveness Micro-regions – Public Sector Performance

RANK	MICRO-REGION	STATE
1	Caxias do Sul	RS
2	Bacia de São João	RJ
3	Guaporé	RS
4	Sananduva	RS
5	Erechim	RS
6	Montenegro	RS
7	Campo Grande	MS
8	Passo Fundo	RS
9	Macaé	RJ
10	Ijuí	RS
11	Gramado-Canela	RS
12	Campanha Meridional	RS
13	Santa Maria	RS
14	Jaguarão	RS
15	Cassilândia	MG
16	Santa Rosa	RS
17	Barra do Piraí	RJ
18	Santiago	RS
19	Vale do Paraíba Fluminense	RJ
20	Itaguaí	RJ

Source: FGV

PERFORMANCE OF THE JUDICIAL SYSTEM

An important component of the overall ranking is the performance of the judicial system[10]: Rio Grande do Sul is leading the index and Rio de Janeiro occupies a good third place. Mato Grosso do Sul is second. Overall, the map shows a heterogeneous picture with some surprises. Acre, Rondônia and Amapá are highly competitiveness, whereas Espírito Santo, Mato Grosso and also Minas Gerais show low performances.

Map 21: Brazil map by quintile of Performance of Judicial System

Source: FGV

[10] Measured by budget management, resource management and procedural efficiency.

Table 14: Ranking by Judicial System Performance

1	Rio Grande do Sul (RS)	23	Mato Grosso (MT)
2	Mato Grosso do Sul (MS)	24	Espírito Santo (ES)
3	Rio de Janeiro (RJ)	25	Pernambuco (PE)
4	Acre (AC)	26	Roraima (RR)
5	Rondônia (RO)	27	Piauí (PI)

Source: IDJUS

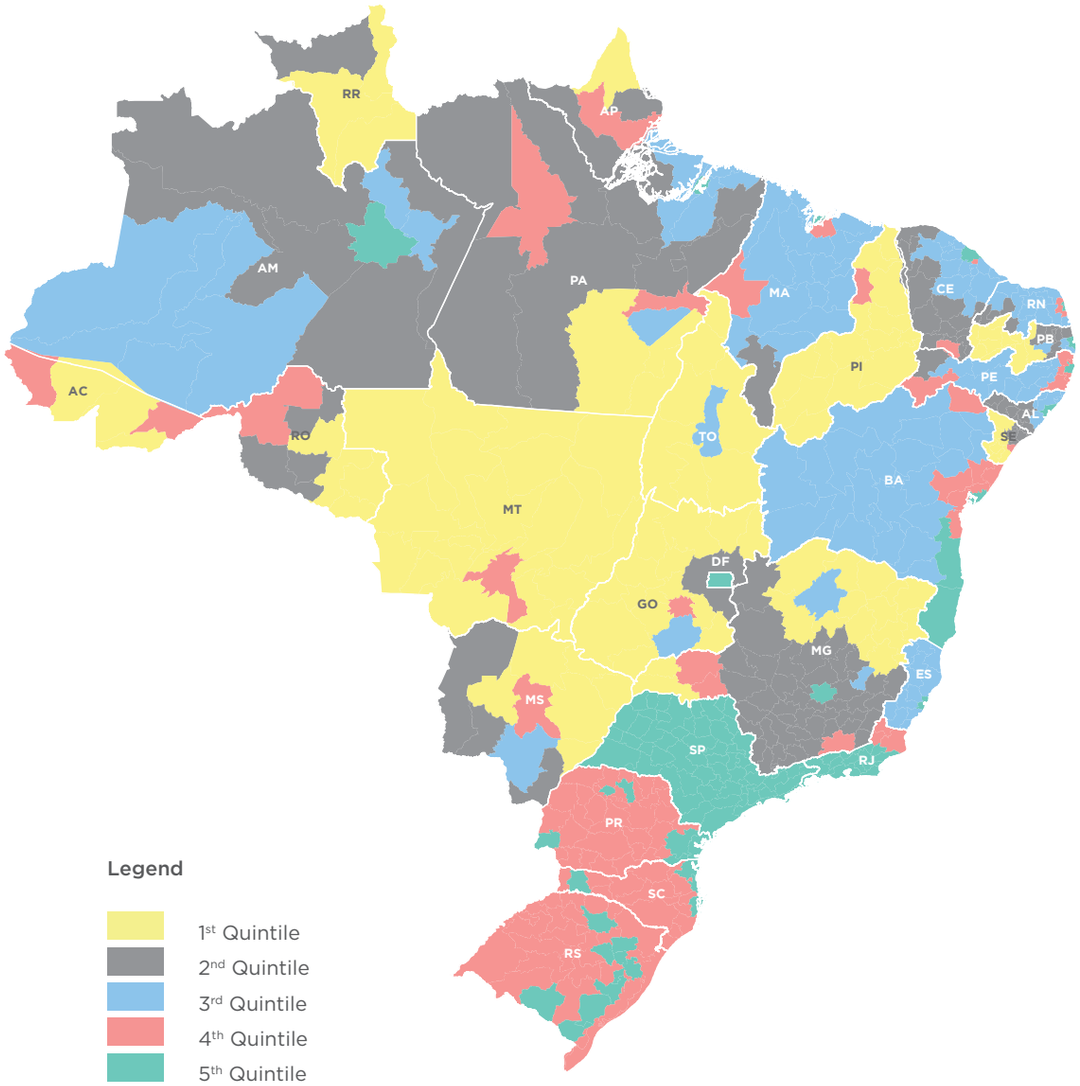
LOGISTICS

Brazil's production structure is extremely sensitive to **logistics** and the low quality of its transport infrastructure is one of the major challenges to sustained competitiveness. Removing the infrastructure bottleneck and reducing costs would help to connect markets and diversify external trade, thus strengthening overall economic performance. There is an important connection with dimension 3: SOCIAL INFRASTRUCTURE, as countries that invest in ICT, electricity and transport infrastructure radically improve the flow of goods and services. This dimension is based on a set of **17 indicators** which measure the following aspects:

- Quality of paved roads
- Total length of railroad lines
- Port capacity
- Airport capacity
- Lengths of waterways
- Trade flows

The score of the logistics dimension is atypical, showing first and foremost the importance of access to logistics hubs (mostly ports and airports), as well as the detrimental effects of poor road and railway coverage. Not surprisingly, coastal areas perform well, as well as states with a long history of agricultural or industrial production. Interestingly, some regions of Northern states (i.e. Belém and Manaus) perform above average.

Map 22: Brazil map by quintile of Logistics



Source: FGV

Table 15: 20 Most competitiveness Micro-regions – Logistics

RANK	MICRO-REGION	STATE
1	Guarulhos	SP
2	Rio de Janeiro	RJ
3	Campinas	SP
4	Porto Alegre	RS
5	Salvador	BA
6	São Paulo	SP
7	Curitiba	PR
8	Recife	PE
9	Fortaleza	CE
10	Belém	PA
11	Brasília	DF
12	Florianópolis	SC
13	Belo Horizonte	MG
14	Natal	RN
15	Foz do Iguaçu	PR
16	Ribeirão Preto	SP
17	Manaus	AM
18	São José do Rio Preto	SP
19	Presidente Prudente	SP
20	Bauru	SP

Source: FGV

ROAD QUALITY

The availability of good-quality paved roads determines the likelihood of new firms entering a given location. Relatively stagnating performances have been typical in road-infrastructure improvement especially in the Northern states, which are clearly out-performed by the Southern and Southeastern states. The roads of São Paulo, Rio de Janeiro and, surprisingly, Alagoas are evaluated best, while Pará, Amazonas and Acre show serious deficits in their road infrastructure.

Map 23: Brazil map by quintile of Road Quality

Source: CNT

Table 16: Ranking by Road Quality

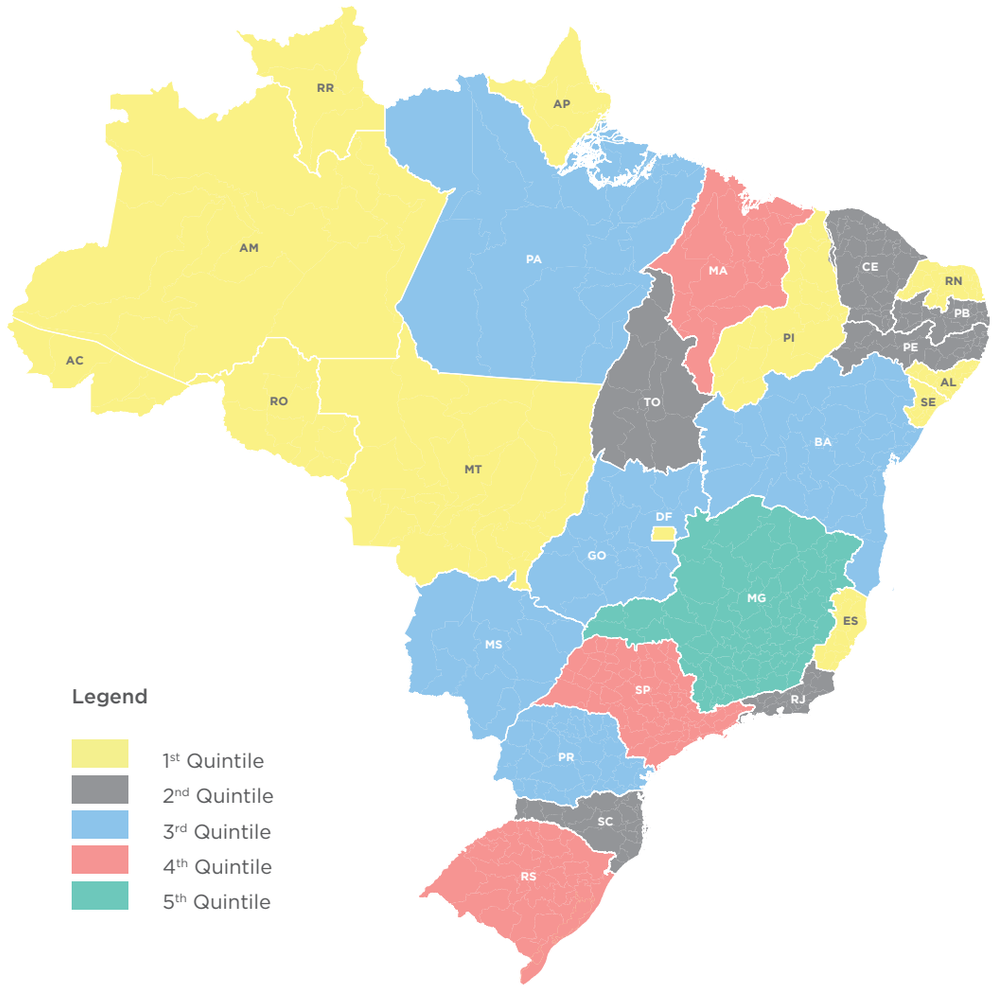
1	São Paulo (SP)	23	Tocantins (TO)
2	Rio de Janeiro (RJ)	24	Roraima (RR)
3	Alagoas (AL)	25	Pará (PA)
4	Paraná (PR)	26	Amazonas (AM)
5	Santa Catarina (SC)	27	Acre (AC)

Source: CNT

RAILWAY EXTENSION

An inadequate railroad network raises the costs of doing business and may result in overuse of road transport. Minas Gerais is the shining star, followed by São Paulo, Rio Grande do Sul and Maranhão. Railway extension provides a competitiveness edge for Pará within the Northern region. Although sizable, Mato Grosso ranks among the least competitiveness states when it come to the length of its railway lines.

Map 24: Brazil map by quintile of Lenght of railway lines



Source: CNT

Table 17: Ranking by Lenghts of railway lines

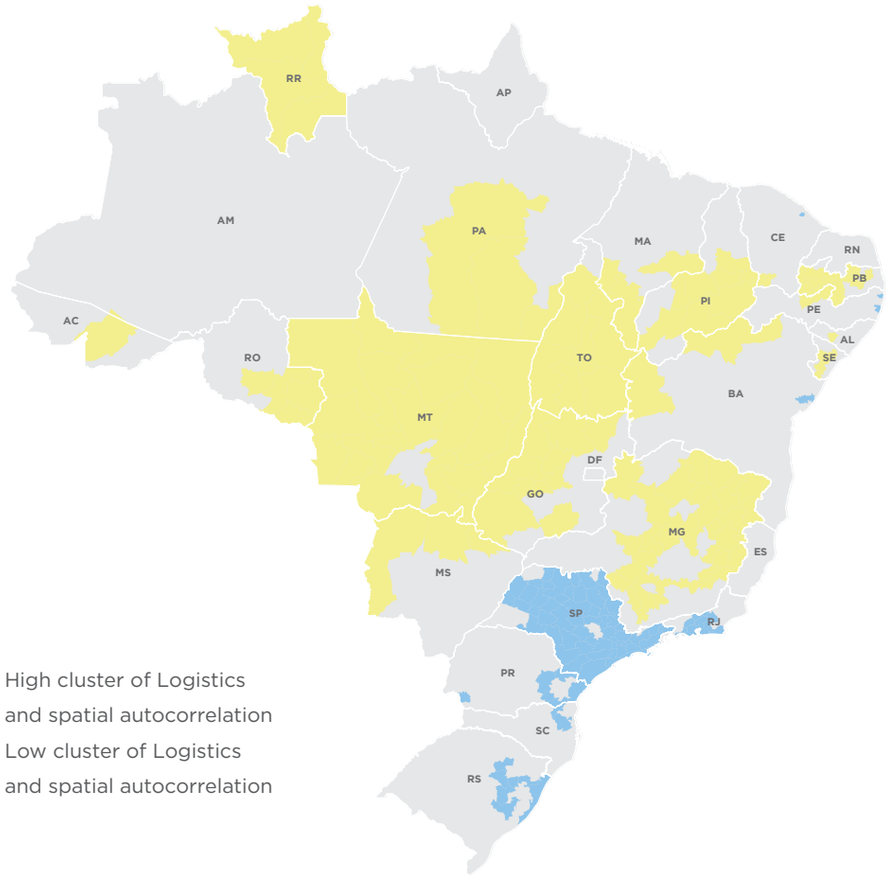
1	Minas Gerais (MG)	23	Federal District (DF)
2	São Paulo (SP)	24	Rondônia (RO)
3	Rio Grande do Sul (RS)	25	Amazonas (AM)
4	Maranhão (MA)	26	Acre (AC)
5	Paraná (PR)	27	Roraima (RR)

Source: PNTL - Mtransporte

INTERESTING PHENOMENA

For a more qualitative analysis of the dimension, clusters per state are analyzed using Spatial Autocorrelation Analysis, or SAA. As the map indicates, there are two logistics clusters: one in São Paulo, the country's undisputed logistics center (although there are important off-shoots around the port areas in many coastal states), the second, less significant, in Rio Grande do Sul. The low-performance cluster is centered on a strip around the most central states, but stretches also to northeastern Minas Gerais, Roraima and other regions.

Map 25: Cluster Analysis – Logistics



Source: FGV

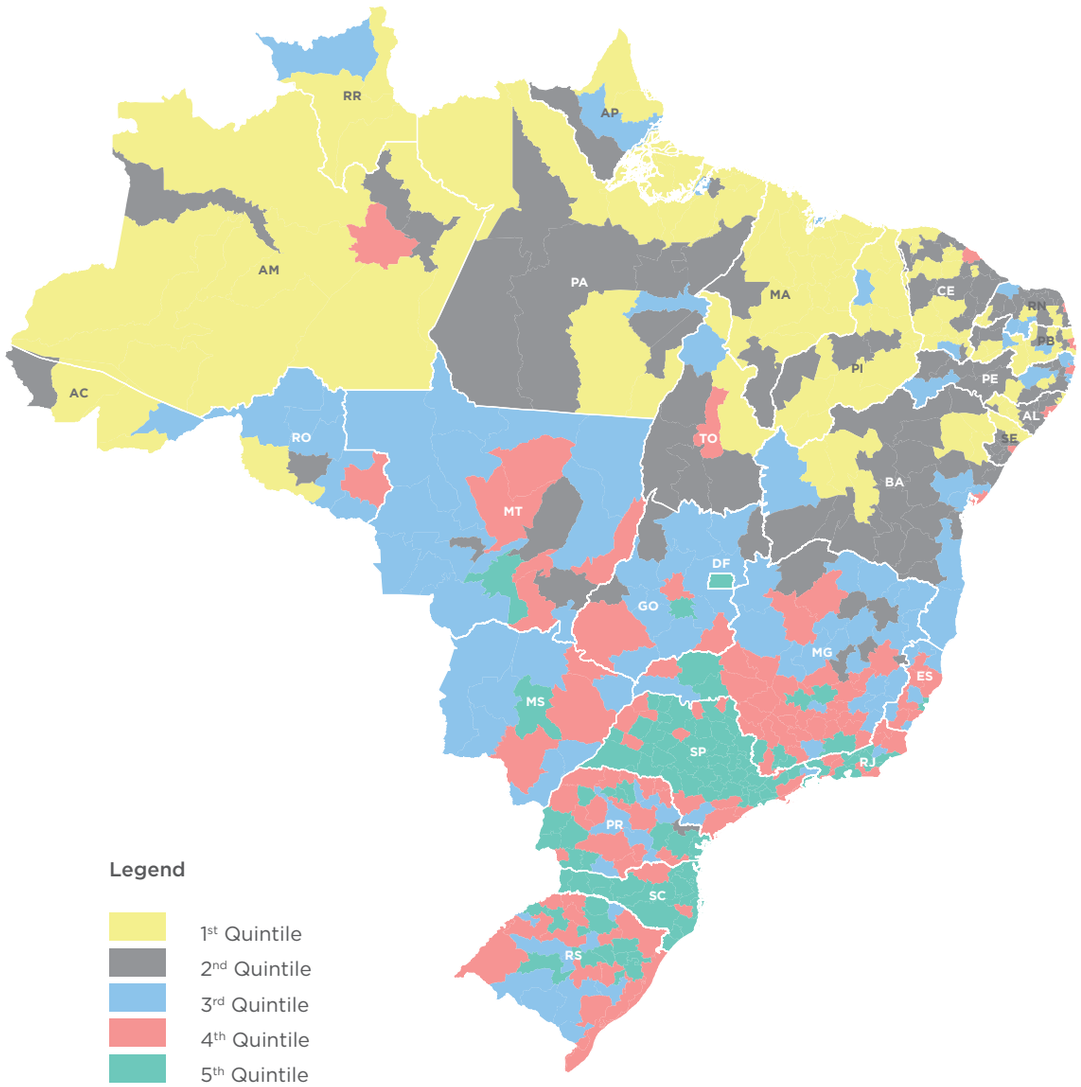
BUSINESS SOPHISTICATION

Business Sophistication is understood as the skillfulness of a micro-region's workforce, in terms of its capacity to handle sophisticated business practices and complex production processes. When highly skilled workers are interconnected in geographically proximate groups, efficiency in the production of goods and services is heightened and greater opportunities for innovation are created. The effective use of information and communications technologies (ICTs) has become an important driver of competitiveness. The technology does not need to be produced within national borders if the workforce is sufficiently skilled to successfully adopt and use it to enhance productivity and enable innovative processes. The dimension includes a set of **4 indicators** which measure the following aspects:

- Skilled human resources in management
- Skilled human resources in advanced manufacturing
- Skilled human resources in ICT

Unsurprisingly, the state of São Paulo offers the most skilled workforce when it comes to advanced manufacturing, ICT and management, with 11 of the top 20 micro-regions located within the state. Less expectedly, the city of São Paulo ranks only 3rd, behind Jundiaí and Osasco. Three of the 10 most competitiveness regions for business sophistication come from Santa Catarina. Once more, Manaus appears as a competitiveness business hub in the otherwise under-performing North. The same is true for Fortaleza in the Northeast.

Map 26: Brazil map by quintile of Business Sophistication



Source: FGV

Table 18: 20 Most competitiveness Micro-regions – Business Sophistication

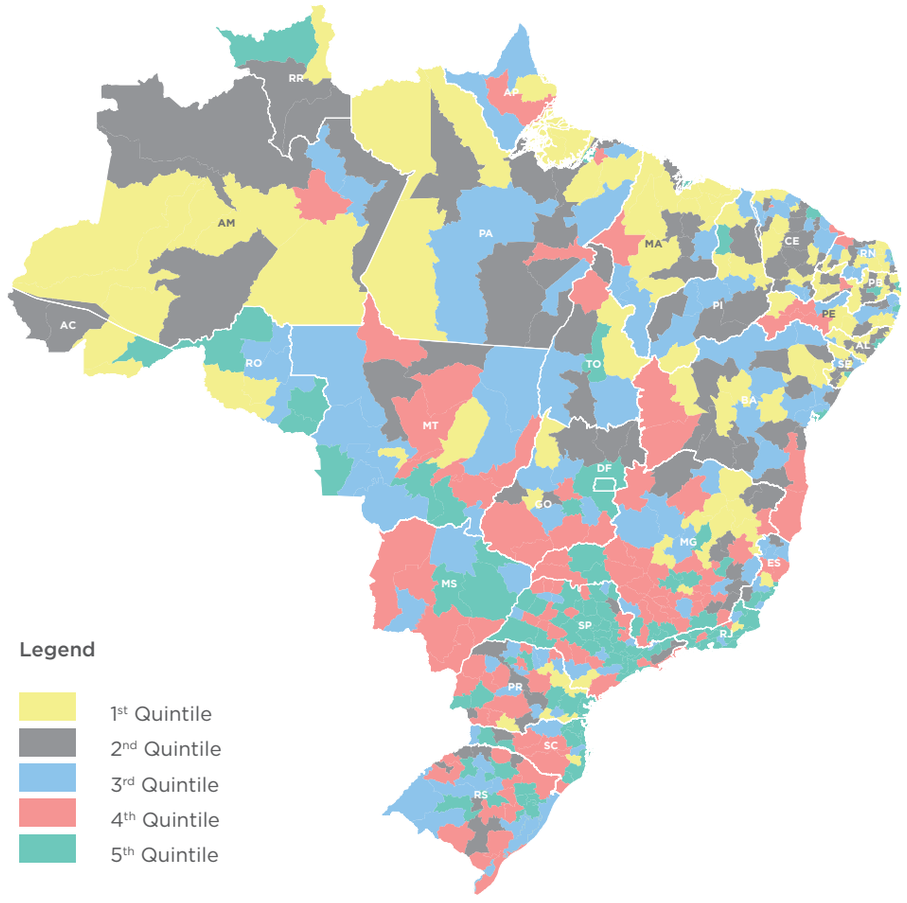
RANK	MICRO-REGION	STATE
1	Jundiaí	SP
2	Osasco	SP
3	São Paulo	SP
4	Campinas	SP
5	Florianópolis	SC
6	Blumenau	SC
7	Joinville	SC
8	Brasília	DF
9	Curitiba	PR
10	Bauru	SP
11	Maringá	PR
12	Criciúma	SC
13	Porto Alegre	SC
14	Caxias do Sul	RS
15	Guarulhos	SP
16	Sorocaba	SP
17	São José dos Campos	SP
18	São Carlos	SP
19	Ribeirão Preto	SP
20	Limeira	SP

Source: FGV

ICT-SKILLED WORKFORCE

A workforce[11] that is able to effectively use and produce information and communications technologies (ICTs) to gain access to advanced knowledge is an important driver of economic productivity. Interestingly, the state of São Paulo is out-performed by the Federal District (1st) and the state of Rio de Janeiro (2nd) in this dimension. Although the typical North-South divide is apparent, a number of Northern and Northeastern regions are highly competitiveness when it comes to ICT skills, while some regions of Paraná and Minas Gerais, among others, under-perform.

Map 27: Brazil map by quintile of ICT – skilled workforce



Source: FGV

[11] Measured as percentage of workers employed in Communications and Information Technology as share of total employment.

Table 19: Ranking by ICT – skilled workforce

1	Federal District (DF)	23	Amazonas (AM)
2	Rio de Janeiro (RJ)	24	Pará (PA)
3	São Paulo (SP)	25	Piauí (PI)
4	Rio Grande do Sul (RS)	26	Alagoas (AL)
5	Santa Catarina (SC)	27	Maranhão (MA)

Source: FGV

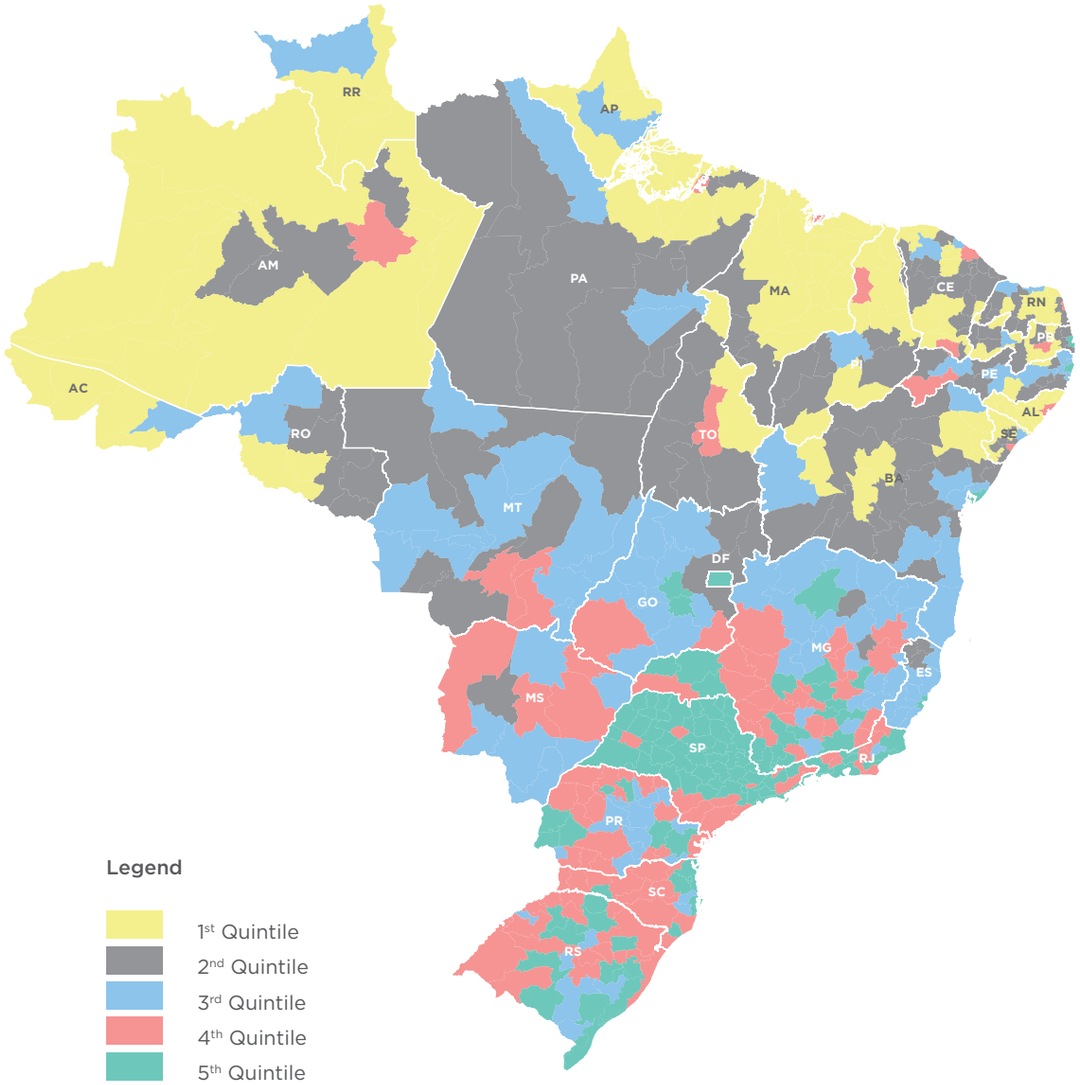
INNOVATION

Innovation is fundamental to many of the productivity gains that economies experience. Brazil has some well-known innovative firms and is at the forefront in high-technology fields such as deep-water oil extraction. However, its long-term competitiveness depends on the ability of each region to go beyond adopting existing technologies, towards the development of cutting-edge products and higher value-added activities. Innovation is closely related to a number of other dimensions, such as institutions, infrastructure, the education system, as well as the efficiency of the labor and goods markets. Based on a extensive set of **42 indicators**, this dimension looks at the following aspects that are considered crucial for competitiveness:

- Availability of skilled labor
- Foreign direct investment
- R&D environment
- Entrepreneurship and startup innovation

More than 75% of the twenty most competitiveness micro-regions in Brazil are located in São Paulo, with the city of São Paulo leading the ranking. Rio de Janeiro is significantly lagging behind, with only two micro-regions – Macaé (5th) and the capital city of Rio de Janeiro (11th) – among the top 20. Despite an overall lack in competitiveness in the North and Northeast, the map shows a number of regional innovation hubs in Amazonas, Piauí, Ceará, Pernambuco, Tocantins, among others.

Map 28: Brazil map by quintile of Innovation



Source: FGV

Table 20: 20 Most competitiveness Micro-regions –Innovation

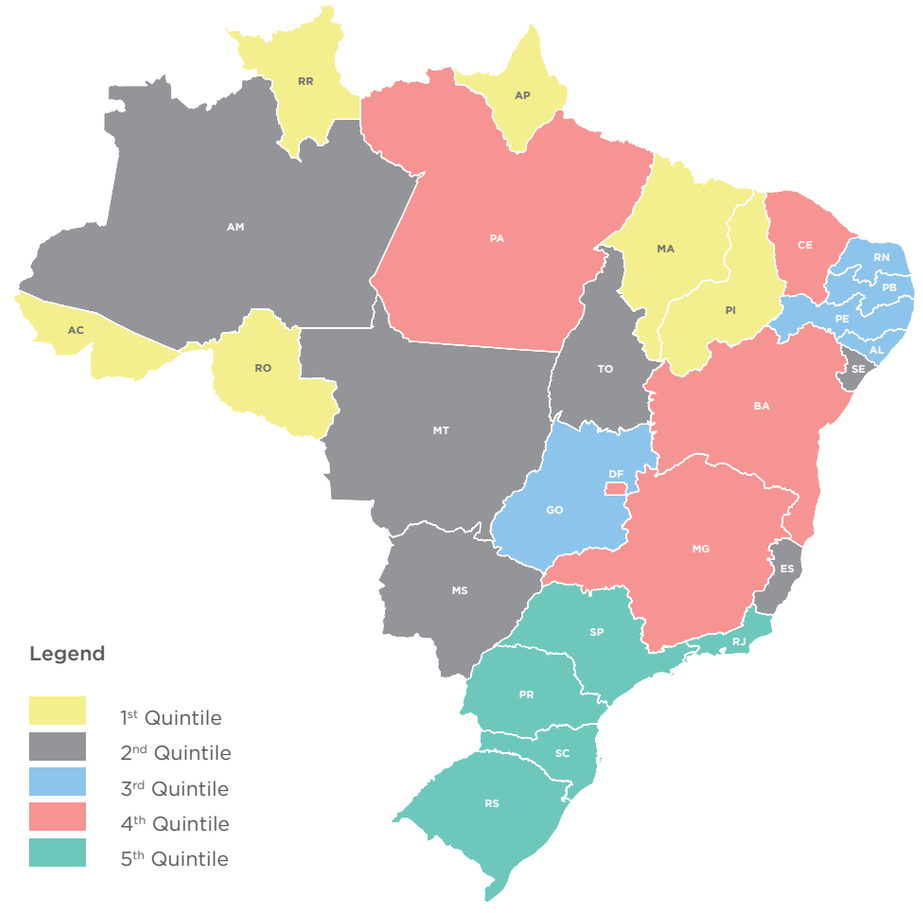
RANK	MICRO-REGION	STATE
1	São Paulo	SP
2	Campinas	SP
3	São Carlos	SP
4	São José dos Campos	SP
5	Macaé	RJ
6	Ribeirão Preto	SP
7	Jundiaí	SP
8	Botucatu	SP
9	Florianópolis	SC
10	Osasco	SP
11	Rio de Janeiro	RJ
12	Piracicaba	SP
13	Itapecerica da Serra	SP
14	Moji Mirim	SP
15	Guarulhos	SP
16	Bauru	SP
17	Rio Claro	SP
18	Belo Horizonte	MG
19	São José do Rio Preto	SP
20	Sorocaba	SP

Source: FGV

EXPENDITURE IN R&D[12]

The development of cutting-edge products and higher value-added activities requires adequate financial assistance from state agencies. São Paulo and Rio de Janeiro are the states which most benefit from R&D funding, a fact that might explain their good performance in the overall innovation ranking. The map highlights that Pará, Ceará and Bahia receive decisively more financial assistance than many of their neighbor states in the North and Northeast, such as Amapá, Acre and Rondônia, which ranks last.

Map 29: Brazil map by quintile of Expenditure in R&D



Source: FINEP

[12] Measured as expenditure by FINEP, the major federal R&D financing agency.

Table 21: Ranking by Expenditure in R&D

1	São Paulo (SP)	23	Piauí (PI)
2	Rio de Janeiro (RJ)	24	Roraima (RR)
3	Rio Grande do Sul (RS)	25	Amapá (AP)
4	Santa Catarina (SC)	26	Acre (AC)
5	Paraná (PR)	27	Rondônia (RO)

Source: FINEP

INTERESTING PHENOMENA

PhDs in STEM fields

In the global economy, countries and regions rely on Science, Technology, Engineering and Mathematics (STEM) skills to deliver world-class competitiveness. The ranking below shows the five states with the highest number of PhDs in STEM fields. It reflects the overall competitiveness ranking in innovation, as well as what has been said about the volume of R&D expenditure granted to the Brazilian states by public agencies such as FINEP.

- São Paulo
- Rio de Janeiro
- Minas Gerais
- Rio Grande do Sul
- Santa Catarina

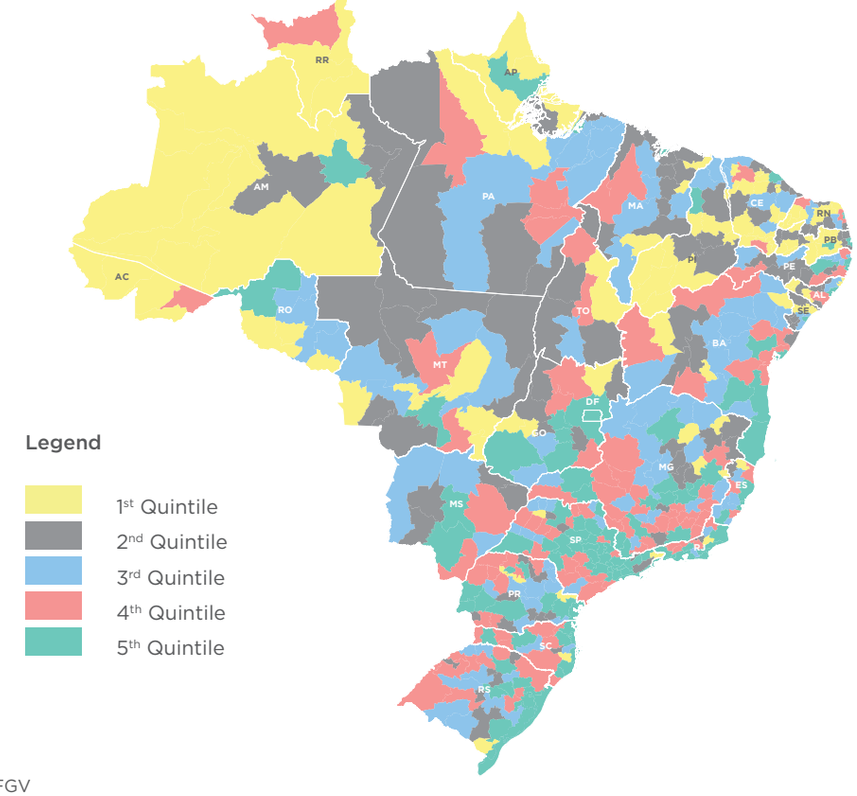
MARKET SIZE

The size of the market is a crucial aspect of a region's competitiveness and productivity, since large markets provide investors with economic opportunities and allow firms to exploit economies of scale and scope. According to The Global competitiveness Report 2014-2015, published by the World Economic Forum, Brazil's main global competitiveness advantage lies in its growing domestic market: Brazil is ranked 9th out of 133 economies. Brazil's economy is among the largest and most dynamic in the world and markets in almost all states are expanding, offering attractive investment and development opportunities. This dimension measures the **market size** of each micro-region, based on a set of **5 indicators** covering the following aspects:

- Size of the local economy
- Population
- Size of firm
- Distance between markets
- Weighted market size

The geographical distribution for this dimension may well be the most heterogeneous, showing few clear patterns. This reflects the substantial populations of large and mid-sized cities even in Brazil's poorest regions, as well as the substantial driving power of agribusiness and mining to make some regions prominent in population and economic importance.

Map 30: Brazil map by quintile of Market Size



Source: FGV

Table 22: 20 Most competitiveness Micro-regions – Market Size

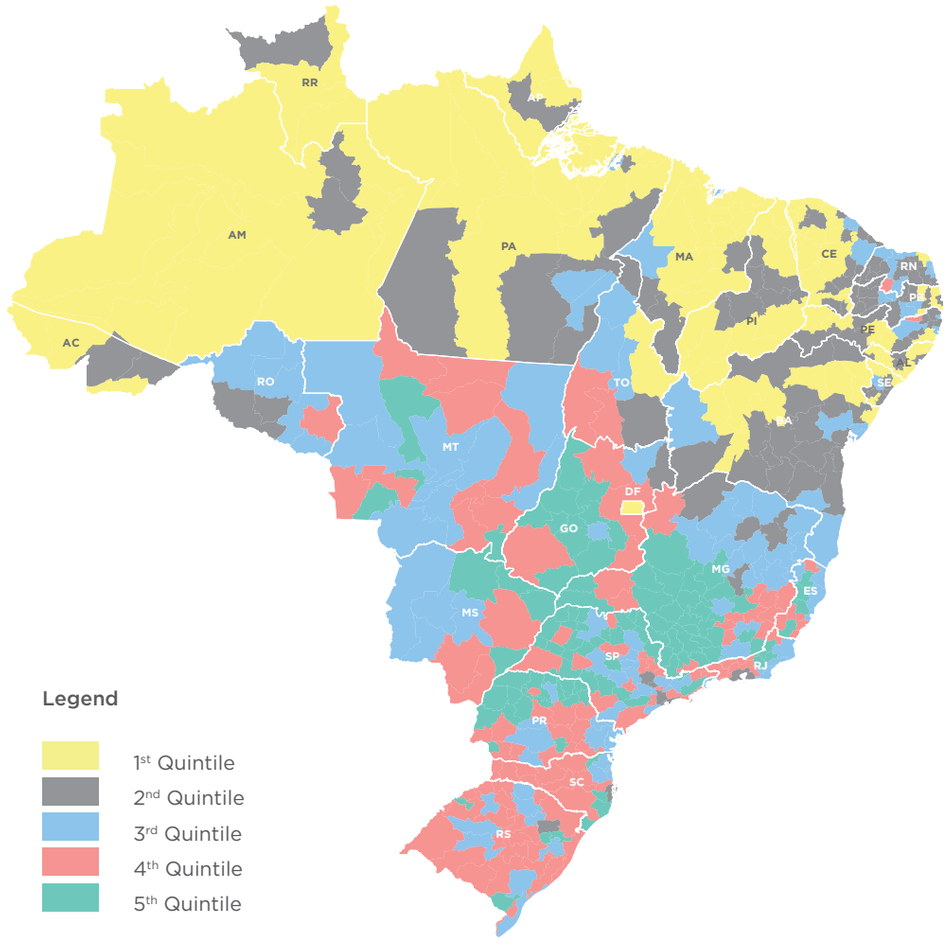
RANK	MICRO-REGION	STATE
1	São Paulo	SP
2	Rio de Janeiro	RJ
3	Belo Horizonte	MG
4	Curitiba	PR
5	Porto Alegre	RS
6	Campinas	SP
7	Brasília	DF
8	Salvador	BA
9	Osasco	SP
10	Recife	PE
11	Fortaleza	CE
12	Vitória	ES
13	Santos	SP
14	Goiânia	GO
15	São José dos Campos	SP
16	Guarulhos	SP
17	Sorocaba	SP
18	Mogi das Cruzes	MG
19	Florianópolis	SC
20	Ribeirão Preto	SP

Source: FGV

MIDDLE CLASS[13]

Brazil's middle class is no longer mostly concentrated in the traditional urban centers of the coast, but in the agriculture-rich inner regions. However, a look at the Federal District (placed 26th) belies this simple interpretation: most of its households earn more than the top limit for this income category. It appears that the self-defined "middle class" of the main cities would be considered rich elsewhere.

Map 31: Brazil map by quintile of Middle Class



Source: Censo 2010

[13] Middle class defined as per capita household income of R$291 -R$1019

Table 23: Ranking by Middle Class

1	Goiás (GO)	23	Pará (PA)
2	Minas Gerais (MG)	24	Alagoas (AL)
3	Paraná (PR)	25	Amazonas (AM)
4	Mato Grosso do Sul (MS)	26	Federal District (DF)
5	Mato Grosso (MT)	27	Maranhão (MA)

Source: Censo 2010

PAYROLL

This indicator illustrates, among other aspects, the large economic weight of São Paulo. Formal labor income (in absolute numbers) is highly concentrated in the southern coastal strip from Bahia to Rio Grande do Sul. However, even within this division, the state of São Paulo stands out on its own. Its inhabitants earn almost twice the labor income of runner-up Rio de Janeiro.

Map 32: Brazil map by quintile of Total Payroll

Source: Rais/MTE

Table 24: Ranking by Total Payroll

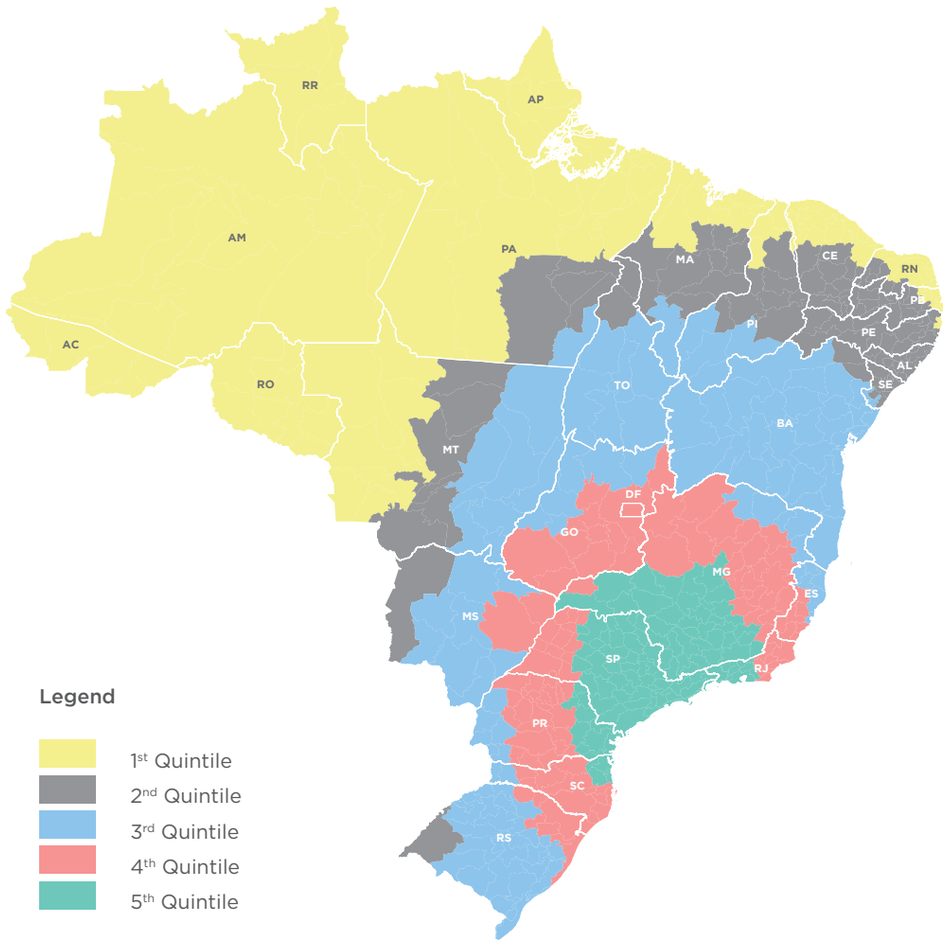
1	São Paulo (SP)	23	Piauí (PI)
2	Rio de Janeiro (RJ)	24	Tocantins (TO)
3	Minas Gerais (MG)	25	Amapá (AP)
4	Rio Grande do Sul (RS)	26	Acre (AC)
5	Paraná (PR)	27	Roraima (RR)

Source: Rais/MTE

WEIGHTED MARKET SIZE[14]

This indicator measures each micro-region's proximity to the country's main internal markets. The highest-performing localities are those located closest to the three major cities of the Southeast: São Paulo, Rio de Janeiro and Belo Horizonte. Isolated from these economic centers and from international trading partners, the distant localities of the Northern region appear less likely to have substantial local markets to spur regional development.

Map 33: Brazil map by quintile of Weighted Market Size



Source: Censo 2010

[14] WMS[i] = soma (j ≠ i) de PIB[j] * exp(-alpha * d[i,j])

Table 25: Ranking by Weighted Market Size

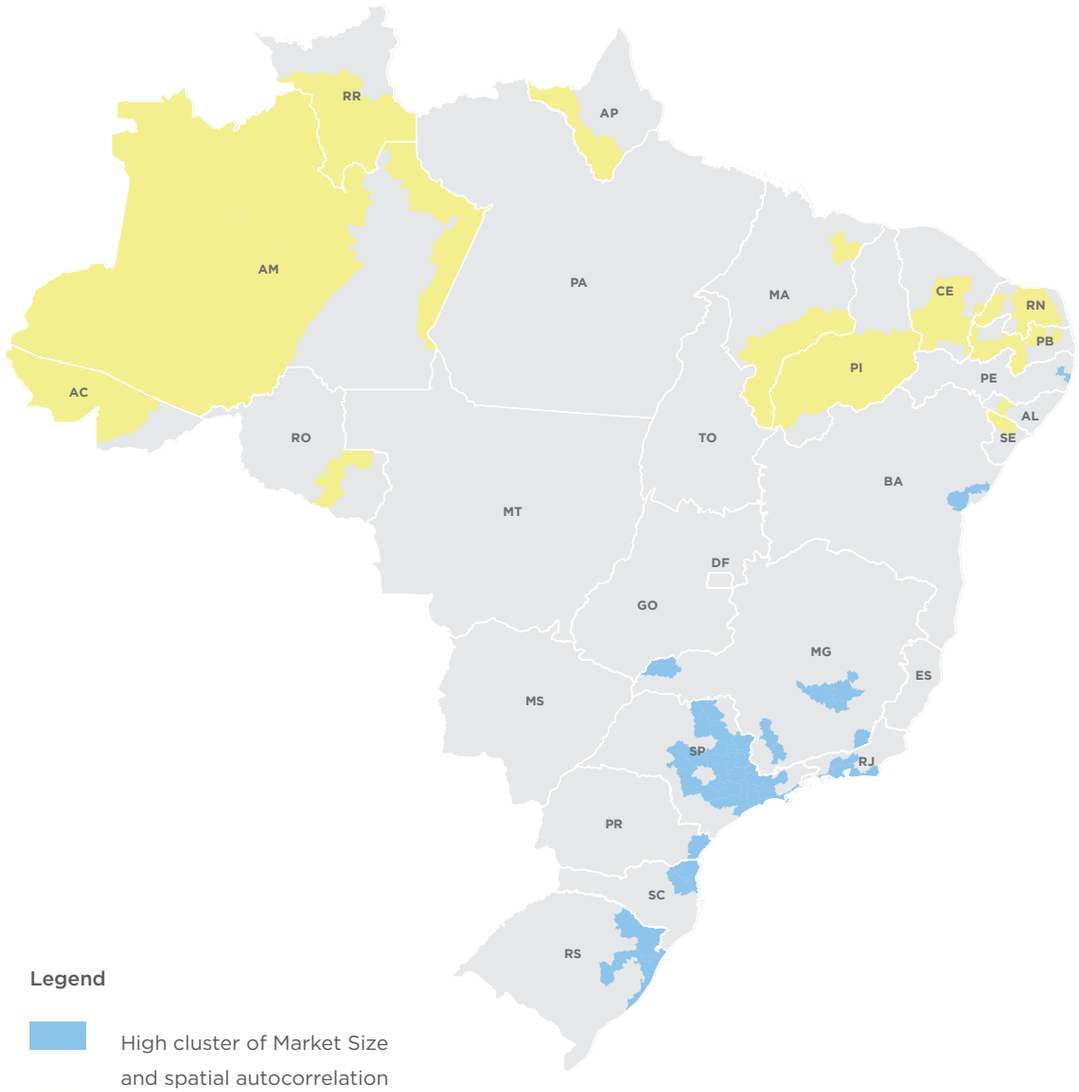
1	São Paulo (SP)	23	Amapá (AP)
2	Minas Gerais (MG)	24	Rondônia (RO)
3	Rio de Janeiro (RJ)	25	Amazonas (AM)
4	Santa Catarina (SC)	26	Roraima (RR)
5	Paraná (PR)	27	Acre (AC)

Source: FGV

INTERESTING PHENOMENA

For a more qualitative analysis of the dimension, clusters per state are analyzed using Spatial Autocorrelation Analysis, or SAA (see note on page 30). Interestingly, applying SAA to this dimension produces smaller, sparser clusters, when compared to the former examples. This indicates a higher degree of spatial heterogeneity. The method is still able to correctly identify the core economic center of the country in São Paulo, as well as economically "blank spots" in the North and Northeast.

Map 34: Cluster Analysis – Market Size



Source: FGV

GOODS MARKET

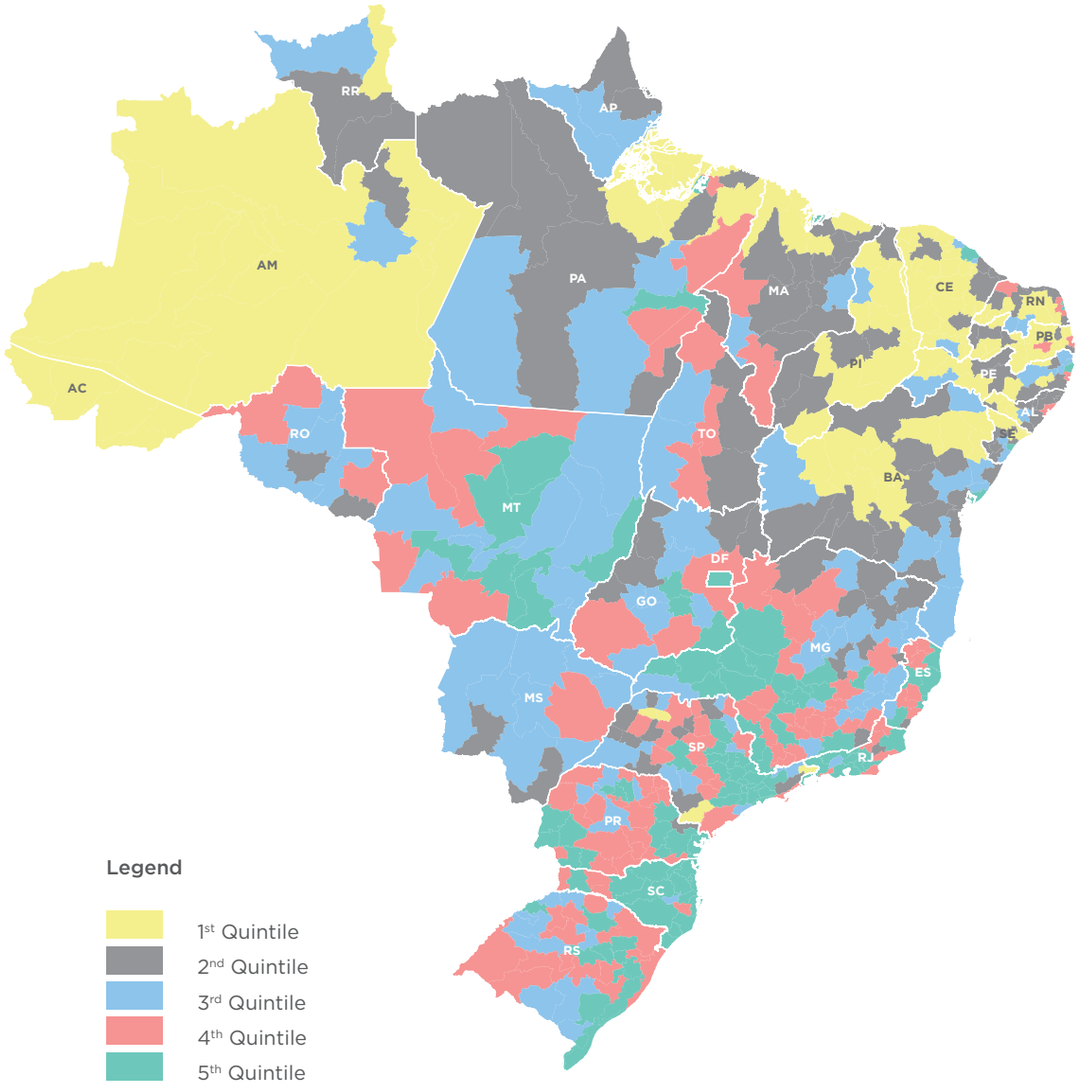
High taxes, constantly changing regulations, a complex system of labor and tax codes and restrictive rules on foreign direct investment (FDI) and international trade are major obstacles to the efficient exchange of goods and tend to reduce aggregate economic activity. This dimension measures the ability of each region to create and maintain market structures in which all resources are allocated to their most appropriate and efficient uses. It also includes tax burden, an important variable affecting not only the efficient allocation of resources but also the profitability of existing and future investments.

The dimensions includes a set of **5 indicators** related to two important aspects of a competitiveness goods market:

- Intensity of local competition
- Tax burden

The substantially heterogeneous map below reveals the mostly exogenous impact of tax-policy decisions as well as the highly variable competitiveness scenario prevailing in each region.

Map 35: Brazil map by quintile of Goods Market



Source: FGV

Table 26: 20 Most competitiveness Micro-regions – Goods Market

RANK	MICRO-REGION	STATE
1	São Paulo	SP
2	Itajaí	RJ
3	Guarulhos	SP
4	Maringá	PR
5	Joinville	SC
6	Londrina	PR
7	Rio de Janeiro	RJ
8	Blumenau	SC
9	Caxias do Sul	RS
10	Itapecerica da Serra	SP
11	Campinas	SP
12	Uberlândia	MG
13	Curitiba	PR
14	Serrana	RJ
15	Piracicaba	SP
16	Vitória	ES
17	Ponta Grossa	PR
18	São Bento do Sul	SC
19	Criciúma	SC
20	Linhares	ES

Source: FGV

TAX BURDEN

As highlighted by the map below, there is a lack of correlation between the taxes collected in a state and its economic importance, indicating the degree of political discretion involved. The states of São Paulo, Rio de Janeiro and Pernambuco are grouped in the same quintile and Amazonas is singled out by the presence of Manaus' special economic zone, which apparently has contributed more to tax collection than to the state's socio-economic growth, as evidenced by the other dimensions analyzed.

Map 36: Brazil map by quintile of Tax Burden

Source: Confaz - MF

Table 27: Ranking by Tax Burden

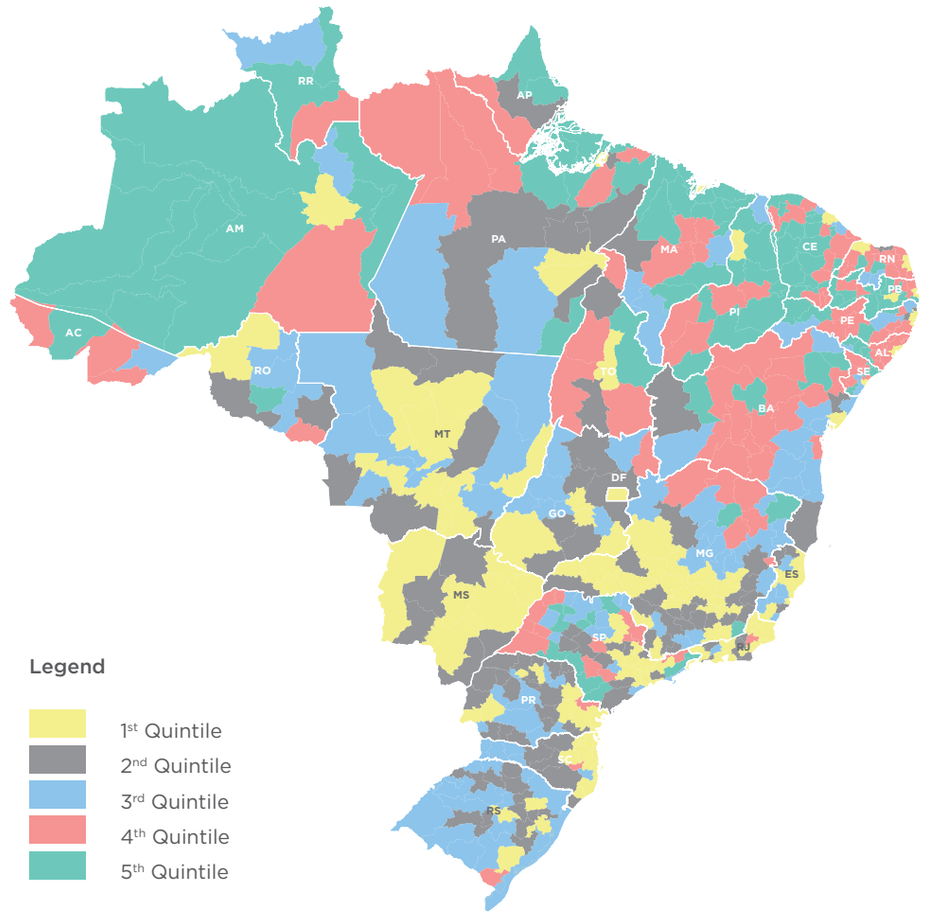
1	São Paulo (SP)	23	Acre (AC)
2	Rio de Janeiro (RJ)	24	Tocantins (TO)
3	Pernambuco (PE)	25	Roraima (RR)
4	Amazonas (AM)	26	Federal District (DF)
5	Rondônia (RO)	27	Amapá (AP)

Source: Confaz - MF

LOCAL COMPETITION

A high level of competition is indicative of economic efficiency, although it may be also negatively correlated with the relative sophistication of economies of scale in leading industries. All other things being equal, regions with more small-size firms (low Herfindahl-Hirschman Index, HHI) are more competitiveness than regions where all production is dominated by one large company (high HHI). This pattern can be clearly identified in the results below: in general, the regions with the lowest HHI correspond to the country's traditional economic centers.

Map 37: Brazil map by quintile of Intensity of Local Competition – Firms - HHI[15]



Source: Rais/MTE

[15] $HHI_{Firms} = \sum_{1}^{N} S_i^2$; $S_i = \frac{\text{\# Companies in the Sector i}}{\text{\# Companies in the Municipality}}$

Table 28: Ranking by Local Competition

1	Piauí (PI)	23	Santa Catarina (SC)
2	Maranhão (MA)	24	Mato Grosso do Sul (MS)
3	Paraíba (PB)	25	Espírito Santo (ES)
4	Acre (AC)	26	Rio de Janeiro (RJ)
5	Amazonas (AM)	27	Federal District (DF)

Source: RAIS/MTE

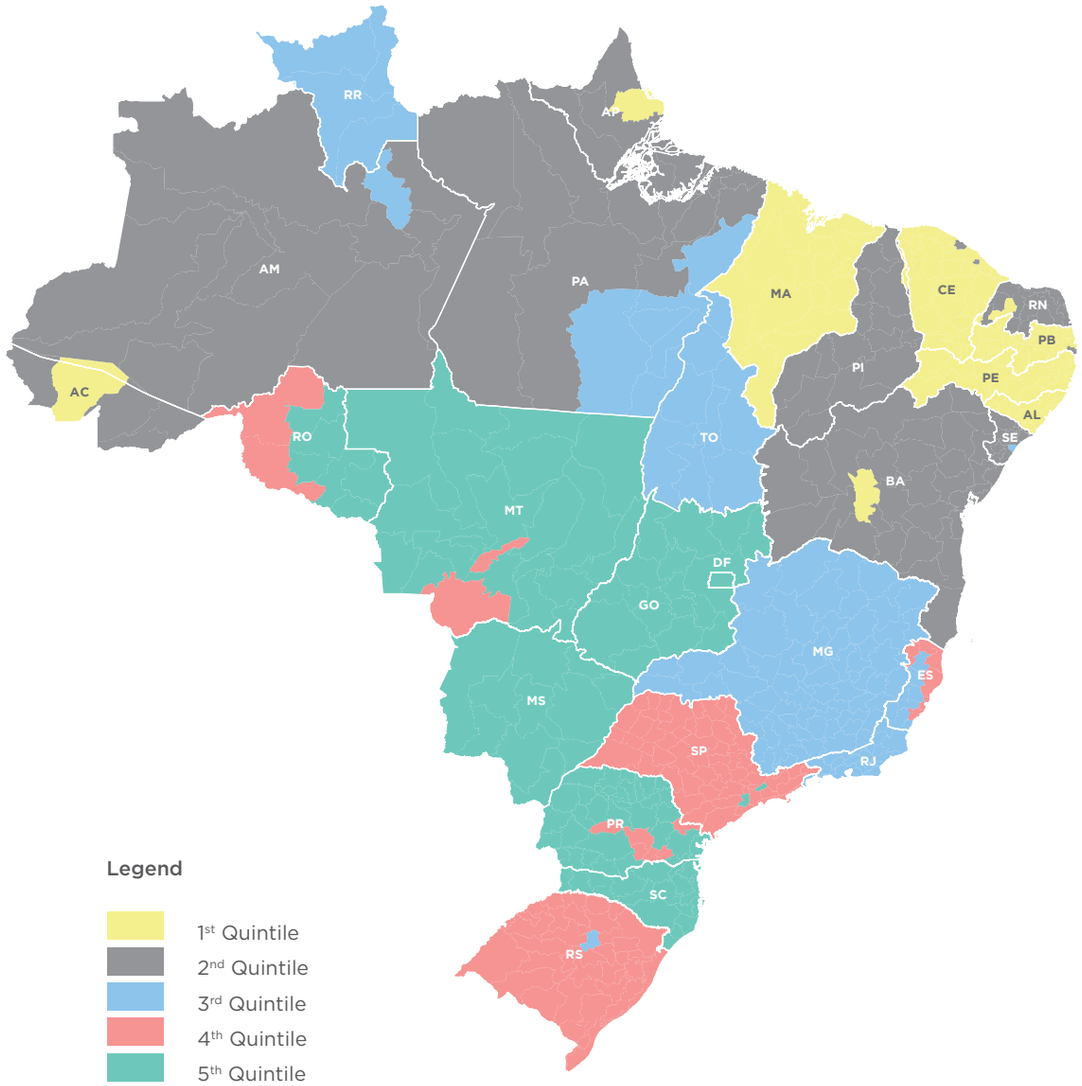
LABOR MARKET

An efficient labor market allocates workers to their most effective use, provides equity between women and men, and is able to attract and retain talent. Conversely, a rigid labor market with high barriers can be an important cause of high youth unemployment. Brazil has a large labor force, but many workers are semi-skilled and unskilled. This dimension includes a set of **15 indicators** which measure the size, flexibility, and efficiency of the labor market, according to the following aspects:

- Employment rates
- Unemployment
- Capacity to attract talent
- Capacity to retain talent

Twelve of the top 20 micro-regions with the most competitiveness labor market are located in the Southern state of Santa Catarina, including the top 5. The competitiveness of the labor markets of many of the Southern and Central-Western states stands in stark contrast to the less efficient labor markets of the Northeastern states of Alagoas, Pernambuco, Paraíba and Ceará. Minas Gerais and Rio de Janeiro display only average performance.

Map 38: Brazil map by quintile of Labor Market



Source: FGV

Table 29: 20 Most competitiveness Micro-regions – Labor Market

RANK	MICRO-REGION	STATE
1	Itajaí	SC
2	Chapecó	SC
3	Joinville	SC
4	Florianópolis	SC
5	São Miguel do Oeste	SC
6	Alto Teles Pires	MT
7	Joaçaba	SC
8	Blumenau	SC
9	Entorno de Brasília	GO
10	Alta Floresta	MT
11	Xanxerê	SC
12	Cassilândia	MS
13	Parecis	MT
14	São Bento do Sul	SC
15	Concórdia	SC
16	Sinop	MT
17	Primavera do Leste	MT
18	Arinos	MT
19	Criciúma	SC
20	Araranguá	SC

Source: FGV

YOUTH UNEMPLOYMENT

An important aspect of regional labor-market efficiency is the ability to keep youth unemployment to a minimum, as failing to employ the youth not only affects economic growth but will significantly hamper future growth. As evidenced by the map below, Brazil's youth unemployment rates are significantly higher in the North and Northeastern regions. Surprisingly, the Federal District suffers from one of the highest youth unemployment rates in the country. Tocantins and Piauí appear to be highly competitiveness within their respective regions.

Map 39: Brazil map by quintile of Youth Unemployment

Source: PNAD 2013

Table 30: Ranking by Youth Unemployment

1	Rio Grande do Norte (RN)	23	Rio Grande do Sul (RS)
2	Amapá (AP)	24	Paraná (PR)
3	Federal District (DF)	25	Mato Grosso (MT)
4	Alagoas (AL)	26	Santa Catarina (SC)
5	Amazonas (AM)	27	Mato Grosso do Sul (MS)

Source: PNAD 2013

INTERESTING PHENOMENA

Brazil's "Nem-Nems"

Youth unemployment in Brazil goes hand in hand with the Phenomena of the "Nem-Nems" (Portuguese for "Neither-Nors"): youth neither in employment nor in school. The ranking below shows the five micro-regions with the highest share of "Nem-Nems". Unsurprisingly, all are located in the North and Northeast:

1. Traipu, AL
2. Rio Negro, AM
3. Serrana do Sertão Alagoano, AL
4. Itapecuru Mirim, MA
5. Nordeste de Roraima, RR

The micro-regions with the lowest share of "Nem-Nems" are Blumenau (SC), Lajeado-Estrela (RS), Gramado-Canela (RS), Rio do Sul (SC) and Guaporé (RS).

Women in the workforce

The states with the biggest share of women in the workforce are:

1. Roraima
2. Rio Grande do Sul
3. Tocantins
4. Acre
5. Santa Catarina

The state with the smallest share of women in employment is the Federal District, followed by Alagoas, Mato Grosso, Pará and Pernambuco.

Informality

The states with the biggest share of informal workers are:

1. Ceará
2. Piauí
3. Maranhão
4. Tocantins
5. Paraíba

The least informal are:

1. Santa Catarina
2. Rio Grande do Sul
3. Federal District
4. São Paulo
5. Paraná

Migrant and Magnet States

The top migrant-sending states are well known:

1. Paraíba
2. Piauí
3. Alagoas

But the magnet states are not as obvious:

1. Roraima
2. Amapá
3. Goiás

ENERGY RESOURCES

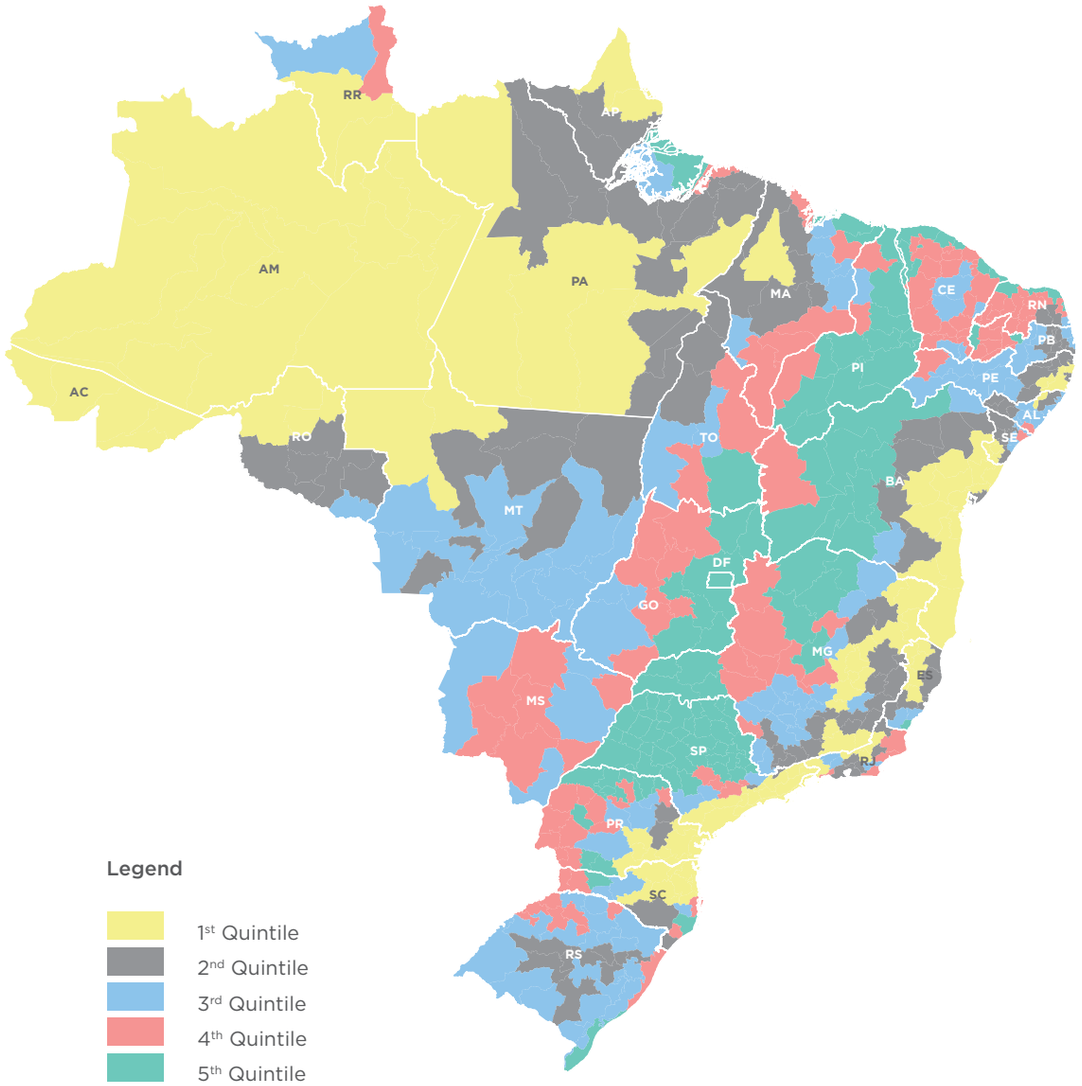
Brazil occupies an outstanding position in energy sources, with the capability to contribute to the greening of the global energy matrix. The localization and diversity of energy sources is of strategic importance for the Brazilian economy and a source of competitiveness advantage of its states.

This dimension looks at the availability of renewable energy resources in each micro-region, understood as a factor which determines investment opportunities. The following **2 indicators** have been included in the analysis:

- Potential for solar energy
- Potential for wind energy

The potential for the generation of energy based on solar radiation and wind speed is highest in the micro-regions of Boquira (BA), Jarnaúba (MG) and Astorga (PR).

Map 40: Brazil map by quintile of Energy Resources



Source: FGV

Table 31: 20 Most competitiveness Micro-regions – Energy Resources

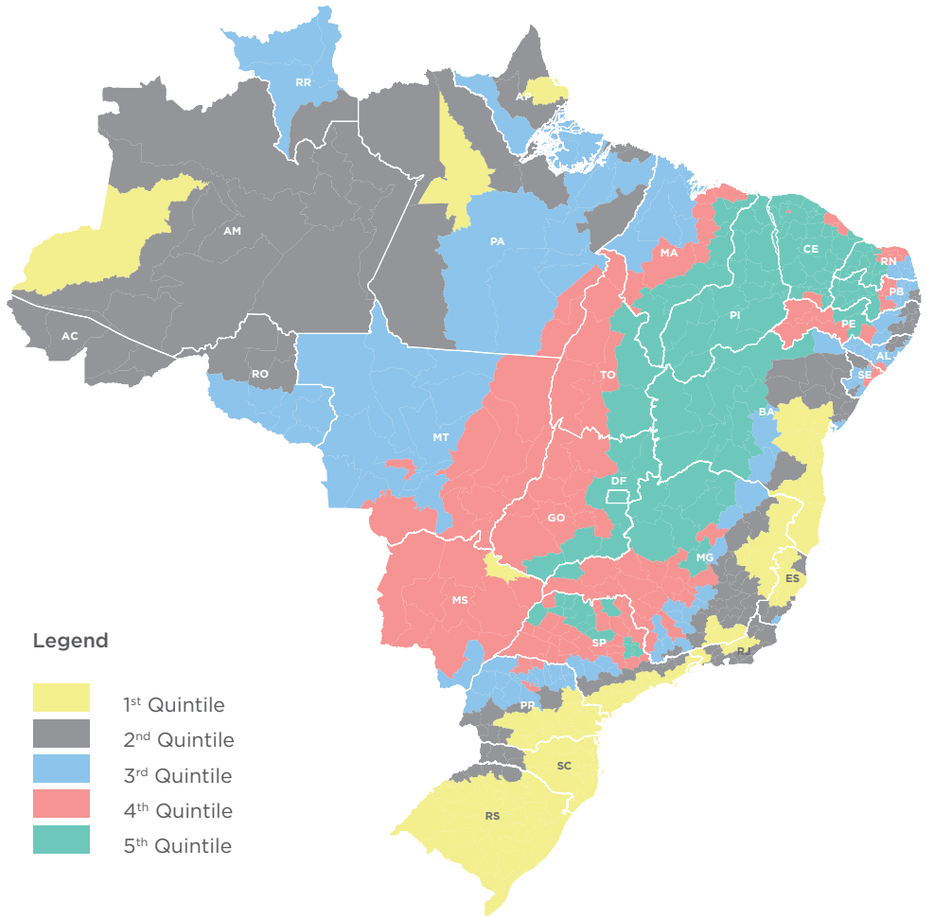
RANK	MICRO-REGION	STATE
1	Boquira	BA
2	Janaubá	MG
3	Astorga	PR
4	Barra	BA
5	Assis	SP
6	Ituverava	SP
7	Ibiapaba	CE
8	Litoral Lagunar	RS
9	Guanambi	BA
10	Baixo Curu	CE
11	Bom Jesus da Lapa	BA
12	Litoral de Camocim e Acaraú	CE
13	Marília	SP
14	Tupã	SP
15	Ourinhos	SP
16	Itaperimim	ES
17	Alto Médio Canindé	PI
18	Porecatu	PR
19	São Raimundo Nonato	PI
20	Montes Claros	MG

Source: FGV

POTENTIAL FOR SOLAR-ENERGY GENERATION

Solar-energy potential is determined not only by incidence of sunlight (which most of Brazil evidently enjoys by virtue of its low latitudes), but also by terrain and cloud coverage. Therefore, the mostly flat, semi-arid regions in Bahia, northern Minas Gerais and Piauí tend to fare better than (for instance) the mountainous Southern coasts or the Southernmost regions of the country.

Map 41: Brazil map by quintile of Solar Radiation



Source: http://en.openei.org/wiki/SWERA/Data

Table 32: Ranking by Solar Radiation

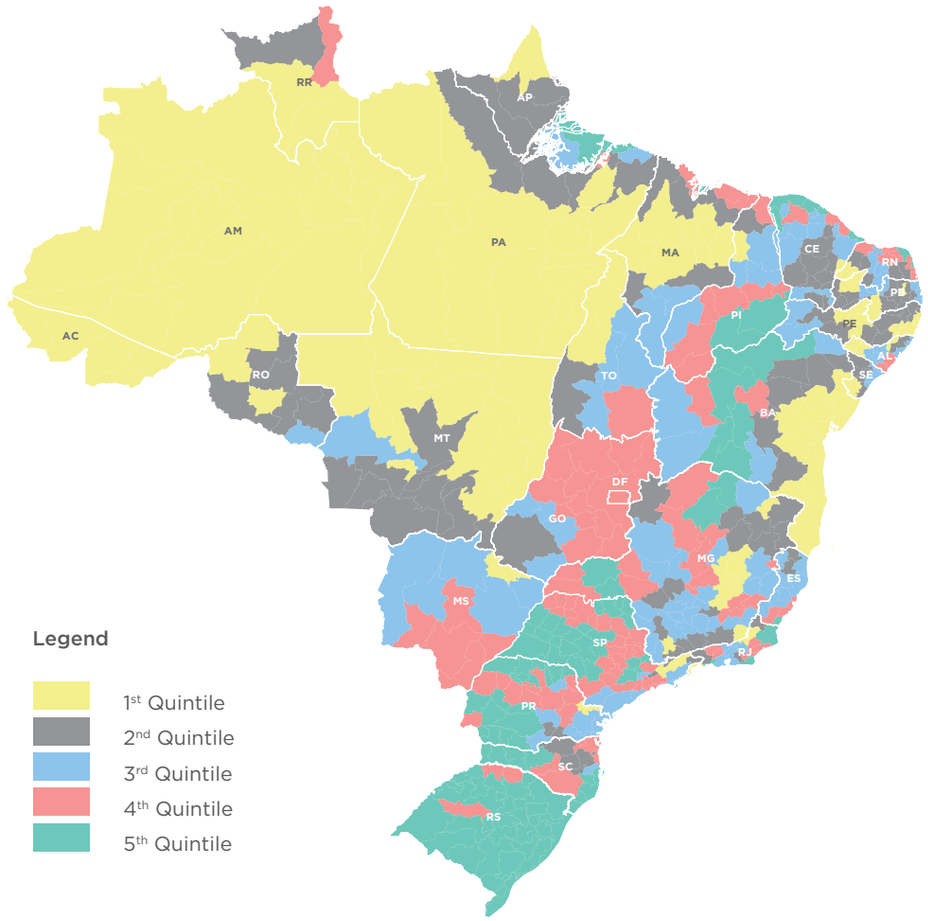
1	Piauí (PI)	23	Espírito Santo (ES)
2	Federal District (DF)	24	São Paulo (SP)
3	Ceará (CE)	25	Paraná (PR)
4	Goiás (GO)	26	Rio Grande do Sul (RS)
5	Tocantins (TO)	27	Santa Catarina (SC)

Source: OpenEI

POTENTIAL FOR WIND-ENERGY GENERATION

Wind power is mostly a function of geo-morphology and weather. In this aspect, Rio Grande do Sul's high potential stands out – the state is indeed the country's foremost producer of wind power. Many coastal regions and some favorably flat areas throughout all regions, except the North, have favorable conditions for the generation of wind energy.

Map 42: Brazil map by quintile of Wind Power



Source: http://en.openei.org/wiki/SWERA/Data

Table 33: Ranking by Wind Power

1	Rio Grande do Sul (RS)	23	Rondônia (RO)
2	Santa Catarina (SC)	24	Mato Grosso (MS)
3	São Paulo (SP)	25	Pernambuco (PE)
4	Paraná (PR)	26	Acre (AC)
5	Federal District (DF)	27	Amazonas (AM)

Source: OpenEI

INTERESTING PHENOMENA

Oil and Gas

The states with the biggest share of oil reserves and natural gas are:

1. Rio de Janeiro
2. Espírito Santo
3. São Paulo
4. Amazonas
5. Bahia

AGRICULTURAL AND EXTRACTIVE RESOURCES

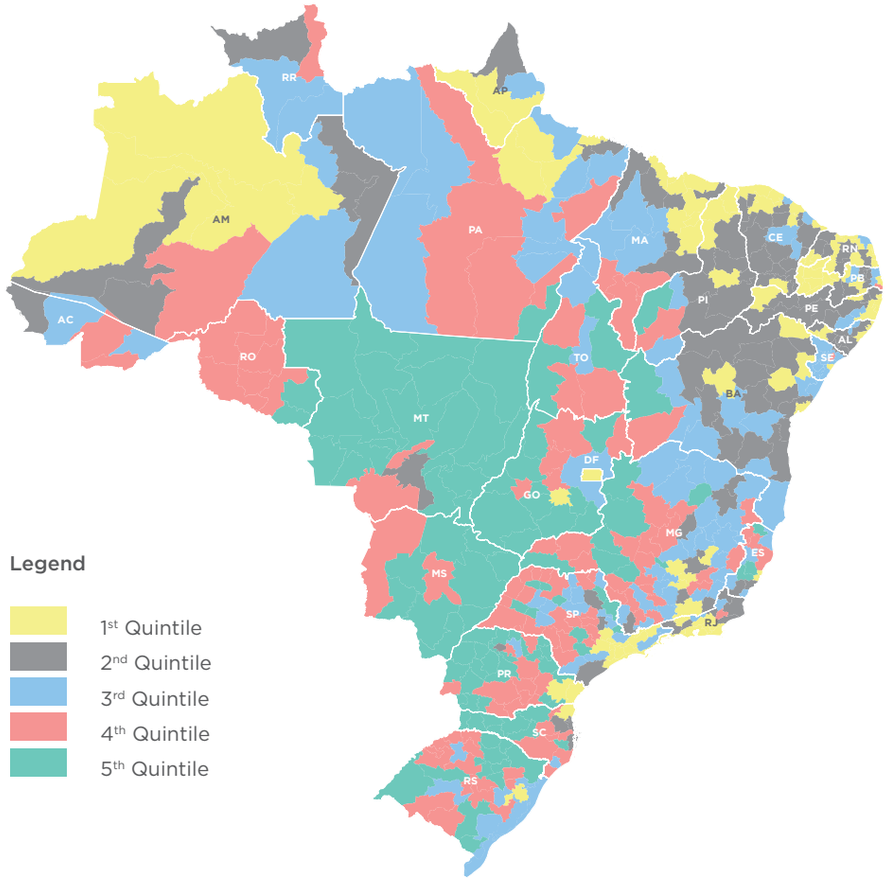
Agriculture and extractive industries are critical drivers of the Brazilian economy, a source of growth and competition and an important area of foreign investment. This dimension measures the availability and productivity of those **agricultural and extractive resources** which are considered crucial for the competitiveness of the Brazilian micro-regions namely vegetal and mineral extraction, sugar cane, cropland, livestock, timber, and fish.

The dimension includes a set of **25 indicators** which measure the following key aspects of agricultural and extractive activities:

- Employed workforce
- Production volume
- Livestock

The map below illustrates very well the business drive of agriculture in the country. The Midwest's substantial endowments are demonstrated, but strong potential production also exists in most other regions, notably the Southern states and the innermost regions of the states of São Paulo and Minas Gerais. Extractive activities in Pará and Minas Gerais are also highlighted.

Map 43: Brazil map by quintile of Agricultural and Extractive Resources



Source: FGV

Table 29: 20 Most competitiveness Micro-regions – Agricultural and Extractive Resources

RANK	MICRO-REGION	STATE
1	Alto Teles Pires	MT
2	Paranatinga	MT
3	Primavera do Leste	MT
4	Tesouro	MT
5	Arinos	MT
6	Parecis	MT
7	Canarana	MT
8	Sudoeste de Goiás	GO
9	Pires do Rio	GO
10	Cassilândia	MS
11	Alto Taquari	MS
12	Norte Araguaia	MT
13	Alto Araguaia	MT
14	Colorado do Oeste	RO
15	Aripuanã	MT
16	Wenceslau Braz	PR
17	Astorga	PR
18	Nhandeara	SP
19	Cianorte	PR
20	Vale do Rio dos Bois	GO

Source: FGV

EMPLOYMENT IN FISHING, SILVICULTURE AND MINING

This indicator captures the significant importance of several extractive activities in different states: for instance, mining in Pará and Minas Gerais, fishing in Rio Grande do Norte and forestry in Amapá.

Map 44: Brazil map by quintile of Workforce in Fishing, Silviculture and Mining

Source: Rais-MTE

Table 35: Ranking by Workforce in Fishing, Silviculture and Mining

1	Pará (PA)	23	Roraima (RR)
2	Rio Grande do Norte (RN)	24	Paraíba (PB)
3	Amapá (MG)	25	Alagoas (AL)
4	Maranhão (AP)	26	Pernambuco (PE)
5	Espírito Santo (ES)	27	Federal District (DF)

Source: RAIS-MTE

4. RESULTS PER VECTOR

HUMAN CAPITAL

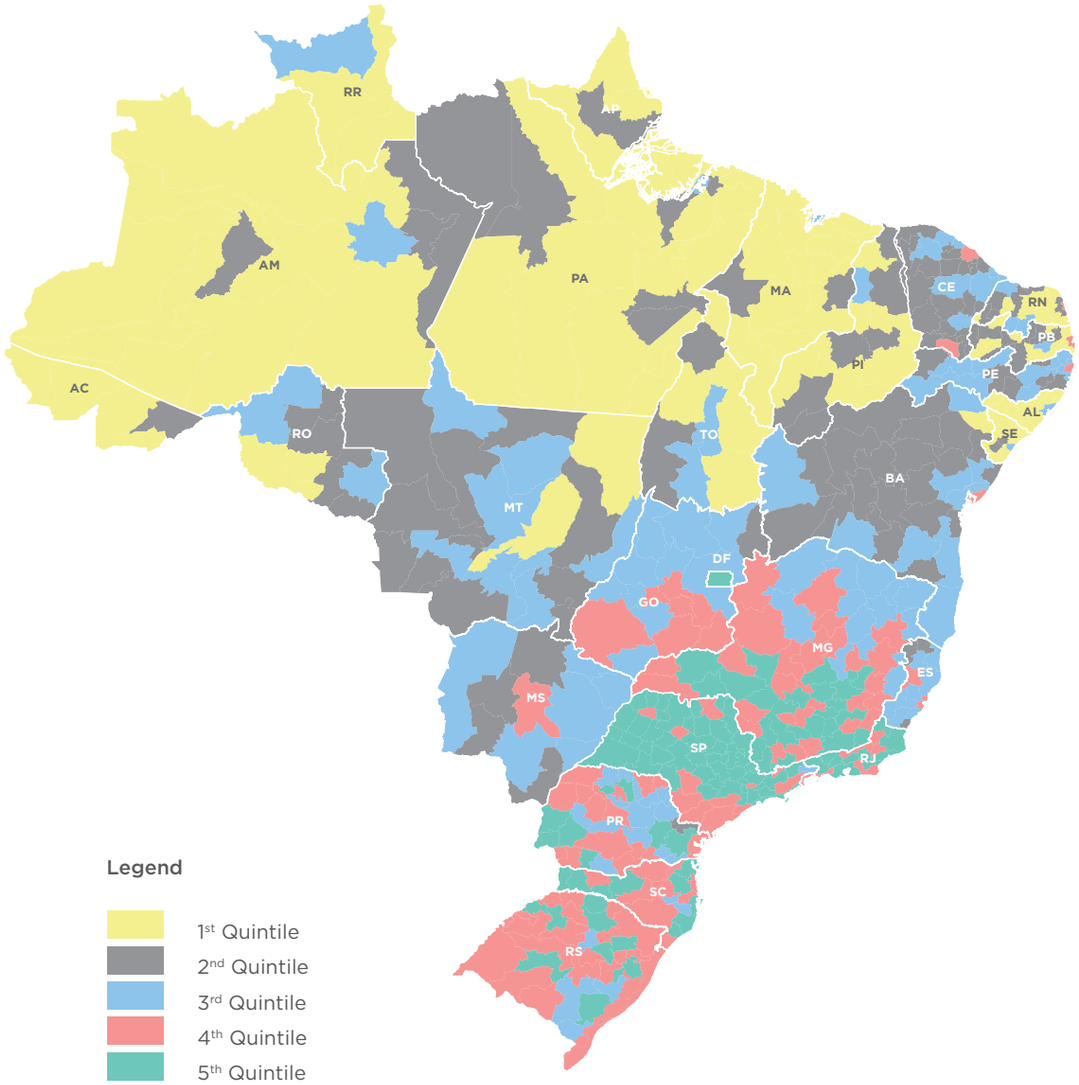
The **Human Capital** vector includes two dimensions:

- Basic Education, and
- Higher and Vocational Education.

In order to be competitive on the regional and global scale, the Brazilian economy needs to move up the value chain into more advanced and diversified manufacturing and services sectors. This will require the development of a sufficiently skilled workforce that can move beyond simple production processes. In other words: only significant and immediate investments in education will enhance local, regional and national productivity and competitiveness. In this context, education will play an even more prominent role in ensuring knowledge spillovers to the domestic economy.

Based on the individual rankings of basic education and higher and vocational education, it comes as no surprise that the micro-region, as well as the state, of São Paulo are out-performing all other regions in human-capital generation. The question that needs to be asked and may be investigated in further studies is "Why?" Why is São Paulo the most competitiveness region and state in education provision? Is it literacy, is it class size, is it the quality of its higher-education institutions? In other words, what is the process that generated the ranking and what lessons can be drawn?

Map 45: Brazil map by quintile of Human Capital



Source: FGV

Table 36: 20 Most competitiveness Micro-regions – Human Capital

RANK	MICRO-REGION	STATE
1	São Paulo	SP
2	Jundiaí	SP
3	Campinas	SP
4	São José dos Campos	SP
5	Fernandópolis	SP
6	Marília	SP
7	Sorocaba	SP
8	São Carlos	SP
9	Limeira	SP
10	São José do Rio Preto	SP
11	Bauru	SP
12	Aracatuba	SP
13	Jales	SP
14	Piracicaba	SP
15	Brasília	DF
16	Votuporanga	SP
17	Florianópolis	SC
18	Ribeirão Preto	SP
19	Belo Horizonte	MG
20	Araraquara	SP

Source: FGV

QUALITY OF LIFE

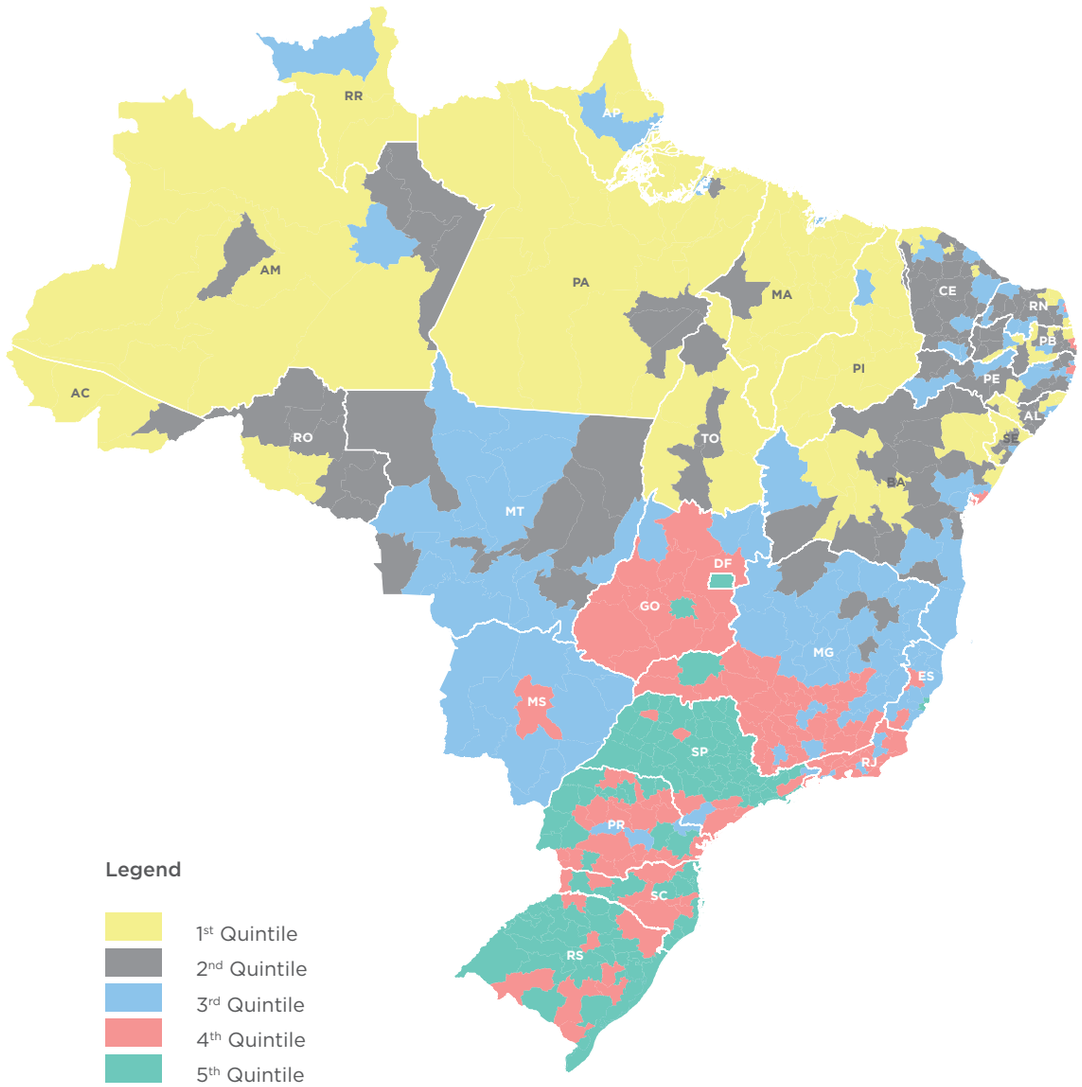
The vector **Quality Of Life** vector includes three dimensions:

- Social Infrastructure,
- Sustainability, and
- Health.

“Quality of life” is here understood as those factors which guarantee and increase labor productivity, including adequate and affordable housing, clean air and public health services, access to ICTs and electricity, and an efficient transport network, among others. Over the past decade, a reduction in poverty and income inequality has been witnessed, but Brazil continues to be one of the most unequal countries in the world, and a more even distribution of income and wealth, on both an individual and a regional basis, is essential for its competitiveness future.

The map reflects what has been observed for the great majority of dimensions and indicators: A strong polarization between the more affluent South, and the poor, sometimes under-developed Northern and Northeastern regions. Quality of life grows worse the more one travels North, except for a few brighter spots which indicate average living conditions. Florianópolis stands out as the micro-region with the highest quality of life. A possible topic for further investigation: 12 of the top 20 regions are located in São Paulo. What factors account for this success?

Map 46: Brazil map by quintile of Quality of Life



Source: FGV

Table 37: 20 Most competitiveness Micro-regions – Quality of Life

RANK	MICRO-REGION	STATE
1	Florianópolis	SC
2	Barretos	SP
3	São Paulo	SP
4	Curitiba	PR
5	Porto Alegre	RS
6	Maringá	PR
7	Jaú	SP
8	Campinas	SP
9	Marília	SP
10	Londrina	PR
11	Bauru	SP
12	Caxias do Sul	RS
13	Moji Mirim	SP
14	Blumenau	SC
15	São José dos Campos	SP
16	Botucatu	SP
17	Jundiaí	SP
18	São José dos Campos	SP
19	Brasília	DF
20	São João da Boa Vista	SP

Source: FGV

INSTITUTIONS

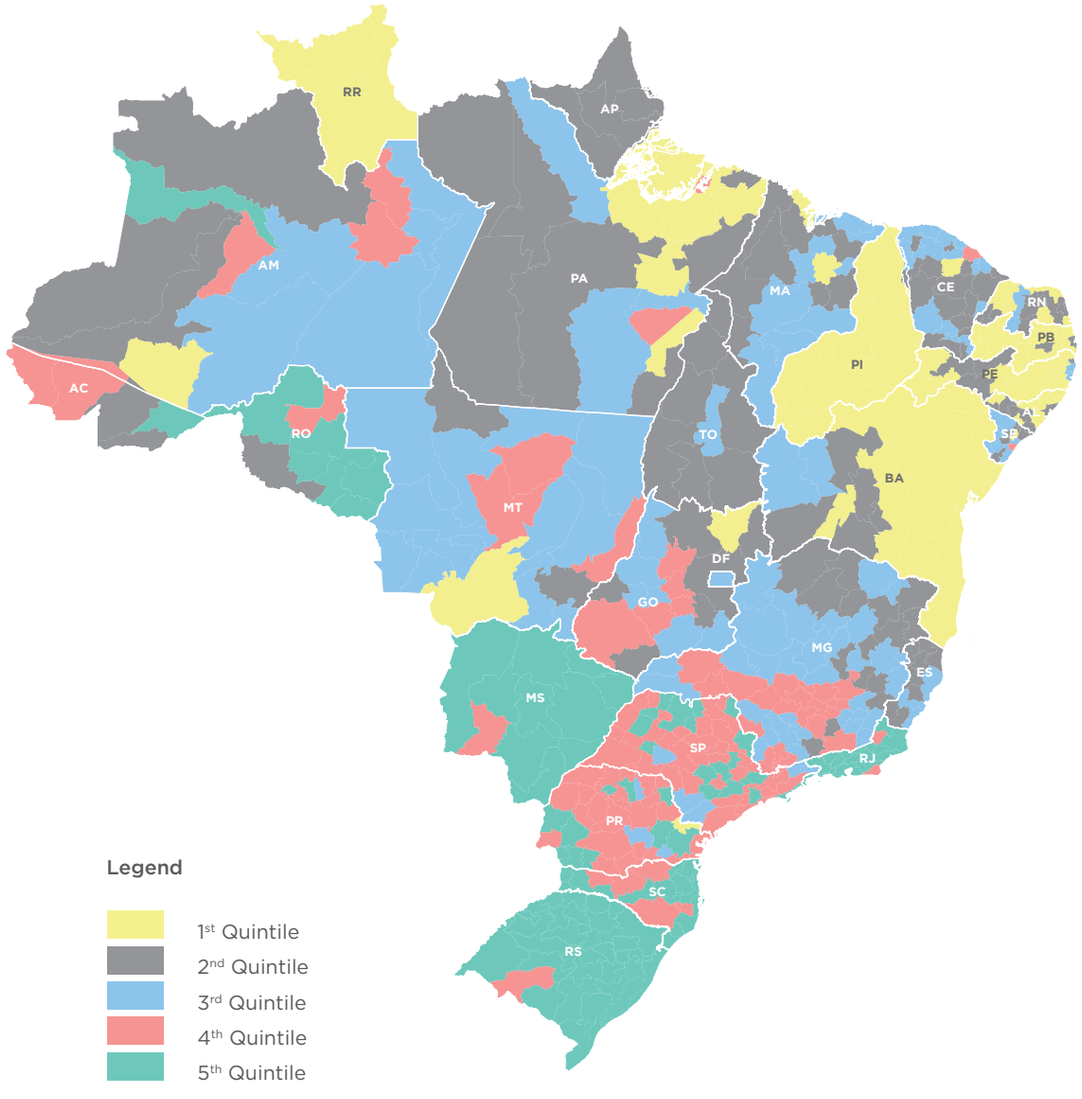
The **Institutions** vector contains one dimension:

- Public Sector Performance.

A sound and fair institutional environment has a strong bearing on regional competitiveness and growth, as it translates into reduced transaction costs of all economic activity. In the World Bank's *Ease of Doing Business Index* of 2014, Brazil ranks 120th out of 189 countries. In comparison with other Latin American countries, Brazil has the best regional performance in the categories "Cost to start a business", "Getting electricity", and "Cost (% of claim) of enforcing contracts". On the downside, Brazil ranks lowest amongst its Latin American counterparts in terms of "Time (days) spent on dealing with construction permits"; "Number of procedures to register property"; and "Time spent (hours per year) on paying taxes (2,600)".

Caxias do Sul, in the state of Rio Grande do Sul, scores highest in the assessment of institutional quality, reflecting the competitiveness of the state. Thirteen of the top 20 regions are located in the Southernmost state of Brazil. The states of Roraima in the far North as well as Piauí and Bahia in the Northeast are strikingly under-performing when it comes to the quality of their institutions. Interestingly, the Northern region is not performing as badly as may be expected, with several average and high-ranking regions.

Map 47: Brazil map by quintile of Institutions



Source: FGV

Table 38: 20 Most competitiveness Micro-regions – Institutions

RANK	MICRO-REGION	STATE
1	Caxias do Sul	RS
2	Bacia de São João	RJ
3	Guaporé	RS
4	Sananduva	RS
5	Erechim	RS
6	Montenegro	RS
7	Campo Grande	MS
8	Passo Fundo	RS
9	Macaé	RJ
10	Ijuí	RS
11	Gramado-Canela	RS
12	Campanha Meridional	RS
13	Santa Maria	RS
14	Jaguarão	RS
15	Cassilândia	MS
16	Santa Rosa	RS
17	Barra do Piraí	RJ
18	Santiago	RS
19	Vale do Paraíba Fluminense	RJ
20	Itaguaí	RJ

Source: FGV

BUSINESS ENVIRONMENT

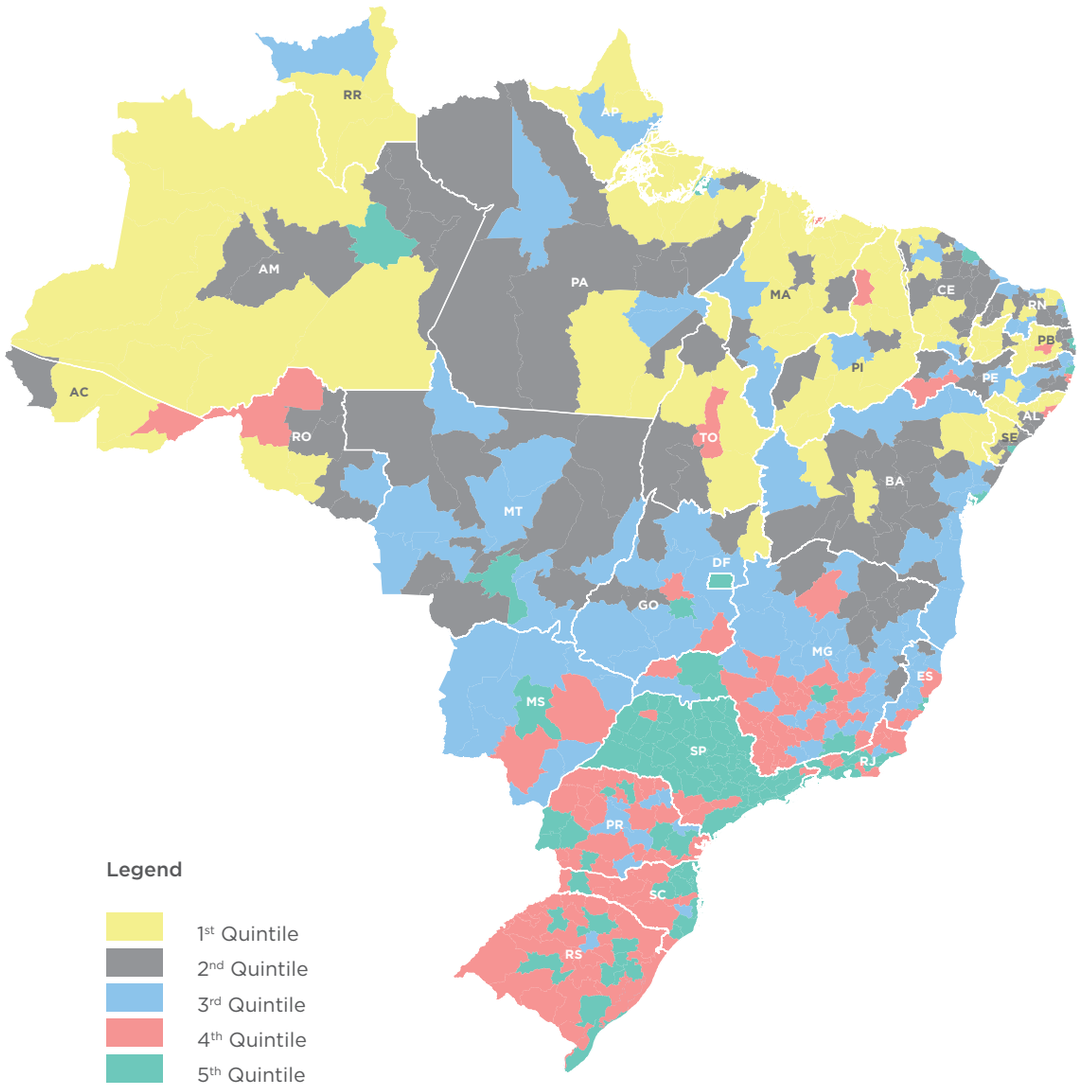
The **Business Environment** vector includes three dimensions:

- Logistics,
- Business Sophistication, and
- Innovation.

A strong business environment is critical for competitiveness, as it sets the operating framework for a strong private sector and, hence, for creating jobs. Successful business activities rely on the efficient flow of goods and services within and across national borders, as well as on a talent pool on which businesses can draw. In order to remain competitiveness, a labor force which is sufficiently skilled to successfully adopt and use technologies to enhance productivity and enable innovative processes is crucial. Moreover, sophisticated behavior of individual firms or sectors will spill over into the economy and lead to modern business processes across the state. In the following, the micro-region that provides the most competitiveness business environment will be identified.

The most favorable places to do business in Brazil are technologically advanced, innovation-prone cities, mostly in São Paulo and other Southeastern and Southern states. Brasília is also notably well-positioned, as are some capitals in the other regions. More surprisingly, many non-capital cities in the state of São Paulo are extremely well-ranked – especially affluent Guarulhos, conveniently located near the country's largest and busiest airport.

Map 48: Brazil map by quintile of Business Environment



Source: FGV

Table 39: 20 Most competitiveness Micro-regions – Business Environment

RANK	MICRO-REGION	STATE
1	Guarulhos	SP
2	Campinas	SP
3	Rio da Janeiro	RJ
4	São Paulo	SP
5	Porto Alegre	RS
6	Curitiba	PR
7	Florianópolis	SC
8	Brasília	DF
9	Jundiaí	SP
10	Osasco	SP
11	Ribeirão	SP
12	Belo Horizonte	MG
13	Bauru	SP
14	Salvador	BA
15	São José dos Campos	SP
16	São José do Rio Preto	SP
17	Recife	PE
18	São Carlos	SP
19	Sorocaba	SP
20	Bragança Paulista	SP

Source: FGV

MARKETS

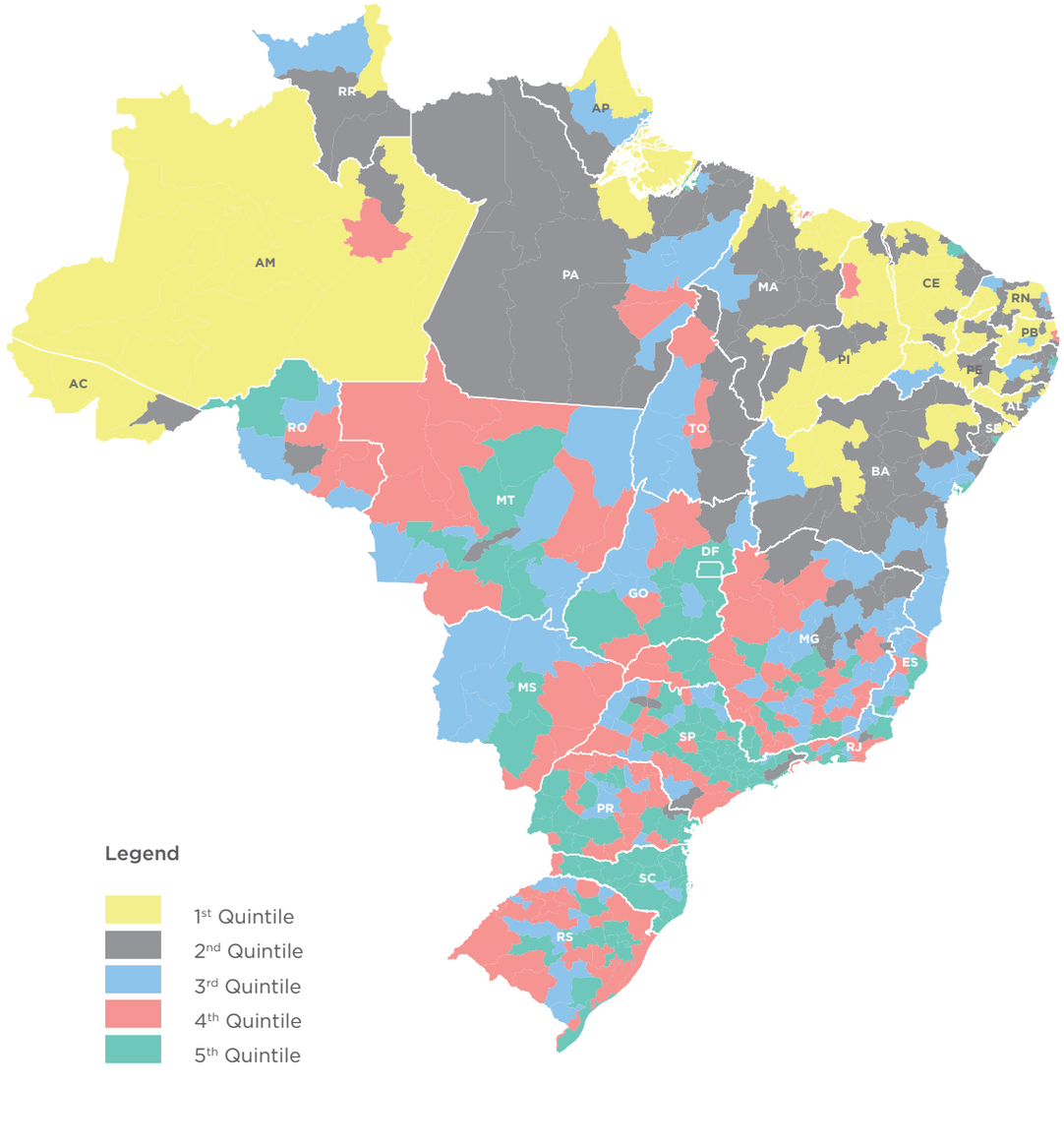
The **Markets** vector includes three dimensions:

- Market Size,
- Goods Market, and
- Labor Market

The size of the market is a crucial aspect of a region's competitiveness and productivity, since large markets provide investors with economic opportunities and allow firms to exploit economies of scale and scope. In a competitiveness goods market, all resources are allocated to their most appropriate use, and obstacles to the efficient exchange of goods, such as high taxes and changing regulations, are reduced to a minimum. An efficient labor market allocates workers to their most effective use, promotes equity between women and men, and is able to attract and retain talent.

With regard to market size and efficiencies (goods and labor), the majority of the Southern regions perform well, while many regions in the North and Northeast exhibit below-average performances, indicating that Brazil's good performance at the aggregate level is skewed by a few extremely well-performing economies in this vector. This fact alone is a reason for further investigation.

Map 49: Brazil map by quintile of Markets



Source: FGV

Table 40: 20 Most competitiveness Micro-regions – Markets

RANK	MICRO-REGION	STATE
1	São Paulo	SP
2	Brasília	DF
3	Curitiba	PR
4	Joinville	SC
5	Itajaí	SC
6	Campinas	SP
7	Florianópolis	SC
8	Blumenau	SC
9	Guarulhos	SP
10	Osasco	SP
11	Porto Alegre	RS
12	Goiânia	GO
13	Rio de Janeiro	RJ
14	Santos	SP
15	São José dos Campos	SP
16	Belo Horizonte	MG
17	Vitória	ES
18	Itapecerica da Serra	SP
19	Maringá	PR
20	Londrina	PR

Source: FGV

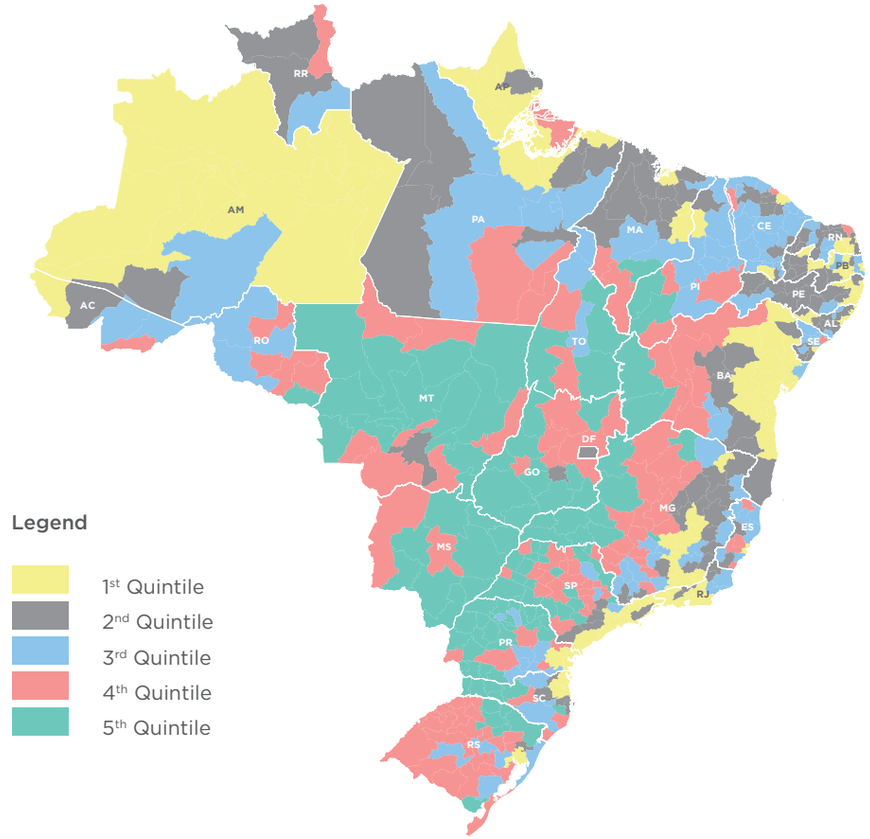
NATURAL RESOURCES

The **Natural Resources** vector includes two dimensions:

- Energy Resources, and
- Agricultural and Extractive Resources.

Brazil's abundant agricultural, mineral, and energy resources have led to the development of an extensive industrial base and a highly diversified economy. Resource extraction generates the largest source of exports, inward investment and potential for government revenues. The widespread use of renewable sources - including solar and wind - contributes to make growth more sustainable.

Map 50: Brazil map by quintile of Natural Resources



Source: FGV

Table 41: 20 Most competitiveness Micro-regions – Natural Resources

RANK	MICRO-REGION	STATE
1	Astorga	PR
2	Alto Teles Pires	MT
3	Pires do Rio	GO
4	Primavera do Leste	MT
5	Tupã	SP
6	Tesouro	MT
7	Parecis	MT
8	Paranatinga	MT
9	Nhandeara	SP
10	Arinos	MT
11	Goioerê	PR
12	Canarana	MT
13	Xanxerê	SC
14	Sudoeste de Goiás	GO
15	Auriflama	SP
16	Alto Taquari	MS
17	Floraí	PR
18	Cianorte	PR
19	Porecatu	PR
20	Cassilândia	MS

Source: FGV

FINAL RESULT

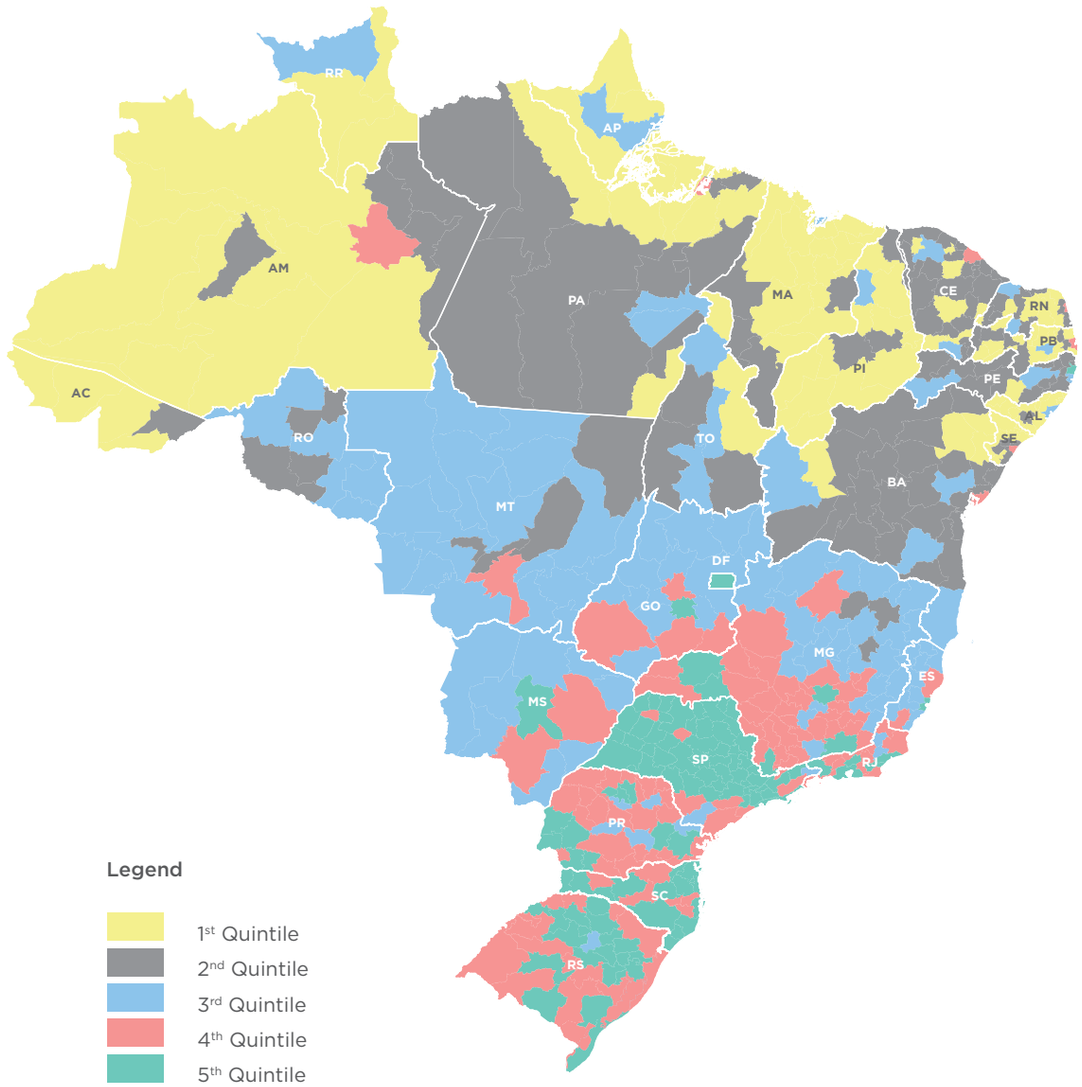
In this conclusion of the second part of the Brazil competitiveness Profile, the final result of the study is presented and further analyzed according to the following points of interest:

- **RANKING PER MICRO-REGION:** Which are the 20 most competitiveness micro-regions when all 224 indicators are aggregated?
- **DASHBOARD TOP 10:** What are the success factors of the 10 highest-ranking micro-regions?
- **TOP 3 PER STATE:** Which are the 3 most competitiveness micro-regions of each of the 26 States and the Federal District?

RANKING PER MICRO-REGION

The aggregated index, displayed below, provides a comparative analysis of the relative economic competitiveness of the 558 micro-regions in Brazil. It has been designed to be a weighted average across the 14 dimensions of competitiveness, each measuring a different aspect that influences the development of businesses and the social and economic welfare of individuals.

Map 51: Brazil map by quintile of Aggregated index



Source: FGV

Table 42: Ranking by Aggregated index

RANK	MICRO-REGION	STATE
1	São Paulo	Sp
2	Campinas	SP
3	Florianópolis	SC
4	Porto Alegre	RS
5	Curitiba	PR
6	Jundiaí	SP
7	Guarulhos	SP
8	Rio de Janeiro	RJ
9	Caxias do Sul	RS
10	São José dos Campos	SP
11	Piracicaba	SP
12	Bauru	SP
13	Osasco	SP
14	Sorocaba	SP
15	Joinville	SC
16	Ribeirão Preto	SP
17	São José do Rio Preto	SP
18	São Carlos	SP
19	Brasília	DF
20	Maringá	PR

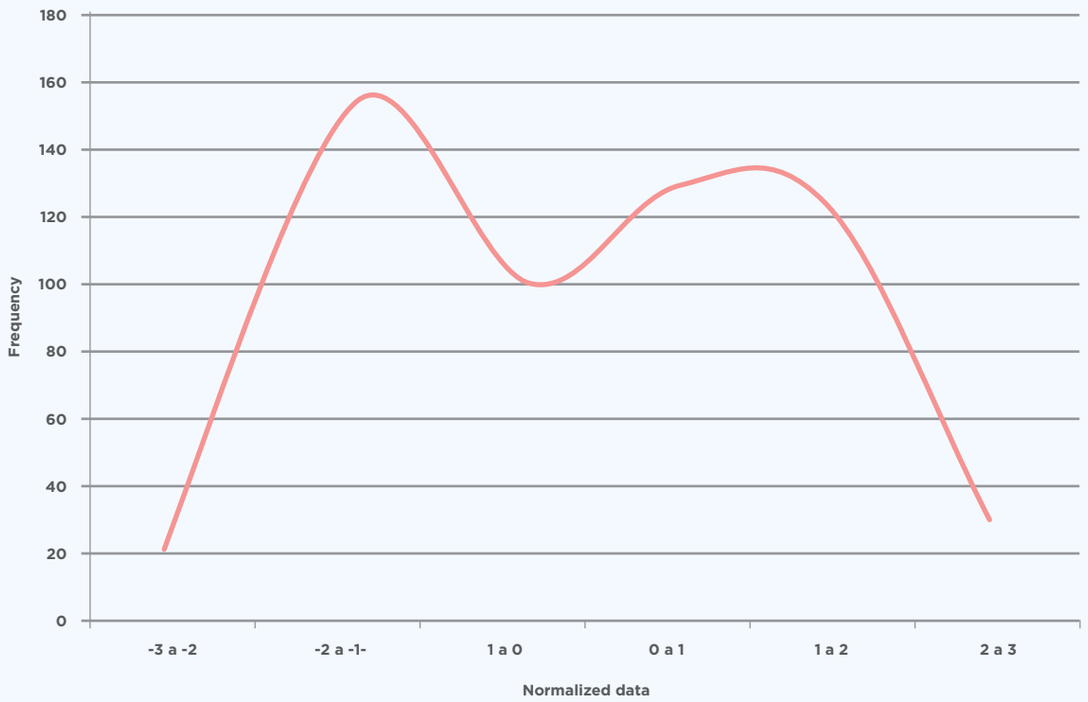
Source: FGV

INTERESTING PHENOMENA

A tale of two Brazils

As expected, the aggregate competitiveness figures presented in this report do not point towards a uniform condition of competitiveness in Brazil, but instead mask wide differences among the country's micro-regions, suggesting a competitiveness divide across the country. There is a polarization between very competitiveness and less competitiveness micro-regions, and a smaller - but considerable - number of regions placed in the middle.

Figure 3: Overall Ranking



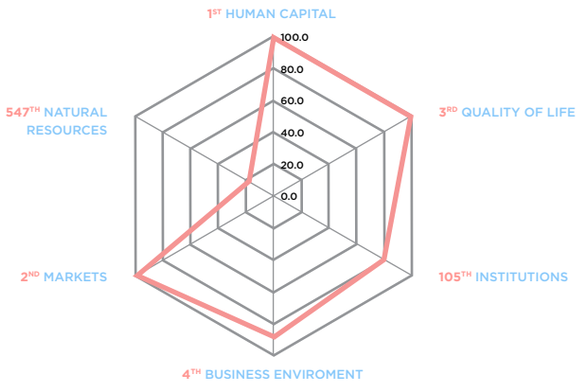
Source: FGV

DASHBOARD TOP 10

SÃO PAULO (1ST)

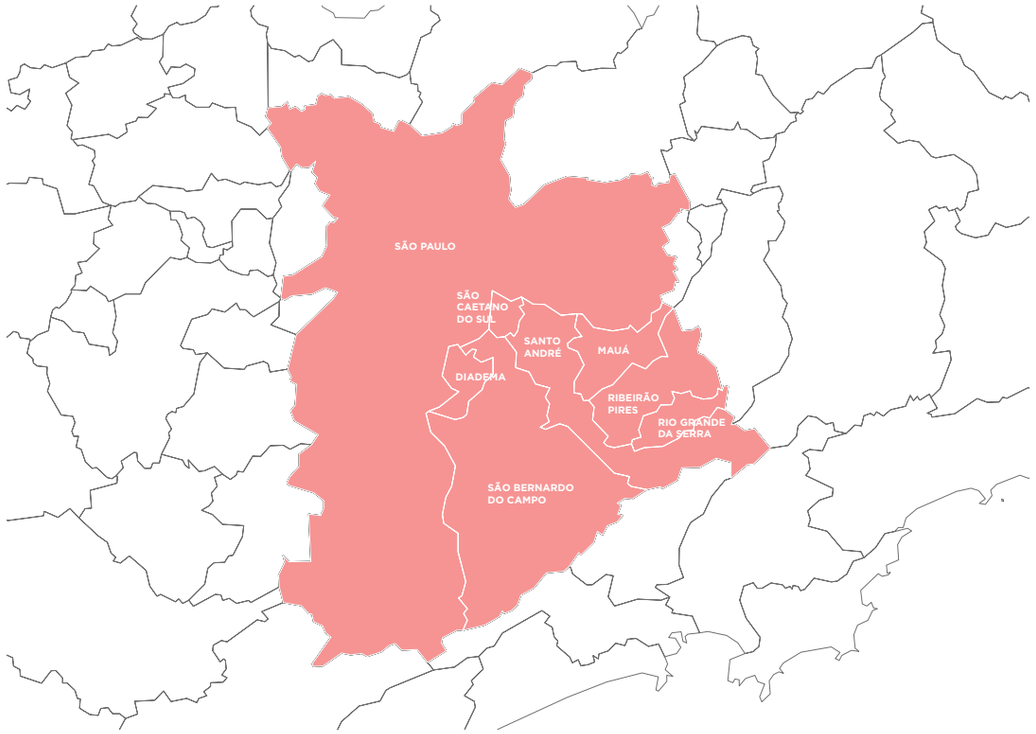
State	São Paulo
Number of Municipalities	8
Size	2,350 km²
Population	13,958,229
Density	5,940 people per km²

Figure 4: Competitiveness Vector Scores – São Paulo



Source: FGV

Map 52: Micro-region: São Paulo

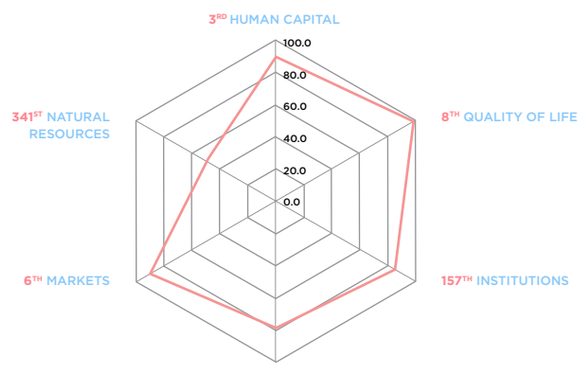


Source: FGV

CAMPINAS (2ND)

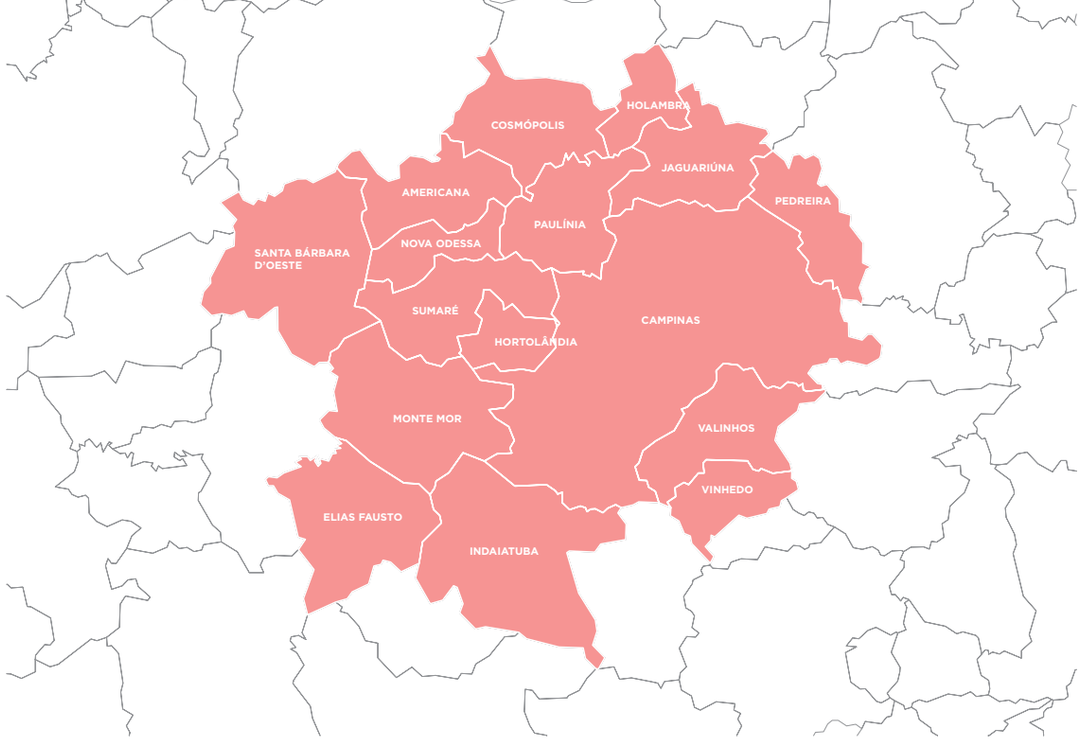
State	São Paulo
Number of Municipalities	16
Size	3,083 km²
Population	2,694,521
Density	874 people per km²

Figure 5: Competitiveness Vector Scores – Campinas



Source: FGV

Map 53: Micro-region: Campinas

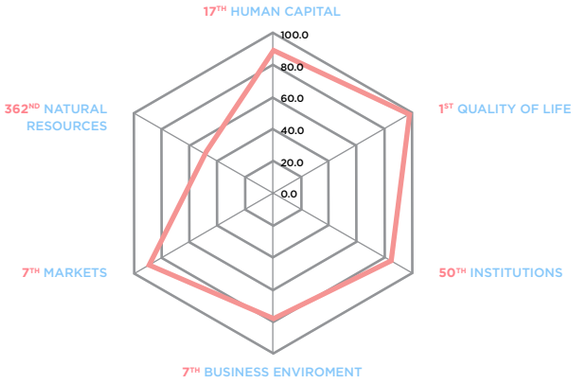


Source: FGV

FLORIANÓPOLIS (3RD)

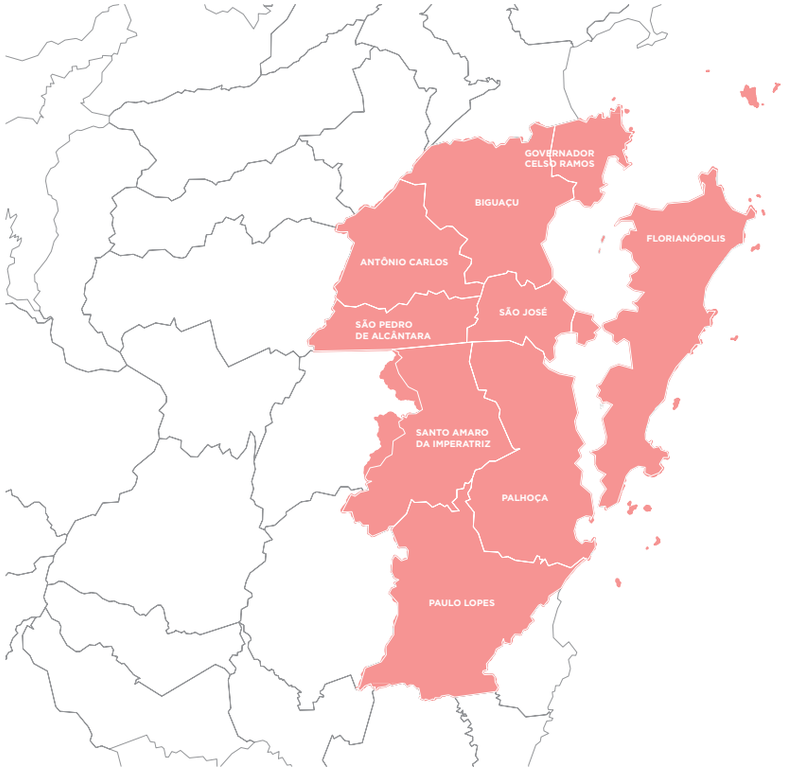
State	Santa Catarina
Number of Municipalities	9
Size	2,873 km²
Population	903,568
Density	314 people per km²

Figure 6: Competitiveness Vector Scores – Florianópolis



Source: FGV

Map 54: Micro-region: Florianópolis

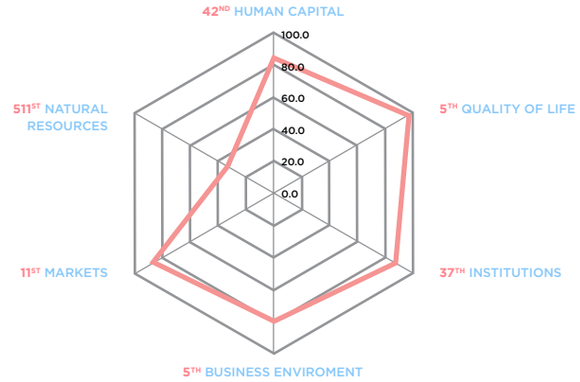


Source: FGV

PORTO ALEGRE (4TH)

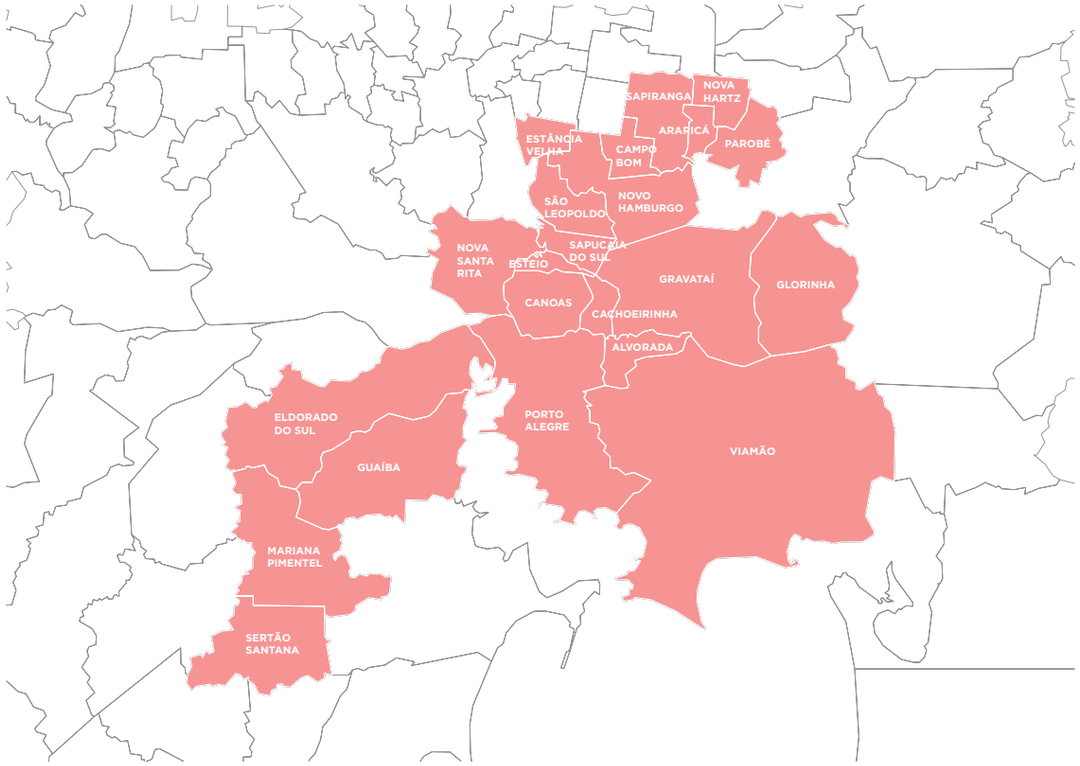
State	Rio Grande do Sul
Number of Municipalities	22
Size	5,591 km²
Population	3,658,690
Density	654 people per km²

Figure 7: Competitiveness Vector Scores – Porto Alegre



Source: FGV

Map 55: Micro-region: Porto Alegre

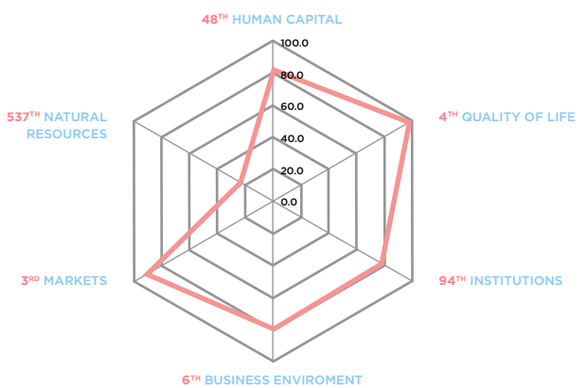


Source: FGV

CURITIBA (5TH)

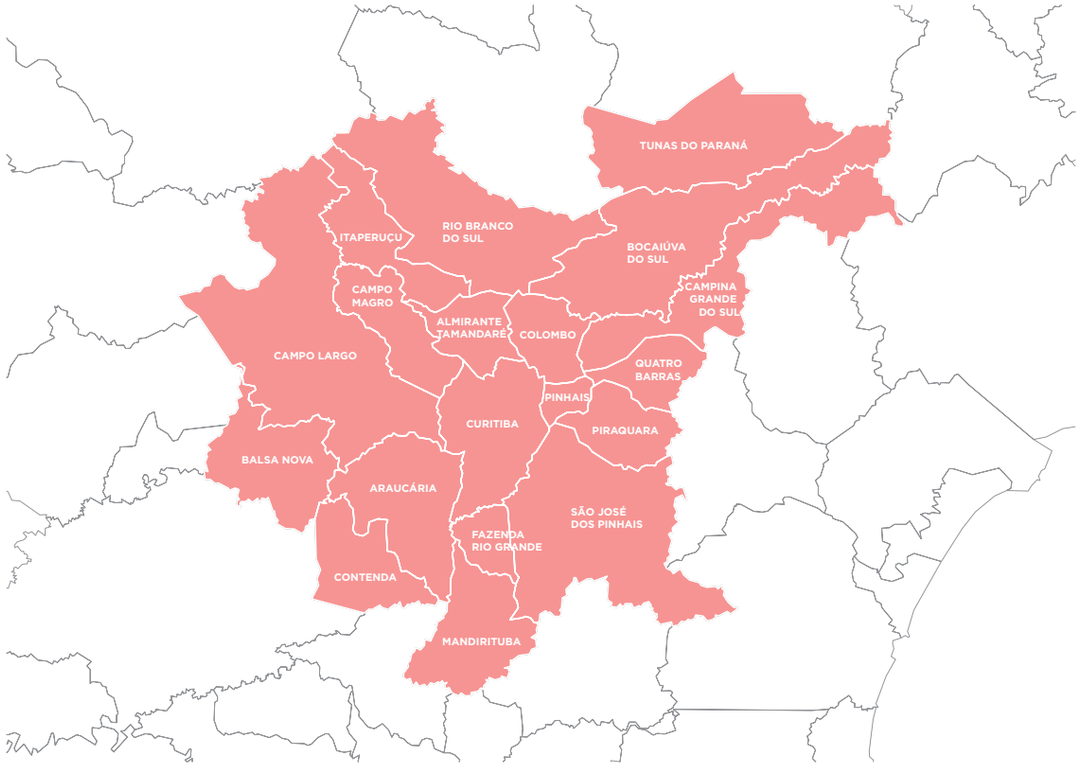
State	Paraná
Number of Municipalities	19
Size	8,541 km²
Population	3,120,488
Density	365 people per km²

Figure 6: Competitiveness Vector Scores – Curitiba



Source: FGV

Map 56: Micro-region: Curitiba

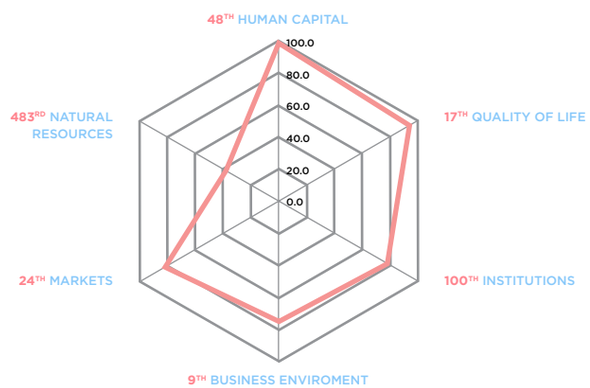


Source: FGV

JUNDIAÍ (6TH)

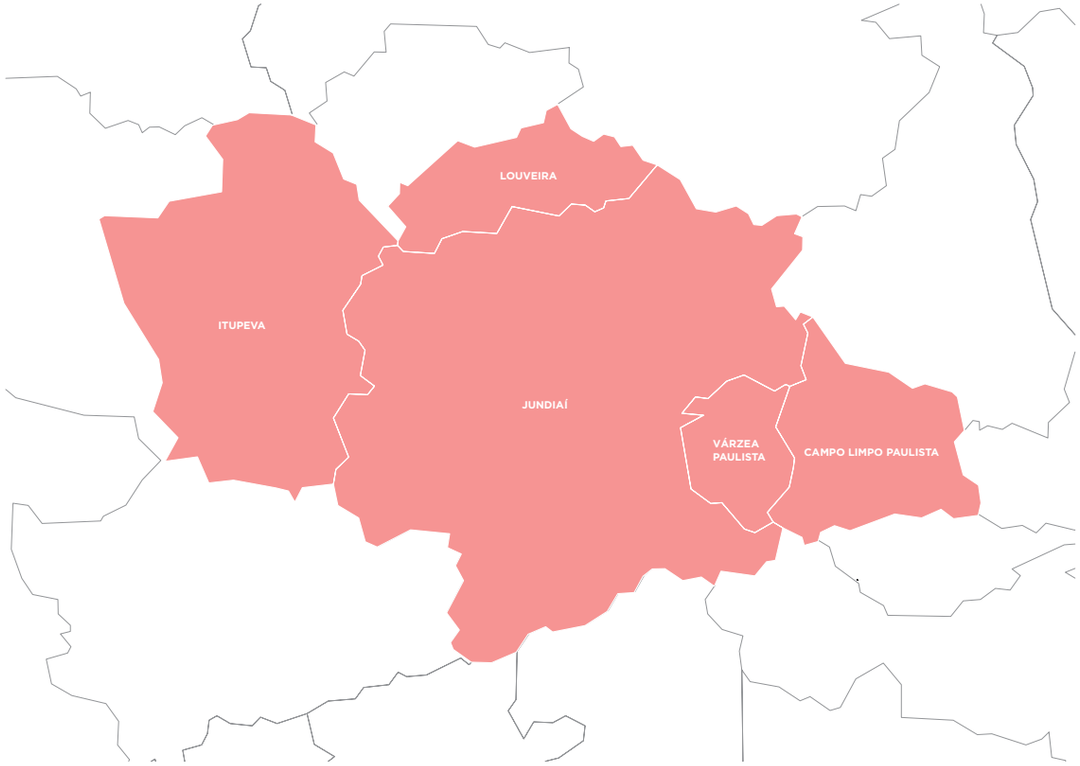
State	São Paulo
Number of Municipalities	5
Size	802 km²
Population	648,871
Density	809 people per km²

Figure 6: Competitiveness Vector Scores – Jundiaí



Source: FGV

Map 57: Micro-region: Jundiaí

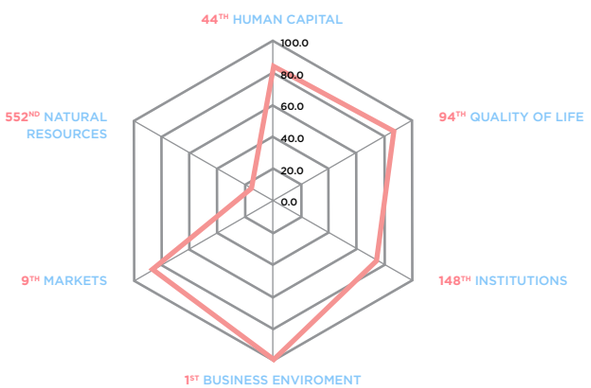


Source: FGV

GUARULHOS (7TH)

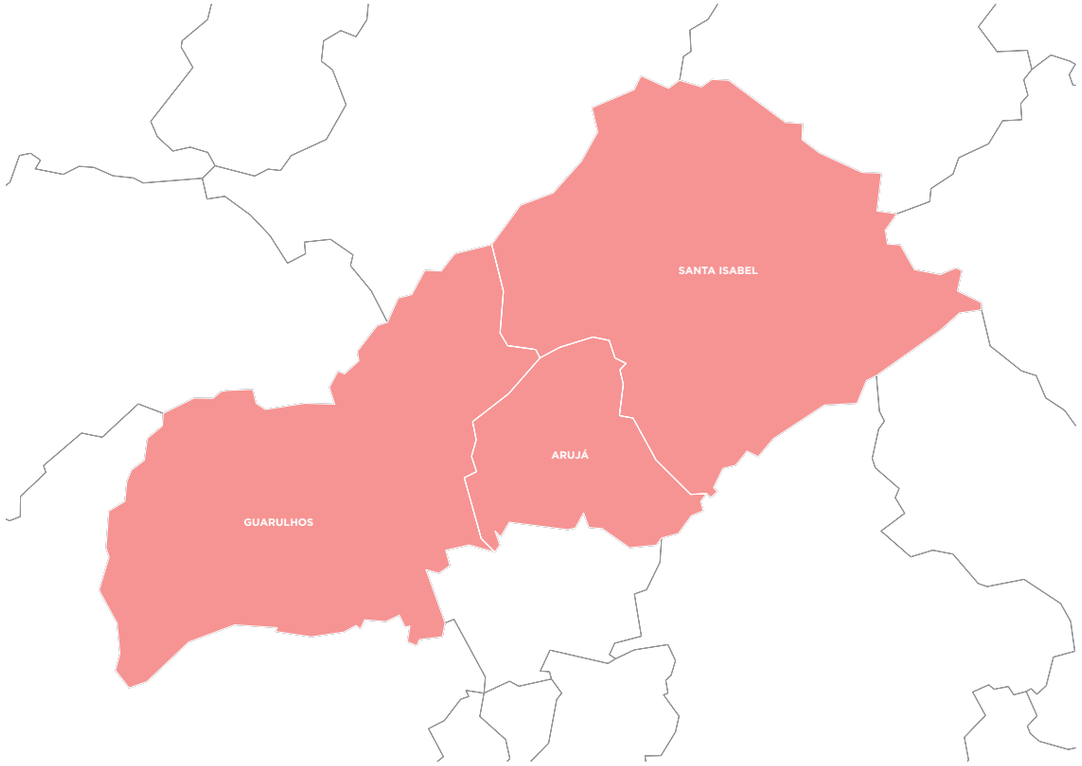
State	São Paulo
Number of Municipalities	3
Size	778 km²
Population	1,373,264
Density	1,765 people per km²

Figure 6: Competitiveness Vector Scores – Guarulhos



Source: FGV

Map 58: Micro-region: Guarulhos

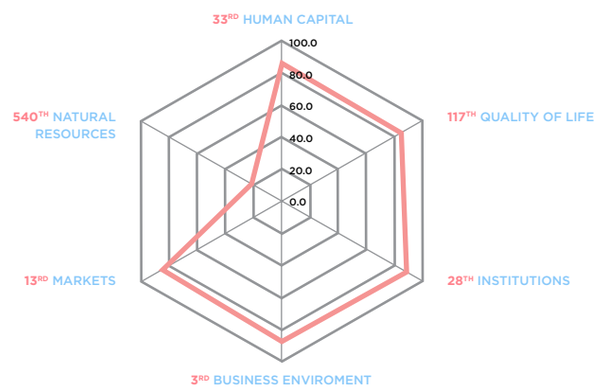


Source: FGV

RIO DE JANEIRO (8TH)

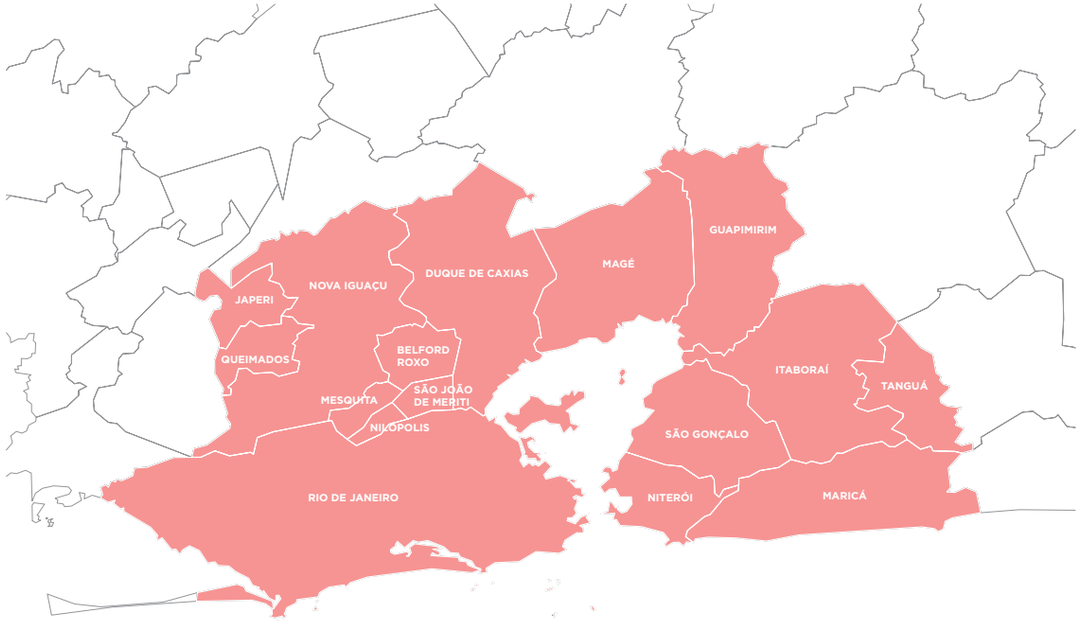
State	Rio de Janeiro
Number of Municipalities	16
Size	4,585 km²
Population	11,740,202
Density	2,561 people per km²

Figure 6: Competitiveness Vector Scores – Rio de Janeiro



Source: FGV

Map 59: Micro-region: Rio de Janeiro

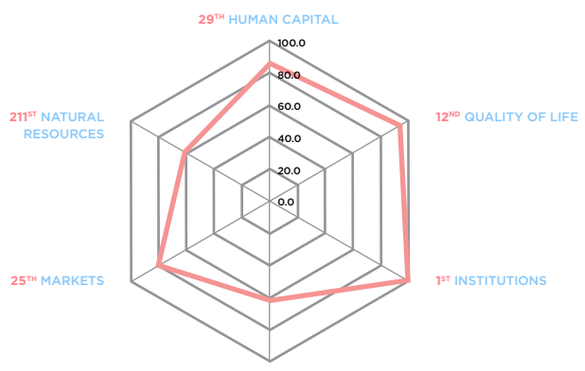


Source: FGV

CAXIAS DO SUL (9TH)

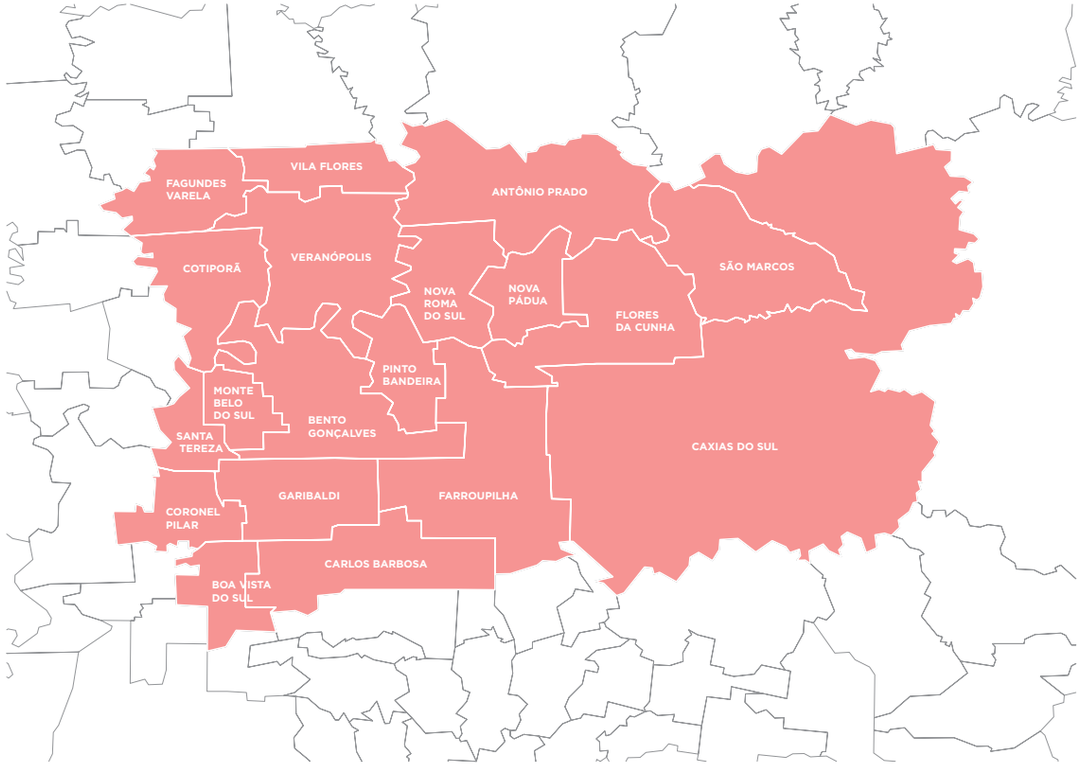
State	Rio Grande do Sul
Number of Municipalities	18
Size	4,958 km²
Population	787,135
Density	159 people per km²

Figure 6: Competitiveness Vector Scores – Caxias do Sul



Source: FGV

Map 60: Micro-region: Caxias do Sul

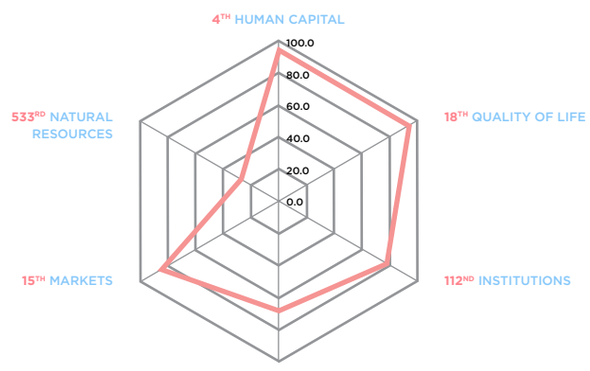


Source: FGV

SÃO JOSÉ DOS CAMPOS (10TH)

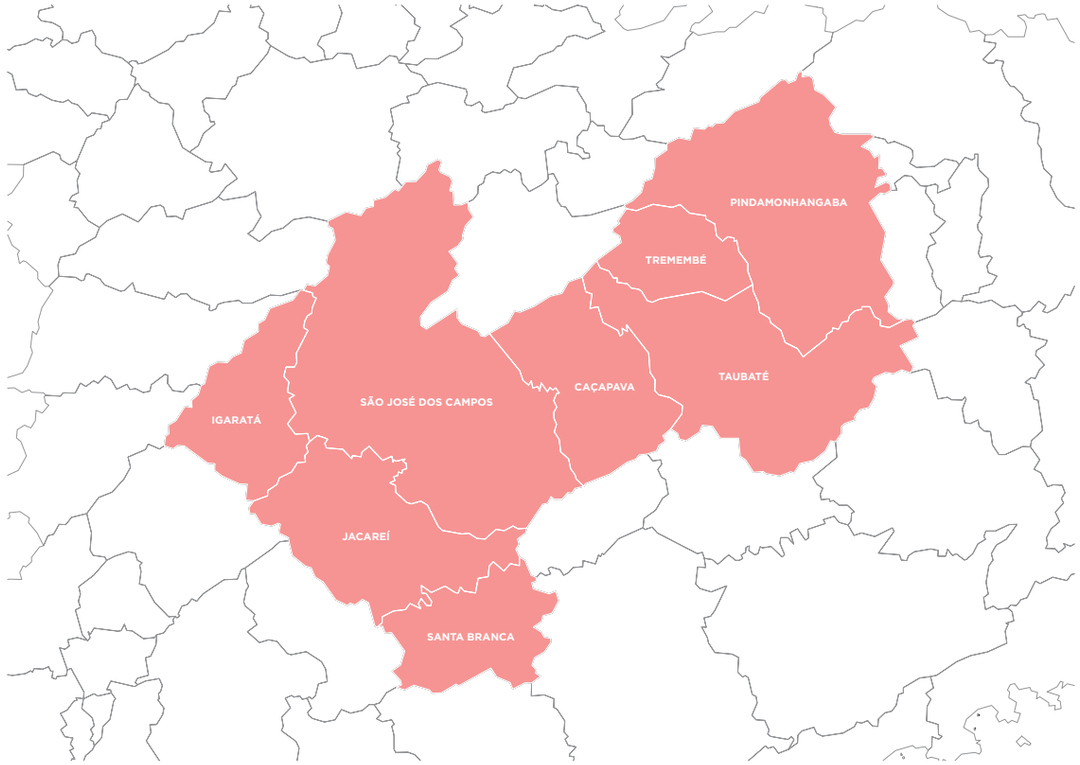
State	São Paulo
Number of Municipalities	8
Size	4,044 km²
Population	1,442,646
Density	357 people per km²

Figure 6: Competitiveness Vector Scores – São José dos Campos



Source: FGV

Map 61: Micro-region: São José dos Campos



Source: FGV

TOP 3 PER STATE

Legend

1º Quintile | 2º Quintile | 3º Quintile | 4º Quintile | 5º Quintile

Table 53: Top 3 Micro-regions of Each Federal Unit

MACRO REGION	FEDERAL UNIT	MOST competitiveness MICRO-REGION	SECOND MOST competitiveness MICRO-REGION	THIRD MOST competitiveness MICRO-REGION
North	RO	Porto Velho (261st)	Vilhena (282nd)	Cacoal (302nd)
	AC	Rio Branco (342nd)	Cruzeiro do Sul (502nd)	Brasiléia (530th)
	AM	Manaus (219th)	Rio Preto da Eva (369th)	Itacoatiara (420th)
	RR	Boa Vista (312nd)	Sudeste de Roraima (470th)	Caracaraí (506th)
	PA	Belém (225th)	Parauapebas (316th)	Marabá (335th)
	AP	Macapá (340th)	Mazagão (497th)	Oiapoque (535th)
	TO	Porto Nacional (258th)	Gurupi-To (324th)	Araguaína (333rd)
Northeast	MA	Aglomeração Urbana de São Luís (273rd)	Imperatriz (346th)	Gerais de Balsas (399th)
	PI	Teresina (292nd)	Floriano (402nd)	Picos (426th)
	CE	Fortaleza (142nd)	Cariri (288th)	Sobral (318th)
	RN	Natal (189th)	Mossoró (289th)	Seridó Ocidental (337th)
	PB	João Pessoa (230th)	Campina Grande (276th)	Patos (374th)
	PE	Recife (125th)	Suape (291st)	Petrolina (301st)
	AL	Maceió (286th)	Arapiraca (413rd)	São Miguel dos Campos (455th)
	SE	Aracaju (233rd)	Agreste de Itabaiana (373rd)	Estância (377th)
	BA	Salvador (148th)	Barreiras (290th)	Feira de Santana (306th)
Southeast	MG	Belo Horizonte (22nd)	Uberlândia (42nd)	Uberaba (67th)
	ES	Vitória (78th)	Cachoeiro de Itapemirim (210th)	Linhares (214th)
	RJ	Rio De Janeiro (8th)	Vale do Paraíba Fluminense (58th)	Macaé (83rd)
	SP	São Paulo (1st)	Campinas (2nd)	Jundiaí (6th)
South	PR	Curitiba (5th)	Maringá (20th)	Londrina (21st)
	SC	Florianópolis (3rd)	Joinville (15th)	Blumenau (24th)
	RS	Porto Alegre (4th)	Caxias do Sul (9th)	Passo Fundo (32nd)
Central-West	MS	Campo Grande (98th)	Três Lagoas (199th)	Dourados (203rd)
	MT	Cuiabá (208th)	Rondonópolis (237th)	Alto Teles Pires (242nd)
	GO	Goiânia (77th)	Anápolis (137th)	Catalão (151st)
	DF	Brasília (19th)		

Source: FGV

PART 3: MACROECONOMIC VARIABLES AND SECTOR COMPETITIVENESS

I. METHODOLOGICAL NOTE

FGV Projetos and Financial Times have developed an innovative methodology to measure the exposure of Brazil's productive sectors to two macro-economic factors: exchange rate and fiscal burden. The Methodology can be summarized as follows:

1. Data Collection:
   Exports, Imports, ICMS and IPI16, Production of 110 Brazilian product categories;

2. Calculations:
   The exchange-rate and fiscal-burden output exposure of 110 product categories;

3. Aggregation of results:
   The output exposure for each sector of the Brazilian economy – "direct effects";

4. Input-Output analysis:
   Exposure of the total inputs[17] used to produce the sector's output – "indirect effects";

5. In-depth Analysis:
   Identification of special cases which present the nuances (dynamics) of the Brazilian economy.

The exposure of the 56 sectors to the exchange rate is calculated by dividing the flow of the 110 product (imports plus exports) by its total production and then aggregating by sectors.

The economic intuition of this variable differs between import and export exposure: If the imports of a product are high relative to its production, foreign competition is high. On the other hand, elevated value of a product's export is a sign of strong foreign demand. In both cases, the exchange rate affects the production of internationalized industries.

[16] ICMS (*Imposto de Circulação de Mercadorias e Serviços*) is a tax on the movement of goods and services. IPI (*Imposto sobre Produtos Industrializados*) is a tax on industrialized products. These were chosen because of their representativeness in total taxes, and because they are value-added taxes. This allows the usage of the methodology without incurring in double accounting.

[17] Total inputs means the direct inputs used in production, plus the inputs of the direct inputs, and so on. It captures the chain effects of a given product.

An important innovation of the analysis is the assessment of the total-input exposure rate. By using the Input-Output Table, not only the inputs of a given product (called direct inputs) can be assessed, but also the effect on the whole chain (the inputs of the direct inputs, and so on). This provides a parameter for the intensity of the exposure of a product's production process. A high number reveals that a considerable part of its inputs is exported or imported and is consequently subject to exchange- rate variability.

The same methodology can be applied to assess the fiscal-burden exposure rate. This represents the relative tax paid per productive sector and its inputs. The product rate is calculated by dividing the tax paid (ICMS and IPI) by the total output. Subsequently, it is aggregated by sectors, and the Input-Output Table allows for the measurement of the (indirect) fiscal-burden exposure rate.

II. ASSESSMENT FRAMEWORK

The framework of analysis consists of examining the effects of two macro-economic variables - exchange rate and fiscal burden - on 56 Brazilian production sectors defined by the national accounts system (SCN/IBGE). The output and input effects of both variables will be assessed for each sector. The result will help to answer the following questions:

1. Which sectors are most affected by each of the macro-economic variables?
2. Which sectors are not affected by them?
3. Is the effect on inputs relevant to the output effects?
4. Which sectors have higher input than output effects?
5. The sectors which have been included in the analysis are shown on the following page.

Figure 14: Fifty Six Brazilian Sectors

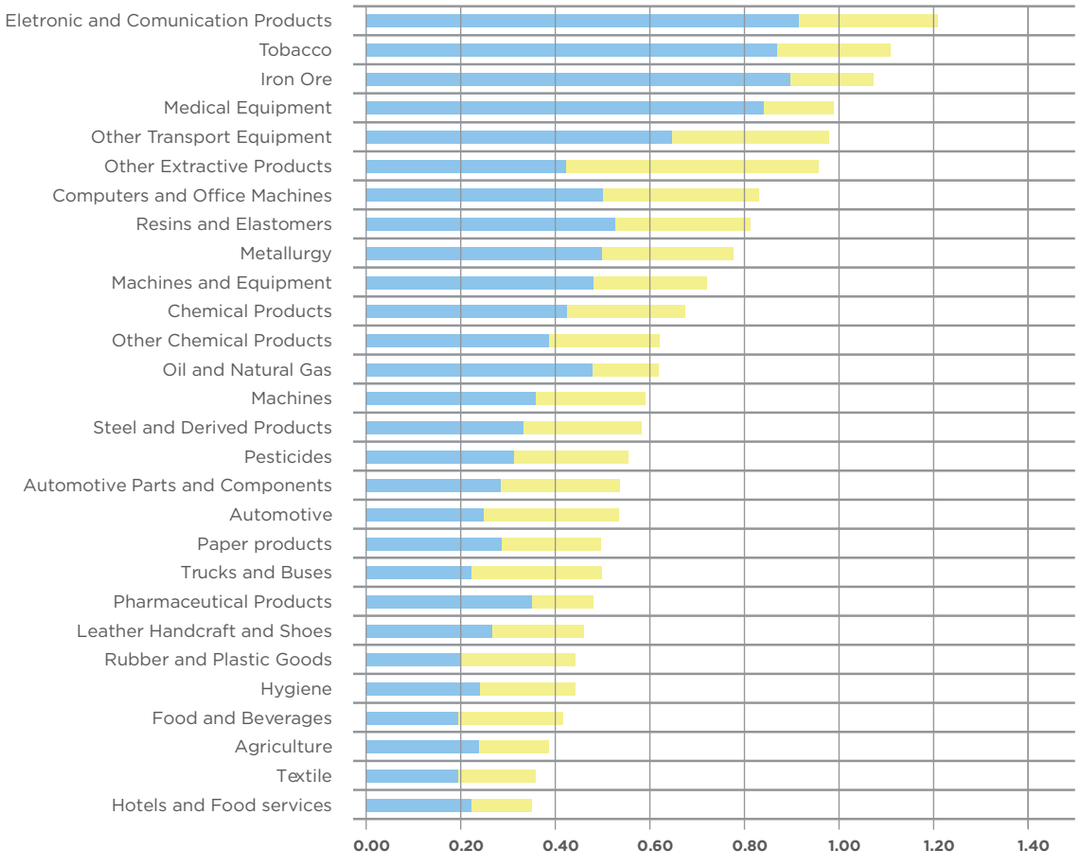
Agriculture	Wood Products	Ink, Varnish	Appliances
Furnitures and Other Products	Hotels and Food Services	Livestock and Fishing	Paper Products
Other Chemical Products	Computers and Office Machines	Electricity, Gas, Water and Sewer	Services to Companies
Oil and Natural Gas	Papers, Magazines and Books	Rubber and Plastic Goods	Electric Machines
Construction	Private Education	Iron Ore	Oil Refining
Cement	Electronic and Communication Products	Commerce	Private Health
Other Extrative Products	Alcohol	Other Non-Metallic Products	Medical Equipment
Transport and Storage	Services to Families	Food and Beverages	Chemical Products
Steel and Derived	Automotive	Information Services	Domestic Services
Tobacco	Resins and Elastomers	Metallurgy	Trucks and Buses
Finance and Insurances	Public Education	Textile	Pharmaceutical Products
Metal Products	Automotive Parts and Components	Real Estate	Public Health
Clothes and Accessories	Pesticides	Machines and Equipment	Other Transport Equipment
Maintenance	Social Security and Public Administration	Leather Handcraft and Shoes	Hygiene

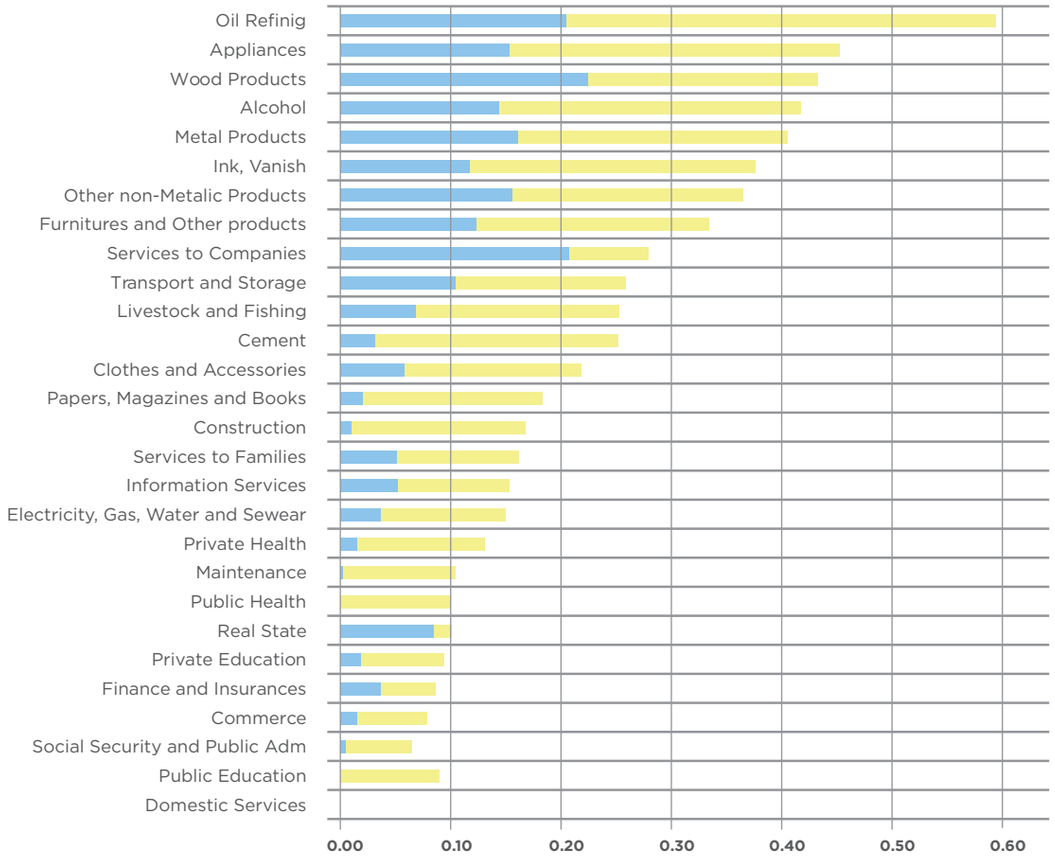
Source: SCN/IBGE

III. RESULTS PER DIMENSIONS

EXCHANGE RATE

Figure 15: Total (Direct and Indirect) Effect of the Exchange Rate on Brazilian Sectors





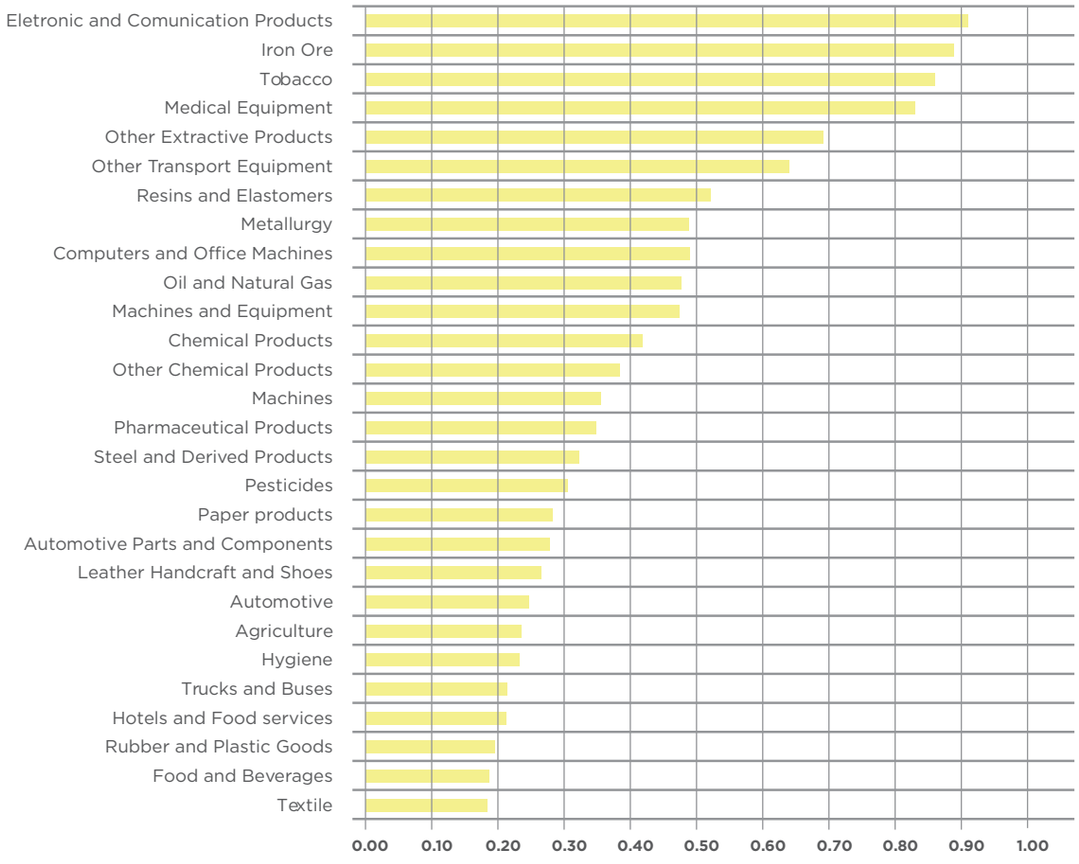
Legend

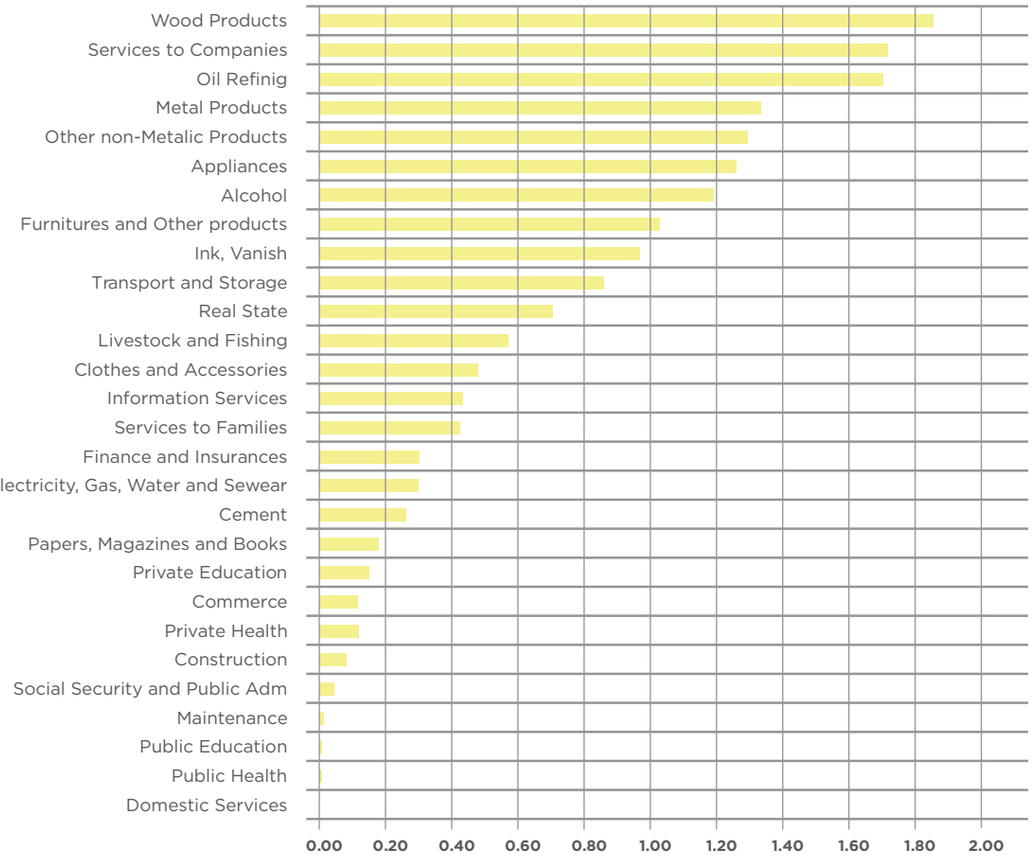
Product Exposure

Input Exposure

Source: FGV

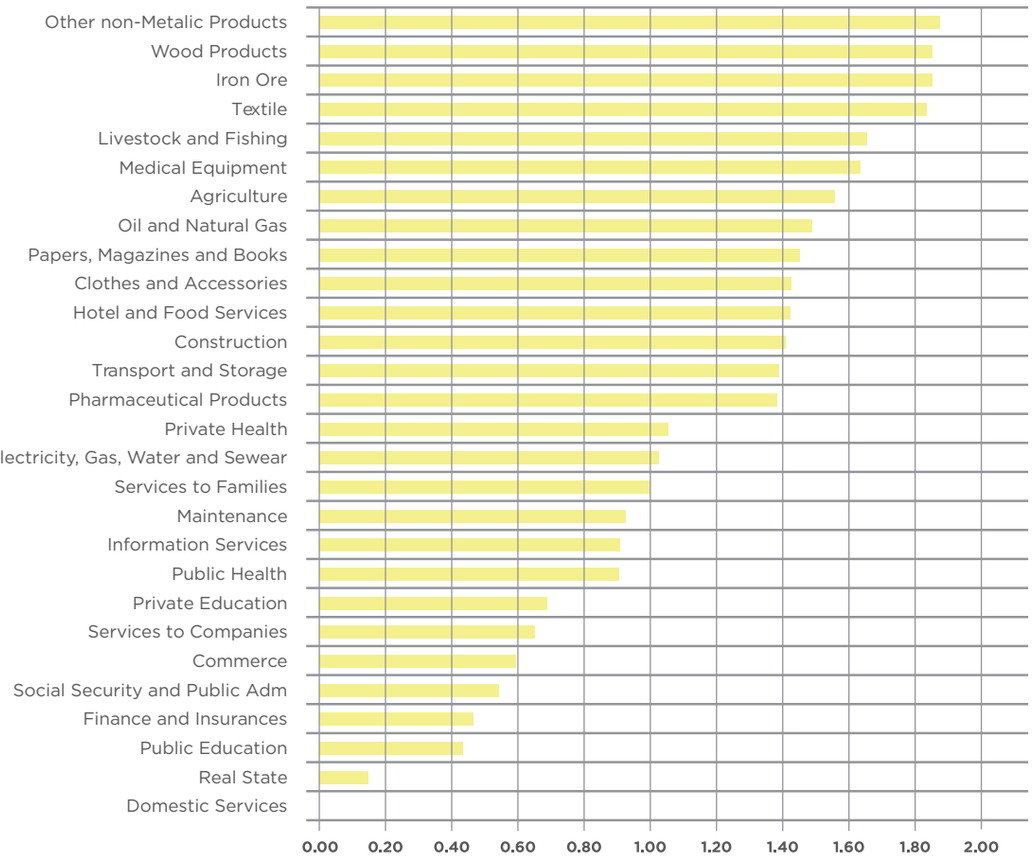
Figure 16: Direct Effect of the Exchange Rate on Brazilian Sectors





Source: FGV

Figure 17: Indirect Effect of the Exchange Rate on Brazilian Sectors



Source: FGV

KEY FINDINGS

Analysis of indirect effect evaluates the impact of direct effects as mediated by the intermediate consumption from other Brazilian sectors. The result presents the exposure of its inputs to exchange rate.

Those sectors with a high value of this kind of exposure benefit from an appreciated exchange rate, given that this would reduce the input cost, thereby lowering the production expenses and leading to higher competitiveness.

The results are more homogeneous than those presented for the direct effect, meaning that all the non-tradable sectors have similar exposure.

In the top 25%, it is possible to see three big industries with more than three sectors:

1. Machines and Equipment – Computers and Office Equipment, Electronic and Communications Products, and Appliances;

2. Chemical – Resins and Elastomers, Chemicals, and Pesticides; and

3. Transport – Other Transport Equipment, Trucks and Buses, Automotive, and Automotive Parts and Components.

Metallurgy and Steel and Derived also present a cluster on the Metallurgy Industry (probably due to the high flow of its own products, plus Iron Ore). Tobacco and Oil Refining close the top 25% sectors with highest indirect exposure.

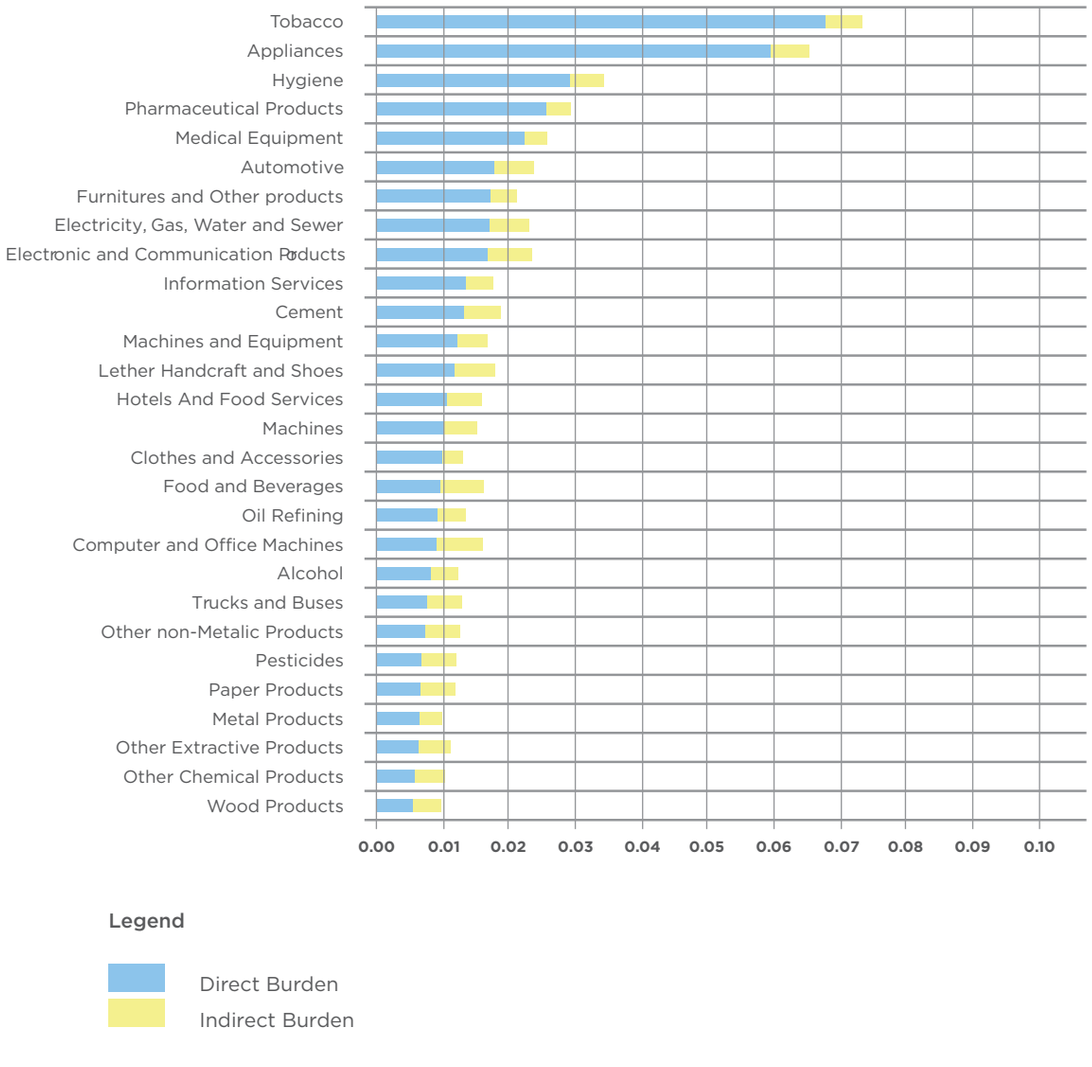
FISCAL BURDEN

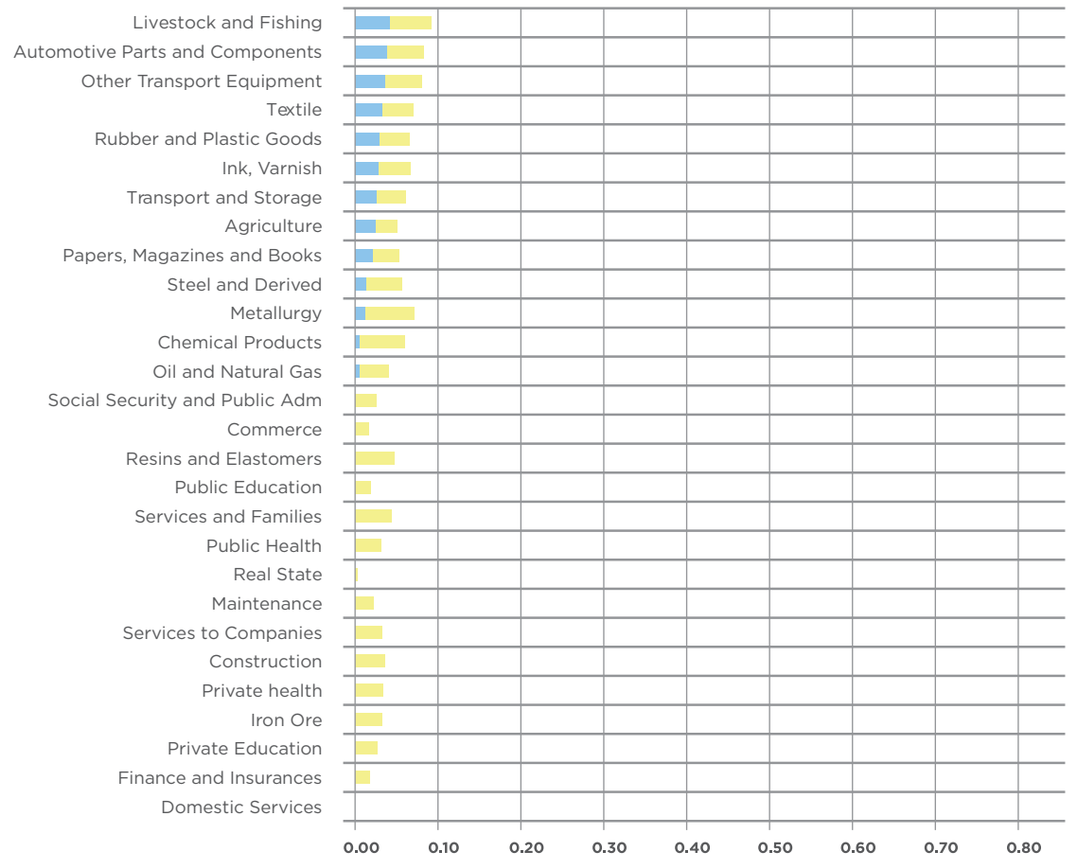
The analysis of the fiscal burden is important for measuring the competitiveness of each sector. Those most affected by taxes experience more friction in their production process.

Another possible channel is the political effect. If, for some reason, a government has to increase its revenues, those sectors with highest exposure will be more susceptible to bear this increase.

The division between direct and indirect effects is important to measure properly all the effects of the tax burden across different sectors. The direct effect is responsible for identifying those that pay more taxes by output. The indirect effect measures the exposure of its inputs, providing all the value-added tax paid within the sector's costs.

Figure 18: Total (Direct and Indirect) Exposure to Tax Burden





Source: SCN/IBGE

KEY FINDINGS

The most prominent result is the total tax-burden difference between the sectors of Tobacco and Appliances and all other Brazilian sectors. The former has a total effect of 0.73 while the latter accounts for 0.66. The third sector most affected is Hygiene, with almost 50% less total tax burden, 0.34.

Moreover, unlike the exchange-rate effect, there is not a well-marked industry pattern of the main 25% affected sectors.

The direct effect ranges from 0 to 0.68. The top 25% ranges from 0.11 and 0.68. Excluding the top two sectors, the burden varies between 0.11 and 0.29. This means that there is still a big difference between those sectors, indicating that the sectors which suffer from high value-added taxes are very concentrated.

The indirect tax burden is homogeneous among the sectors, ranging from 0 to 0.7. This provides a first glimpse that the tax burden bears an even effect on the production chain of the various sectors.

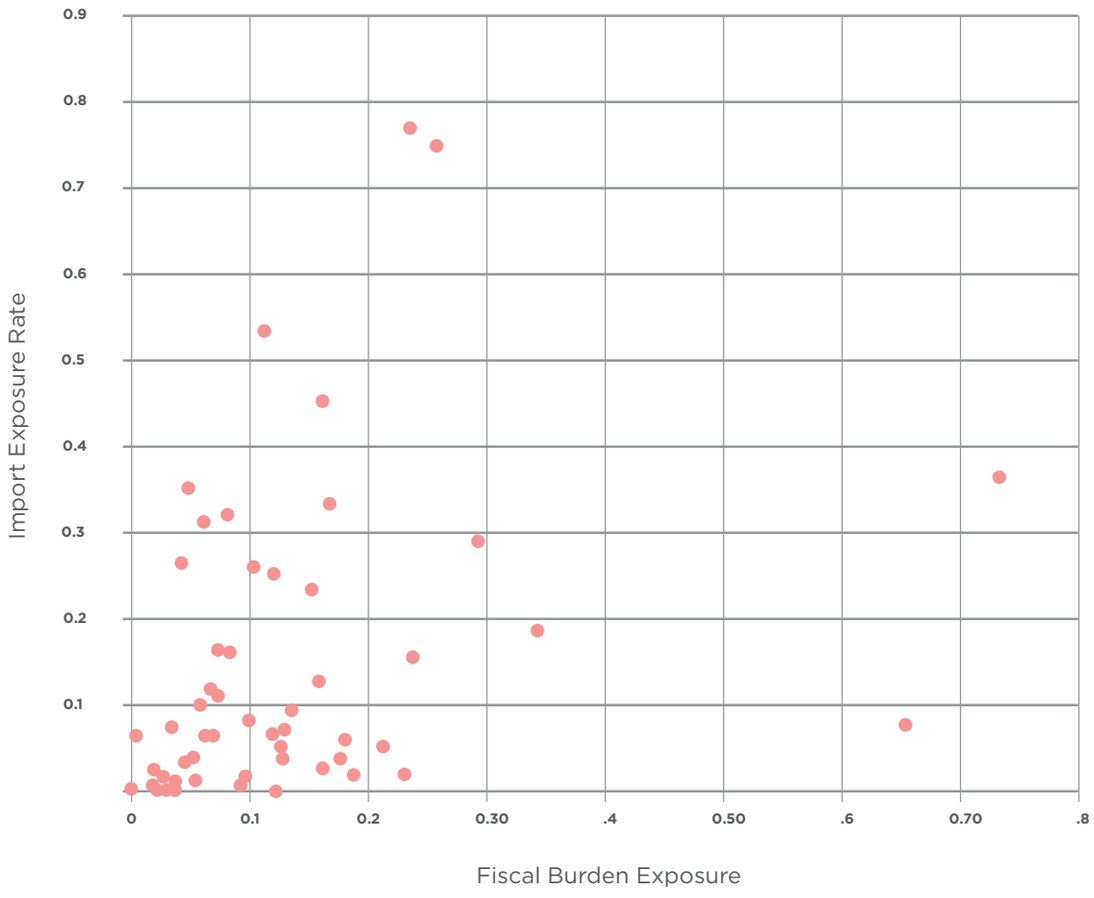
It is important to emphasize that the analysis concerns the value-added taxes ICMS and IPI.

SECTOR FISCAL BURDEN X IMPORT EXPOSURE

This dispersion graph presents two measures: Fiscal Burden Exposure on the horizontal axis, while the Import Exposure Rate is presented on the vertical axis. The second variable is a proxy for foreign competition faced by a sector.

If a given sector faces no competition from foreign products, then the fiscal burden does not interfere in the sector's competitiveness edge. This happens because every company produces in the same (national) environment. If a sector has foreign competition, then the tax structure will affect the sector's competitiveness, when compared to companies from other countries.

Figure 19: Dispersion Graph Fiscal Burden Exposure x Import Exposure Rate



Source: FGV

KEY FINDINGS

The aim of this analysis is to select those sectors that face high foreign competition as well as an elevated tax burden. To present these sectors, the plot was divided into four quarters by the mean of Import Exposure rate (around 0.13) and the Fiscal Burden rate (around 0.14).

From this analysis were selected ten sectors that present an elevated effect by both variables. They pertain mainly to two industries:

1. Equipment and Machines: Electronic and Communications Products, and Medical Equipment have the highest import exposure, and high fiscal burden. Computers and Office Equipment, Machines and Equipment and Electric Machines also present high exposure to international competition.

2. Health Industry: Pharmaceutical Goods and Hygiene are present in this quarter, showing that together with Medical Equipment (placed in Equipment and Machines), the Health Industry is exposed to both import rate and fiscal burden.

The remaining three sectors within this quarter are Hotels and Food, Automotive, and Tobacco. The first one is on the edge of the boundaries. It comprises non tradable service like tourism. The Automotive sector faces increasing competition from foreign countries. The third sector , Tobacco also has a high tax exposure.

There are key consequences from these results:

1. Brazilian industry lose competitiveness due to a greater price of inputs from Equipment and Machinery. Their elevated prices is a consequence, among other factors, of the elevated tax burden beard by this sector;

2. Public Health: An important finding is the consequences of the effects on the Health Industry. It suffers from high taxes and high international competition.

PART 4: CONCLUDING REMARKS

REGIONAL COMPETITIVENESS

A set of stylized facts has survived for long enough to fossilize into sociological cliché: Southern and Southeastern states have better standards of life, while the Northeast remains poor and the North and Central-West lie almost un-discovered. Much of this has changed, but much of it remains living fact, and indicators such as the logistics-weighted market size (page 70) still showcase an economy radiating from the Rio-São Paulo axis inwards.

However, as many other measurements of this study have shown, this is far from the whole story. First, the macro-regional story has changed. Old saws about there being “a Belgium and an India” in Brazil have been complicated by the emergence of large-scale, export-oriented agriculture as a major economic and political force, as well as income growth at the lower strata and oil, gas and mineral developments. There are so many facets to the regional arrangement of the Brazilian economy now that country comparisons prove insufficient. At the same time, the South and Southeast out-perform the rest of the country in terms of infrastructure, labor markets, education, as well as in providing a healthy environment for its citizens. This translates into a wide dominance of most rankings by a handful of states.

The novel contribution of this study, however, has not been in qualifying this age-old regional issue a bit further . Rather, it focuses at the level of micro-regions– 558 in all – which allows us to shed a closer light on the many facets of the competitiveness puzzle. Far from being smooth, this micro-regional map is blotchy, both revealing contrasts and gradients inside states and highlighting focal points in under-developed states that seem to be unique among their peers.

This gives rise to two sets of useful interpretations. First, the micro-regional map allows for enough heterogeneity that tracking the evolution of regions that are, for example, further along in STEM training than in other education statistics, should prove enlightening.

The massive heterogeneity of Brazil can be leveraged to the goal of a massive experiment, with potential useful generalizations. The second set of interpretations has to do with identifying opportunities. The isolated regions standing out in less-developed states may turn out to be strategic entry points for the expansion of market or the establishment of corporate bases around natural resources, for example. Differentials inside a state may also point to specific places (rather than abstract regions) to watch as potential grounds for investments and public-private partnerships. There are, of course, general lessons to be taken: education, institutions

and business environment appear to be more important than natural, static endowments. Low-income regions tend to be located in states lacking in infrastructure and suffering from poor education. What micro-regional measurements show, however, is that the complexities and irregularities of the regional map of the Brazilian economy are worth understanding.

SECTOR COMPETITIVENESS

Competitiveness was discussed, earlier on, as the meeting between potential productivity and the presence of enabling circumstances that allow for that potential to be actualized. Two major variables that have a macro effect on this ability to actualize potentials, namely exchange rates and differential tax burdens, were also highlighted.

In contrast to what general equilibrium or trade-driven views may lead the thinking, the dynamics of exchange are not simply a result of international competition and comparative advantage. Rather, they are mediated by monetary policies, secondary goals and further complexities (such as the tradables/non-tradables split). This means that despite being arguably desirable for many reasons, floating exchange rates do not automatically lead to a level playing field in the international stage. What is more, differential tax burdens have an even more direct effect: if industries that compete against each other face a different cost structure due to local policies, competitiveness will, in all likelihood, be affected. But beyond these very broad strokes, there remains the question of why economies facing different exchange-rate regimes (whether conducive to cheaper imports or exports) and taxation rates focus on specific sectors – or rather, why some industries thrive more than others. In this study, a generalization of input-output analysis has been deployed to track the effects of these factors, how they have different effects on sectors, and how these effects spread throughout the linkages in the economy.

As with the micro-regional analysis in regional economics, this has allowed to put traditional stylized facts under a microscope and emerge with a more complex, nuanced picture. A key result is that devaluated exchange rates, while particularly favorable to exports, can also be harmful for the imports of many important sectors of the Brazilian economy, in light of their cost structure and their location within the inter-dependent sectorial networks captured by input-output analysis.

The tax burden, too, has different effects on sectors, although cumulatively (the degree to which taxes are paid over and over again at each link in productive chains) this leads to an approximate correspondence between more industrialized sectors and heavier overall tax burdens once sectorial linkages are taken into account.

The picture that emerges from these analyses, while more complicated, leads also to a more mature debate about macro policy as a competitiveness factor. Brazil must make headway in many areas in order to set itself on a sustainable growth trajectory moving forward, which might mean taking short-term and long-term considerations on equal footing, lest too-broad policies lead to punitive economic distortions to important sectors of the economies. Ultimately, the challenge is for macro policy to create the right conditions for the economy as a whole to be able to best realize its potential.

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ANNEX - TECHNICAL NOTE

AUTHORSHIP

This report has been coordinated and elaborated by FGV Projetos and presents the first results of a major, ongoing collaborative effort between FGV and the Financial Times. It provides the base for the implementation of a worldwide multi-platform initiative on the Brazil competitiveness Profile that includes live events and a Financial Times Special Report.

STATED PURPOSE

This report presents first results of an innovative approach to competitiveness which allows for the dynamic comparison of the competitiveness of different localities and productive sectors in Brazil. The facts and figures presented and discussed in this report and in differing formats in the future are meant to guide foreign investors in making the right choices to optimize productivity and ease investment risks, while allowing Brazilian policy and decision-makers to track their progress over time and make the necessary choices that will keep the country on a sustainable growth path.

ANALYTICAL FOCUS

The report is centered on two main lines of analysis:

ANALYTICAL FOCUS I: 558 MICRO-REGIONS

The competitiveness of the 558 Brazilian micro-regions is measured based on a comprehensive set of 224 indicators structured across 14 dimensions and 6 vectors of competitiveness.

ANALYTICAL FOCUS II: 56 PRODUCTIVE SECTORS

It is analyzed the influence of two major macroeconomic variables – exchange rate and fiscal burden – on the competitiveness of 56 productive sectors.

DATA SOURCES

The analysis is based on data from the latest statistics, obtained from public and private institutions. The 224 indicators are described in detail in the annex of this report.

PRESENTATION OF DATA

ANALYTICAL FOCUS I: 558 MICRO-REGIONS

In order to shed light on the complexity and dynamics of regional competitiveness, data is organized and presented in a wide variety of ways and on a range of levels.

The micro-regions are ranked in an aggregated index and in accordance to their score per individual dimension and vector. For each case, the Top 20 highest-scoring regions are presented, accompanied by a heat map. Furthermore, the Top 10 most competitiveness micro-regions are profiled in order to understand which factors account for their outstanding performance.

In order to further enrich the analysis, interesting phenomena are by means of highlighted municipal-level data analysis and cluster analysis, among other methods.

ANALYTICAL FOCUS II: 56 PRODUCTIVE SECTORS

All the information on the effects of exchange rate and fiscal burden on sectorial competitiveness is presented in the form of illustrative graphs supported by accessible in-depth analysis.

DATA SOURCES

The Brazil Competitive Profile is based on nationally consistent and updated data available to the public on municipalities and , data states which together represent a uniform basis to evaluate the competitiveness of the Brazilian micro-regions, as well as of states and municipalities. The final database collected information from a wide range of sources, which are described in the following pages. Moreover, for each dimension, a detailed description of all indicators is provided that includes source, year, and level (state or municipal).

BASIC EDUCATION

Figure 22: Data Source - Basic Education

#	INDICATOR	SOURCE	YEAR	INDICATOR DESCRIPTION
PRIMARY AND SECONDARY SCHOOL PERFORMANCE				
1	Average Test Score, 4th Grade Exam	IDEB	2013	Data comes from the Basic Education Development Index (IDEB) which monitors student achievement and progression flows at primary and lower secondary education (4th and 8th grade) based on data from the School Census, the National Basic Education Assessment System (Aneb-SAEB) and Prova Brasil, a population-based assessment of public schools. The results of IDEB are calculated from the performance obtained by the students who participated in the Prova Brazil / SAEB and approval rates, calculated on the basis of information provided to the School Census.
2	Average Test Score, 8th Grade Exam			
3	Average Test Score, 11th Grade Exam			
CLASS SIZE				
4	Ratio of Students to Classrooms	INEP	2013	Class Size is an indicator for the quality of the basic education system, as the number of children in a class affects the quality of teaching and learning. Measured by ratio of students to classroom.
COLLEGE PREPAREDNESS				
5	Average Test Score, High School Exam (3rd Year) - Natural Sciences	ENEM	2012	Data comes from the National Exam of Upper Secondary Education (ENEM) which measures the performance of secondary school students in 5 subjects: Sciences, Humanities, Languages, Mathematics, and Writing. ENEM is centered on the assessment of achievement in skills and capabilite of individuals. The exam is the main access instrument to ascend to higher education in Brazil, including scholarship.
6	Average Test Score, High School Exam (3rd Year) – Humanities			
7	Average Test Score, High School Exam (3rd Year) – Languages			
8	Average Test Score, High School Exam (3rd Year) – Mathematics			
9	Average Test Score, High School Exam (3rd Year) – Writing			
LITERACY SKILLS				
10	Percentage of Population Older than 5 Able to Read and Write	Censo	2010	The percentage of the population older than 5 unable to read or write, as an indicator for literacy skills.
YOUTH IN SCHOOL AT CRITICAL AGE				
11	Share of Female Youth Aged 16-17 in School	Censo	2010	Out-of-school-youth undermine competitiveness, as they miss many of the fundamentals of basic education. The ability of keeping youth at critical age in school, thus, is an indicator for a competitiveness education system.
12	Share of Male Youth Aged 16-17 in School			

HIGHER AND VOCATIONAL EDUCATION

Figure 23: Data Source - Higher and Vocational Education

#	INDICATOR	SOURCE	YEAR	INDICATOR DESCRIPTION
HIGHLY SKILLED LABOR				
13	Share of Formal Workforce with University Degree	RAIS/ MTE	2013	These indicators look at the availability of highly qualified labor. IPEA (Institute for Applied Economic Research - Secretariat of Strategic Affairs) defines qualified labor as individuals with work experience in a specific sector, and/or with "above average years of schooling". As a result, individuals with Graduate Diplomas, Master Degree and PhDs, are considered skilled.
14	Number of Higher Education Graduates	INEP	2013	
15	Share of Those Aged 18 to 25 in University	Censo	2010	University attainment is a key indicator of human capital which refers to the skills and knowledge on hand in the workforce.
16	Share of Those Aged 35 to 65 in College	Censo	2010	
17	Share of Higher Education Students per 100.000 Residents	INEP/Censo	2012	
LABOR WITH TECNICAL EDUCATION				
18-31	Number of Students Enrolled in Technical Education	INEP	2013	Students enrolled in technical schools, from the fields of: Environment and Health; Educational and social development; Industrial processes and control; Management and Business; Tourism, Hospitality and leisure; Information and communication; Infrastructure; Military; Food Services; Cultural production and design; Industrial Production; Natural Resources; Security
QUALITY OF ACADEMIC TRAINING				
32-49	Test Score in National Student Performance Exam	ENADE	2012	Data comes from ENADE (National Exam for the Assessment of Student Performance) Administration; Accounting; Economics Design; Law; Journalism; Psychology; Publicity and Advertising; International Relations; Executive Secretary; Business Technology Management; Human Resources Technology Management; Financial Technology Management; Logistics Technology; Marketing Technology; Technology in Management Processes; Tourism. ENADE is obtained by the average performance of their graduates in General Education (FG) and the Specific Component (EC)
50	Rankings of Best State Universities	Folha de São Paulo	2014	National college rankings of best state universities
51	Rankings of Best State Universities	CWUR	2014	National college rankings of best state universities
52	Rankings of Best State Universities	QS ranking	2013	National college rankings of best state universities
53	Rankings of Best State Universities	Webometrics	2010	Global college ranking
ABILITY TO ATTRACT TALENT				
54	Inbound Student Mobility	Ciência sem Fronteiras	2013	The states ability to attract talent from abroad is measured by the number of foreign students

SOCIAL INFRASTRUCTURE

Figure 24: Data Source - Social Infrastructure

#	INDICATOR	SOURCE	YEAR	INDICATOR DESCRIPTION
ACCESS TO INFORMATION AND COMMUNICATION TECHNOLOGY				
55	Households with Telephone Access	Censo	2010	These indicators consider the state of development of mobile and landline connections and the extent of the mobile telecommunications network in each region. Assessment covers the absolute numbers of Households with Telephone Infrastructure, as well personal computers and internet access. An additional measure used is the Internet bandwidth speed.
56	Households with Telephone Access, Landline Only			
57	Households with Telephone Access, Mobile			
58	Households with Telephone Access, Landline And Mobile			
59	Households with Personal Computer	Censo	2010	
60	Households with Personal Computer with Internet Access			
61	Internet Bandwidth Speed (Up to 2Mbps)	Anatel	2014	
62	Internet Bandwidth Speed (Above 2Mbps)			
ACCCESS TO AND AFFORTABILITY OF ELECTRICITY				
63	Percentage of Households with Access to Electricity	Censo	2010	The percentage of households with access to electricity is an indicator of a state's electricity supply network
64	Cost of Electricity – Residential (in R$ per KWh)	ANEEL	2014	Cost of electricity is an indicator for the affordability of electricity.
65	Cost of Electricity – Industrial (in R$ per KWh)			
66	Cost of Electricity – Commercial (in R$ per KWh)			
QUALITY OF URBAN TRANSPORT				
67	Time Spent Commuting from Home to Work - Up to 5 min	Censo	2010	This indicator looks at the average time spent commuting from home to work as an indicator for the quality of urban transportation infrastructure.
68	Time Spent Commuting from Home to Work - Between 6 and 30 min			
69	Time Spent Commuting from Home to Work - Between 30 and 60 min			
70	Time Spent Commuting from Home to Work - Between 1 and 2 hours			
71	Time Spent Commuting from Home to Work - More than 2 hours			

SUSTAINABILITY

Figure 25: Data Source – Sustainability

#	INDICATOR	SOURCE	YEAR	INDICATOR DESCRIPTION
INCOME INEQUALITY				
72	Gini Coefficient	PNAD	2013	Two different measures are used to evaluate the inequality of income distribution within a region. The Gini coefficient captures the distribution of monthly income from all jobs held by individuals aged 10 years or older. The higher the value of the Gini coefficient, the more income disparity. The second measure is the Ratio of income at 90th percentile to that at 10th in urban areas, which looks at the ratio between incomes at the top of the distribution (the 90th percentile) and the bottom of the distribution (the 10th percentile)
73	Ratio of Income at 90th Percentile to that at 10th	Censo	2010	
74	Poverty	MDS	2013	Share of population living in extreme poverty (US$ PPP 1,25/day)
AFFORDABILITY AND QUALITY OF HOUSING				
75	Ratio of Rent to Household Income among Renters in Urban Areas	Censo	2010	The measurement of housing affordability provides information on the overall performance of housing markets and its dysfunctions. The main drivers of housing affordability are family income and mortgage rates. The rent to income ratio is the basic affordability measure for housing in a given area. Another important metric is the mortgage interest to income ratio.
76	Ratio of Mortgage to household Income among those with Mortgages in Urban Areas	PNAD	2013	
77	Quality of Housing	Censo	2010	Share of population living in adequate housing. Adequate housing affects health status, access to jobs, and general inclusion in society.
BASIC SANITATION				
78	Households with Bathroom	Censo	2010	This indicator describes the extent to which people access to safe drinking-water and basic sanitation, and the extent to which they can avoid contaminating the living environment and drinking-water sources.
79	Households with Access to Public Water Services	Censo	2010	Inadequate access to water in the home is also a source of economic disadvantage and social inequality.
BIODIVERSITY PROTECTION				
80	Pollution	Denatran	2014	Emissions of vehicle fleet is used as a proxy for air pollution.
81	Protected Areas	MMA	2012	Protected areas per region in sq km.
QUALITY OF PUBLIC SERVICES				
82	Quality of Public Transport	POF/IBGE	2009	Based on individual perceptions of the quality of public transportation, health, and education services as well as leisure offers in urban areas. Data comes from the Integrated System of Household Surveys (POF) of the Brazilian Institute of Geography and Statistics (IBGE).
83	Quality of Public Health Services			
84	Quality of Public Education Services			
85	Quality of Public Offers for Leisure			

HEALTH

Figure 26: Data Source – Health

#	INDICATOR	SOURCE	YEAR	INDICATOR DESCRIPTION
ACCESS TO HEALTH SERVICES				
86	Employment in Health Care Services	RAIS/MTE	2013	Absolute number of people employed in health care services
87-96	Employment in Health Care Services per Field of Activity	RAIS/MTE	2013	Absolute number of people employed in health care services, including: Mobile emergency attendance services; Patient pick up services, except emergency attendance services; Ambulatorial services performed by physicians and dentists; Complementary diagnostic and therapeutic services; Activities of health professionals, except physicians and dentists; Activities in support of health management; Care activities for human health not previously specified; Assistance services for the elderly, handicapped, immunosuppressed and convalescent sick provided in collective and private residences; Provision of Home care infrastructure and assistance; Psychosocial assistance to people with mental health disorders, mental retardation and substance abuse
97	Hospital Beds	Datasus - MS	2013	Number of hospital beds per 1,000 inhabitants, as an indicator for access to health services
QUALITY OF PUBLIC HEALTH SERVICES				
98	Life Expectancy	Atlas IDHM/ PNUD	2010	Life Expectancy at birth
99	Infant Mortality	Atlas IDHM/ PNUD	2010	Number of deaths of infants under one year old per 1,000 live births as an indicator for the quality of public health services.
SELF-RATED HEALTH				
100	Self-rated Health	IBGE	2013	Self-rated health, classified as very good, good, average, bad, very bad among the population aged 55 to 65, for the following diseases: Diabetes, Cardiovascular Disease, Cancer, Depression.

PUBLIC SECTOR PERFORMANCE

Figure 27: Data Source - Public Sector Performance

#	INDICATOR	SOURCE	YEAR	INDICATOR DESCRIPTION
MANAGEMENT OF PUBLIC FINANCES				
101	Own Revenue	FIRJAN	2012	The proper management of public finances (including investments; spending; revenue; liquidity; net debt) is critical for ensuring trust in the state's business environment.
102	Spending with Personnel			
103	Investments			
104	Liquidity			
105	Cost of Debt			
JUDICIAL SYSTEM PERFORMANCE				
106	Budget Management	CPJUS	2012	Judicial efficiency. IDJus is an indicator that attempts to measure the Brazilian judicial performance in the State Court. IDJus assumes that adequate performance Justice involves the improvement of the courts in three basic dimensions of the Judiciary: budget management, resource management and process management.
107	Resource Management			
108	Process Management			
PUBLIC SECURITY CONDITIONS				
109	Number of Homicides per 100,000 People	Julio Jacobo Waiselfisz, Mapa da Violencia	2013	This indicator looks at whether violent crime is likely to pose a significant problem for business. Assessment is based on the number of homicides per 100,000 people.

LOGISTICS

Figure 28: Data Source – Logistics

#	INDICATOR	SOURCE	YEAR	INDICATOR DESCRIPTION
ROADS				
110-114	Quality of Paved Roads	CNT - Pesquisa de Rodovias	2013	The indicator measures the quality of paved roads which determine the likelihood of new firms entering a given location. Data comes from the Pesquisa de Rodovias of the CNT, which assesses paved road according to five criteria: Number of Roads evaluated as very good, good, regular, fair, very fair.
RAILROAD				
115	Extension of Railroad Lines	PNTL - Mtrasnporte	2010	The indicator measures the total Lengths of railroad lines (kms of rail per sq km) in a region. An inadequate railroad network raises the costs of doing business and may result in an overuse of road transport.
PORTS				
116-118	Cargo Movement at Inland Ports and Seaports	ANTAQ	2013	The indicator looks at the cargo Movement at Ports and Seaports, measured as the total container movements, as well as container movement (weight) divided by total cargo movement (weight).
119	Distance to Port	FGV	2014	Micro-region center distance to nearest port.
AIRPORTS				
120-121	Number of Domestic and International Destinations at Airports	ANAC	2014	The indicator looks at the number of national and regional destinations, as well as international destinations of the regional airport(s).
122-123	International and Domestic Flights per Week	ANAC	2014	The indicator looks at the number of seats in National and Regional Flights per week, as well as the number of seats in international Flights per week.
124	Distance to Airport	FGV	2014	Micro-region center distance to nearest airport.
WATERWAYS				
125	Extension of Waterways	PNTL	2010	The indicator measures the total Lengths of waterways (kms per sq km).
TRADE FLOWS				
126	Export	Aliceweb2	2013	Export Value in US$.

BUSINESS SOPHISTICATION

Figure 29: Data Source - Business Sophistication

#	INDICATOR	SOURCE	YEAR	INDICATOR DESCRIPTION
SKILLED HUMAN RESOURCES IN MANAGEMENT				
127	Management	Censo	2010	Share of workforce employed in management positions, according to the following employee classifications: Management COD 1120-1330
SKILLED HUMAN RESOURCES IN ADVANCED MANUFACTURING				
128	Complex Manufacturing	RAIS/MTE	2013	Share of workforce engaged in complex manufacturing, according to the following firm classifications: Manufacturing of chemical products CNAE 20-21 Metallurgy CNAE 24 Metal products CNAE 25 , Electronics CNAE 26 Capital equipment CNAE 27-28 Motor vehicles CNAE 29, 30, Gas and electricity CNAE 35
SKILLED HUMAN RESOURCES IN COMMUNICATION AND INFORMATION TECHNOLOGY				
129	Occupational Employment in Communication and Information Technology	Censo	2010	Total occupational employment in Communication and Information technology, according to the following employee classifications: CIT Managers COD 1330 CIT instructors COD 2356 CIT professionals and database and network specialists COD 2521-2529 CIT Technicians COD 3511-3514
130	Sector Employment in Communication and Information Technology	RAIS/MTE	2013	Total sector employment in Communication and Information technology, according to following firm classifications: Information technologies services CNAE 62 Information services CNAE 63 Telecommunications CNAE 61

INNOVATION

Figure 30: Data Source – Innovation

#	INDICATOR	SOURCE	YEAR	INDICATOR DESCRIPTION
AVAILABILITY OF SKILLED LABOR				
131-146	Scientists , Engineers, and R&D Directors	RAIS/MTE	2013	The Indicator includes absolute numbers of Scientists , Engineers, and R&D Directors, including: Civil engineers (2142), Electronic engineers (2143), Mechanical engineers (2144), Chemical engineers (2145), Metallurgist and Materials engineers (2146), Mining engineers (2147), Agrimensor engineers and cartographic engineers (2148), Industrial, Production and Security engineers (2149), Agricultural Engineers (2221), Food engineers (2222), Philosophers and Political scientists (2514)
147-156	Workers Employed in R&D; Market Research and Pharmaceutical Production	RAIS/MTE	2013	The Indicator includes people employed in R&D; Market research and Pharmaceutical Production, including: Manufacture of Pharmaceutical Chemical Products (21106), Medicines for Human Use (21211), veterinary medicinal products (21220), pharmaceutical preparations (21238), R&D in natural sciences and engineering (72100) and in social sciences and humanities (72207), Advertising agencies (73114), Allocation of advertising space, except media (73122), Advertising activities not specified above (73190), Market and Public Opinion Research (73203)
157-159	Workers with Graduate Diploma, Masters Degree, and PhD	Censo	2013	Highest level of education completed.
FOREIGN DIRECT INVESTMENT				
160	FDI per State in R$	Banco Central	2010	Looks at inward Foreign Direct Investment in R$, considered critical for innovation.
R&D ENVIRONMENT				
161-165	Performance of R&D Institutions	Ministry of Education	2013	This indicator looks at the performance of research and development (R&D) institutions in each region, assessed by the number of universities with a Score of 4, 5, 6 or 7 in the Ranking of the Coordination Agency for the Improvement of Higher Education Personnel (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, CAPES) .
166	Technology Parks	Anprotec	2008	Number of Technology Parks, an area managed in a manner designed to promote innovation
167	Public Expenditure in R&D	FINEP	2013	Looks at the expenditure in R&D in R$ da FINEP. Financial assistance from state agencies is considered crucial for the development of cutting-edge products and processes and higher value-added activities .
ENTREPRENEURSHIP AND STARTUP INNOVATION				
168	Number of Venture Capital Firms	ABVCAP	2012	Unleashing innovation requires an environment that enables entrepreneurship. Providing access to venture capital and financing determines how many businesses will succeed in developing new or improved products and services. The indicator looks at the concentration of entrepreneurs and startup companies, service providers, angel investors and the number of venture capital firms.
169	Startups	StartupBase	2011	
170	Entrepreneurs		2011	
171	Angel Investors		2011	
172	Service Providers		2011	

MARKET SIZE

Figure 31: Data Source – Market Size

#	INDICATOR	SOURCE	YEAR	INDICATOR DESCRIPTION
SIZE OF THE ECONOMY				
173	Size of the Economy	IBGE	2012	Gross Domestic Product at current prices (in thousand Reais)
POPULATION				
174	Population	IBGE	2012	Number of residents
FIRM SIZE				
175	Firm Size	RAIS/MTE	2013	Number of enterprises with more than 100 employees
DISTANCE BETWEEN MARKETS				
176	Distance between Markets	FGV	2014	Physical Distance to consumer centers (in km)
177	Weighted Market Size	FGV	2014	This indicator measures each micro-region's proximity to the country's main internal markets

GOODS MARKET

Figure 32: Data Source - Goods Market

#	INDICATOR	SOURCE	YEAR	INDICATOR DESCRIPTION
INTENSITY OF LOCAL COMPETITION				
178	Points in the Herfindahl Index - Calculated with the Payroll of firms	RAIS/MTE	2012	Points in the Herfindahl Index is an indicator for the intensity of local competition, an important driver for market efficiency, and thus business productivity, by ensuring that the most efficient firms, producing goods demanded by the market, are those that thrive.
179	Points in the Herfindahl Index - Calculated with the Number of firms			
TAX BURDEN				
180	Social Contribution on Net Profits (CSLL) - R$	CONFAZ - MF	2013	This indicator looks at the tax burden of each state, which can be an obstacle to the efficient exchange of goods. Data comes from analysis of ICMS, a state tax for goods and services (Imposto sobre Operações relativas à Circulação de Mercadorias e Serviços), CSLL, the Social Contribution on Net Profits (Contribuição Social sobre o Lucro Líquido), and ISS, a tax on services (Imposto sobre Serviços de Qualquer Natureza).
181	Tax on the Circulation of Goods and Services (ICMS) - R$			
182	Tax on Services (ISS) – R$			

LABOR MARKET

Figure 33: Data Source – Labor Market

#	INDICATOR	SOURCE	YEAR	INDICATOR DESCRIPTION
EMPLOYMENT				
183	Full Employment	PNAD	2013	Share of the population aged 18 to 64 in employment for pay (positive earnings).
184	Employment to Population Ratio	PNAD	2013	% of working age population in labor force
185	Male Employment Rates	PNAD	2013	Share of the male population aged 18 to 64 in employment for pay
186	Female Employment Rates	PNAD	2013	Share of the female population aged 18 to 64 in employment for pay
UNEMPLOYMENT				
187	Unemployment Rate	PNAD	2013	Unemployment rates by age group
188 - 189	Youth Unemployment	Censo e PNAD	2013	Share of the population aged 18 to 24 that is looking for a job
190	Youth neither in Employment nor in School	PNAD	2013	Share of the population aged 18 to 25 that is neither employed nor in school
CAPABILITY TO ATTRACT TALENT				
191-192	Internal Migration – Municipality	Censo and PNAD	2010 and 2013	Share of the population aged 18 to 64 born in another municipality
193-194	Internal Migration – State	Censo and PNAD	2010 and 2013	Share of the population aged 18 to 64 born in another state
CAPABILITY TO RETAIN TALENT				
195	Ratio of Long-term Migrants to (sending) State Population	PNAD	2013	Ratio of those born in a state but living in another, to sending's state population
196	Ratio of Recent Migrants to (sending) State Population	PNAD	2013	Share of the population aged 18 to 64 that moved to another state within last 5 years
197	Ratio of migrants from a state and that state's population	PNAD	2013	Share of the population that moved to another state within last 5 years to that state's population

ENERGY RESOURCES

Figure 34: Data Source – Energy Resources

#	INDICATOR	SOURCE	YEAR	INDICATOR DESCRIPTION
SOLAR INSOLATION				
198	Average Daily Solar Radiation	http://en.openei.org/wiki/SWERA/Data	2006	Average daily solar radiation in kwh/sqm/day is used as a proxy for potential of solar energy generation per region .
WIND POWER				
199	Average Daily Wind Speed	http://en.openei.org/wiki/SWERA/Data	2006	Average daily wind speed (sq km) is used as a proxy for the potential of wind energy generation per region.

AGRICULTURAL AND EXTRACTIVE RESOURCES

Figure 35: Data Source: Agricultural and Extractive Resources

#	INDICATOR	SOURCE	YEAR	INDICATOR DESCRIPTION
AVAILABLE WORKFORCE				
200	Total Employment	RAIS/MTE	2013	Total Number of employees
201	Employment in Mining	RAIS/MTE	2013	Number of people employed in the following industries: Carbon (CNAE 05); Oil (CNAE 06); Metals (CNAE 07); Iron, aluminum, tin, Non-metals (CNAE 08); and Support services (CNAE 09)
202	Employment in Fishing	RAIS/MTE	2013	Number of people employed in the Fishing (CNAE 03.1) and Aquaculture Industries (CNAE 03.2)
203	Employment in Forestry	RAIS/MTE	2013	Number of people employed in the forestry industry (Native and planted timber and support services, CNAE 02)
PRODUCTION VOLUME				
204-205	Production from Extractive and Silviculture Industries	PEVS - IBGE	2012	Gross value of production in thousands of R$
206-207	Production from permanent and temporary cropland	PAM - IBGE	2012	Crop value in thousands of R$
208	Production from Sugarcane	ÚNICA	2013/14	Production in thousand tons per harvest period
LIVESTOCK				
209-220	Volume of Livestock	PPM - IBGE	2011	Average size of herd in thousands (Cattle, Horses, Buffalos, Donkeys, Mules, Swines, Goats, Sheeps, Roosters, Pullets, Chicks, Chickens, Quails , Rabbits)
221-224	Slaughter Value	PPM - IBGE	2011	Slaughter value in thousands of R$ (Cattle, Chickens, Sheep, Swines)

METHODOLOGY – DIMENSIONS OF COMPETITIVENESS

Each of the dimensions of competitiveness was built according to a four-stage iterative process:

Variable selection and grouping

Selecting suitable variables from the database, according to criteria of completeness, data quality and economic sense; adjusting for missing or nonexistent values[18]; and occasionally grouping closely-related variables into a single indicator;

Spatial aggregation

Conforming the variables into a per-micro-region level;

Standardization

Transforming the aggregated variables to conform to the same statistical properties;

Variable aggregation

Synthesizing the standardized variables into a single indicator, through averaging with selected weights.

At the end of the four stages, the indicator produced was analyzed for consistency and, if deemed necessary, the process was adjusted and repeated.

The detailed results of this process are described hereafter for each dimension. They are also available as Python scripts.

BASIC EDUCATION

Variable selection and grouping

The following variables were selected:

- BEV001 - Literacy
- BEV002 - Class size

[18] The general procedure was that nonexistent values for municipalities were imputed as the microregion's mean, if available, or the national mean otherwise. Missing values were imputed as zero or the non-zero minimum, depending on the situation.

- BEV003007 - Average test score - National Exam of Upper Secondary Education (ENEM) – sum of Natural Sciences, Humanities, Languages, Mathematics and Writing
- BEV008009 - Index of Development of Basic Education (IDEB) – sum of 4th grade and 8th grade exams
- BEV011 – Male school rate
- BEV013 – Female school rate
- BEV015 – Index of Development of Basic Education (IDEB) 11th grade exam

Spatial aggregation

BEV001 through BEV008009 were supplied on a per-municipality basis and were aggregated to micro-region level using population weights. The remaining variables were supplied on a per-micro-region basis.

Standardization

All variables were z-score standardized[19].

Variable aggregation

Weights were selected using Principal Component Analysis (PCA)[20]. The indicator produced explains 47.8% of the total variance in the sample.

[19] If the original variable is x, the z-score is defined as , where and are, respectively, the sample mean and sample standard deviation. The resulting variable has zero mean and unitary variance.

[20] PCA is a simple, widely used numerical method with several applications. Given a set of variables, the algorithm calculates optimal weighing factors such that the weighed average (also called the first principal component) is the best single synthetic indicator for the whole group, that is, it captures or explains the highest proportion of the overall variability of the dataset across samples (compared to all other possible weighed averages).

Table 54: Indicator and its weight – Basic Education

#	INDICATOR	WEIGHT
1	Average Test Score, 4th Grade Exam	0.4643
2	Average Test Score, 8th Grade Exam	
3	Average Test Score, 11th Grade Exam	0.45825
4	Ratio of Students to Classrooms	-0.1027
5	Average Test Score, High School Exam (3rd Year) - Natural Sciences	0.4973
6	Average Test Score, High School Exam (3rd Year) – Humanities	
7	Average Test Score, High School Exam (3rd Year) – Languages	
8	Average Test Score, High School Exam (3rd Year) – Mathematics	
9	Average Test Score, High School Exam (3rd Year) – Writing	
10	Percentage of Population Older than 5 Able to Read and Write	0.4827
11	Share of Female Youth Aged 16-17 in School	0.2713
12	Share of Male Youth Aged 16-17 in School	0.0998

Source: FGV

HIGHER AND VOCATIONAL EDUCATION

Variable selection and grouping

- The following variables were selected:
- HEV009 - Higher education graduates - Total (normalized by population)
- HEV016028 - Vocational student enrollment – Total (normalized by population)
- HEV031 - Higher Education enrollment – Total (normalized by population)
- HEV033049 – University performance – all subjects
- HEV050 – Inbound student mobility
- HEV051 - Share of the population aged 18 to 25 in university
- HEV053 - Workforce aged 25 to 64 with college degree
- HEV055 - Grading of state's two top universities (Folha)
- HEV056 - Grading of state's top university (CWUR)
- HEV057 - Grading of state's top university (QS)
- HEV058 - World ranking (Webometrics)
- HEV059 - Share of the population aged 35 to 65 in collegeBEV001 – Literacy

Spatial aggregation

HEV009 through HEV033049 were supplied on a per-municipality basis and aggregated to micro-region level using population weights. HEV050 was supplied on a per-state basis and state values were utilized as proxies for the micro-regions. The remaining variables were supplied on a per-micro-region basis.

Standardization

All variables were log-transformed[21] and z-score standardized.

Variable aggregation

Weights were selected using Principal Component Analysis (PCA). The indicator produced explains 48.2% of the total variance in the sample.

[21] More precisely, the transformation Y = log(X+1) was used, in order to avoid zero-value issues.

Table 55: Indicator and its weight – Higher and Vocational Education

#	INDICATOR	WEIGHT
13	Share of Formal Workforce with University Degree	0.3059
14	Number of Higher Education Graduates (normalized by population)	0.2961
15	Share of Those Aged 18 to 25 in University	0.3117
16	Share of Those Aged 35 to 65 in College	0.0927
17	Share of Higher Education Students per 100.000 Residents	0.2965
18-31	Number of Students Enrolled in Technical Education (normalized by population)	0.2490
32-49	Test Score in National Student Performance Exam	0.2235
50	Rankings of Best State Universities (Folha de São Paulo)	0.3136
51	Rankings of Best State Universities (CWUR)	0.3046
52	Rankings of Best State Universities (QS ranking)	0.3335
53	Rankings of Best State Universities (Webometrics)	0.3315
54	Inbound Student Mobility	0.3184

Source: FGV

SOCIAL INFRASTRUCTURE

Variable selection and grouping

The following variables were selected:

- IFV001005 – Number of households with telephone infrastructure
- IFV006 – Number of households with personal computer
- IFV007 – Number of households with Internet access
- IFV008 - Internet bandwidth speed (up to 2Mbps)
- IFV009 - Internet bandwidth speed (above 2Mbps)
- IFV010 - Access to electricity
- IFV011 - Cost of electricity - Residential
- IFV012 - Cost of electricity - Industrial
- IFV013 - Cost of electricity - Commercial
- IFV014018 – Excess commuting time

Spatial aggregation

IFV008-009, 011-013 were supplied on a per-state basis and state values were utilized as proxies for the micro-regions. The remaining variables were supplied on a per-municipality basis and were aggregated to micro-region level using population weights. The remaining variables were supplied on a per-micro-region basis.

Standardization

IFV001005 through IFV007 were normalized by population. IFV010 was log-transformed. All variables were z-score standardized.

Variable aggregation

Weights were selected using Principal Component Analysis (PCA). The indicator produced explains 36.9% of the total variance in the sample.

Table 56: Indicator and its weight – Social Infrastructure

#	INDICATOR	WEIGHT
55	Households with Telephone Access	0.3940
56	Households with Telephone Access, Landline Only	
57	Households with Telephone Access, Mobile	
58	Households with Telephone Access, Landline And Mobile	
59	Households with Personal Computer	0.4157
60	Households with Personal Computer with Internet Access	0.4168
61	Internet Bandwidth Speed (Up to 2Mbps)	0.2675
62	Internet Bandwidth Speed (Above 2Mbps)	0.2609
63	Percentage of Households with Access to Electricity	0.3588
64	Cost of Electricity – Residential (in R$ per KWh)	-0.2403
65	Cost of Electricity – Industrial (in R$ per KWh)	-0.2094
66	Cost of Electricity – Commercial (in R$ per KWh)	-0.3566
67	Time Spent Commuting from Home to Work - Up to 5 min	0.0342
68	Time Spent Commuting from Home to Work - Between 6 and 30 min	
69	Time Spent Commuting from Home to Work - Between 30 and 60 min	
70	Time Spent Commuting from Home to Work - Between 1 and 2 hours	
71	Time Spent Commuting from Home to Work - More than 2 hours	

Source: FGV

SUSTAINABILITY

Variable selection and grouping

The following variables were selected:

- SUV001 – Biodiversity protection
- SUV002 - Pollution
- SUV003 - Income equality
- SUV004 - Poverty
- SUV005 - Access to water services
- SUV013 - Access to basic sanitation
- SUV022 - Quality of housing
- SUV025 - Ratio of household income at 90th percentile to that at 10th
- SUV027 - Ratio of rent to household income among renters
- SUV029 - Perception of good quality in public transportation
- SUV030 - Perception of good quality in public health system
- SUV031 - Perception of good quality in public education system
- SUV032 - Perception of good quality in leisure activities
- SUV033 - Ratio of mortgage to household income among those with mortgages

Spatial aggregation

SUV001-002 and SUV005 through SUV022 were supplied on a per-municipality basis and were aggregated to micro-region level using population weights. SUV003-004 were supplied on a per-state basis and state values were utilized as proxies for the micro-regions.

Standardization

SUV002, SUV005, SUV013 and SUV022 were normalized by population. SUV001, SUV002, SUV005, SUV013, SUV022, SUV025, SUV027 and SUV033 were log-transformed. All variables were z-score standardized.

Variable aggregation

Principal Component Analysis (PCA) presented economically unsuitable weights for this set of variables. A simple average was thus utilized, with variable signs inverted depending on the intended interpretation of the dimension.

HEALTH

Variable selection and grouping

The following variables were selected:

- HHV001 - Life expectancy at birth
- HHV002 - Infant mortality
- HHV003 - Hospital beds
- HHV004014 - Number of people employed in health care
- HHV019 - Self-rated health among the population aged 55 to 65

Spatial aggregation

HHV019 was supplied on a per-micro-region basis. The remaining variables were supplied on a per-municipality basis and were aggregated to micro-region level using population weights.

Standardization

HHV003 and HHV004014 were normalized by population and log-transformed. All variables were z-score standardized.

Variable aggregation

Weights were selected using Principal Component Analysis (PCA). The indicator produced explains 72.4% of the total variance in the sample.

Table 57: Indicator and its weight – Health

#	INDICATOR	WEIGHT
86	Employment in Health Care Services	0.4442
87-96	Employment in Health Care Services per Field of Activity	
97	Hospital Beds	0.3084
98	Life Expectancy	0.5054
99	Infant Mortality	-0.5020
100	Self-rated Health	0.4474

Source: FGV

PUBLIC SECTOR PERFORMANCE

Variable selection and grouping

The following variables were selected:

- ISV003 – Homicide rate
- ISV004008 – Fiscal management of municipalities – IFGF index (Firjan)
- ISV009011 – Performance of the Judicial System – IDJus index (CPJUS)

Spatial aggregation

ISV009011 was supplied on a per-state basis and state values were utilized as proxies for the micro-regions. The remaining variables were supplied on a per-municipality basis and were aggregated to micro-region level using population weights[22].

Standardization

ISV003 was log-transformed. All variables were z-score standardized.

Variable aggregation

Weights were selected using Principal Component Analysis (PCA). The indicator produced explains 45.7% of the total variance in the sample.

[22] The Federal District, where Brasília is located, does not possess a municipal government and does not have an IFGF score. The mean of all municipalities was imputed.

Table 58: Indicator and its weight – Public Sector Performance

#	INDICATOR	WEIGHT
101	Own Revenue	0.6905
102	Spending with Personnel	
103	Investments	
104	Liquidity	
105	Cost of Debt	
106	Budget Management	0.7030
107	Resource Management	
108	Process Management	
109	Number of Homicides per 100,000 People	-0.1702

Source: FGV

LOGISTICS

Variable selection and grouping

The following variables were selected:

- LOV001005 – Quality of road pavement
- LOV017 – Distance to nearest airport
- LOV018 – Distance to nearest port
- LOV006 – km of railway per sq km
- LOV007 – km of waterways per sq km
- LOV012 – Cargo movement at dry ports
- LOV013 – Cargo movement at seaports
- LOV014 – Containerization rate
- LOV015 – Trade flows
- LOV008 – Number of seats in regional flights at local airport
- LOV009 – Number of seats in international flights at local airport
- LOV010 – Number of regional destinations at local airport
- LOV011 – Number of international destinations at local airport

Spatial aggregation

LOV008-011, 017, 018 were supplied on a per-municipality basis and were aggregated to micro-region level using population weights. The remaining variables were supplied on a per-state basis and state values were utilized as proxies for the micro-regions.

Standardization

LOV008-011, 017, 018 were log-transformed. All variables were z-score standardized.

Variable aggregation

Weights were selected using Principal Component Analysis (PCA). The indicator produced explains 30.7% of the total variance in the sample.

Table 59: Indicator and its weight – Logistics

#	INDICATOR	WEIGHT
110-114	Quality of Paved Roads	0.3596
115	Extension of Railroad Lines	0.2638
116	Cargo Movement at Inland Ports	0.4496
117	Cargo Movement at Inland Seaports	0.4504
118	Containerization rate	0.1398
119	Distance to Port	-0.0759
120	Number of Domestic Destinations at Airports	0.1753
121	Number of International Destinations at Airports	0.1714
122	Domestic Flights per Week	0.1793
123	International Flights per Week	0.1739
124	Distance to Airport	-0.1956
125	Extension of Waterways	0.0699
126	Export	0.4530

Source: FGV

BUSINESS SOPHISTICATION

Variable selection and grouping

The following variables were selected:

- BUS001 – Share of workforce in management
- BUS002 – Share of workforce in complex manufacturing
- BUS003 – Share of workforce in IT occupations
- BUS004 – Share of workforce in IT firms

Spatial aggregation

All variables were supplied on a per-micro-region basis.

Standardization

BUS002, BUS003, BUS004 were log-transformed. All variables were z-score standardized.

Variable aggregation

Weights were selected using Principal Component Analysis (PCA). The indicator produced explains 30.7% of the total variance in the sample.

Table 60: Indicator and its weight – Business Sophistication

#	INDICATOR	WEIGHT
127	Management	0.3960
128	Complex Manufacturing	0.4209
129	Occupational Employment in Communication and Information Technology	0.3881
130	Sector Employment in Communication and Information Technology	0.4164

Source: FGV

INNOVATION

Variable selection and grouping

The following variables were selected:

- INV010026 – Concentration of human resources in R&D
- INV027029 – Density of people with undergraduate, Master's and Doctor's degrees (weighed)
- INV030042 – State Innovation & Entrepreneurship Sub-index[23]

Spatial aggregation

INV030042 was supplied on a per-state basis and state values were utilized as proxies for the micro-regions. The remaining variables were supplied on a per-municipality basis and were aggregated to micro-region level using population weights.

Standardization

INV010026 and INV027029 were log-transformed. All variables were z-score standardized.

Variable aggregation

Weights were selected using Principal Component Analysis (PCA). The indicator produced explains 73.4% of the total variance in the sample.

[23] Composed of Foreign Direct Investment , Expenditure in R&D, Concentration of start-ups, Concentration of entrepreneurs, Concentration of angel investors, Concentration of service providers, Technology parks, Venture Capital, CAPES evaluation of R&D institutions.

Table 61: Indicator and its weight – Innovation

#	INDICATOR	WEIGHT
131-146	Scientists , Engineers, and R&D Directors	0.5947
147-156	Workers Employed in R&D; Market Research and Pharmaceutical Production	
157-159	Workers with Graduate Diploma, Masters Degree, and PhD	0.6167
160	FDI per State in R$	0.5158
161-165	Performance of R&D Institutions	
166	Number of Technology Parks	
167	Public Expenditure in R&D	
168	Number of Venture Capital Firms	
169	Startups	
170	Entrepreneurs	
171	Angel Investors	

Source: FGV

MARKET SIZE

Variable selection and grouping

The following variables were selected:

- MSV018 – Distance to the border
- MSV028 – Weighed market size[24]
- MSV001 – Municipal GDP (Gross Domestic Product)
- MSV002 – Population
- MSV017 – Number of enterprises

Spatial aggregation

All variables were supplied on a per-municipality basis and were aggregated to micro-region level, either by sum (MSV001, MSV002 and MSV017) or by GDP weights (others).

Standardization

All variables were log-transformed and z-score standardized.

Variable aggregation

Weights were selected using Principal Component Analysis (PCA). The indicator produced explains 60.6% of the total variance in the sample.

Table 62: Indicator and its weight – Market Size

#	INDICATOR	WEIGHT
173	Size of the Economy	0.5589
174	Population	0.5256
175	Firm Size	0.5669
176	Distance between Markets	-0.0886
177	Weighted Market Size	0.2865

Source: FGV

[24] The weighed market size of each municipality is defined as , where is the GDP of municipality and is the distance between municipalities and . is a constant scale equal to

GOODS MARKET

Variable selection and grouping

The following variables were selected:

- GMV001 – Herfindahl-Hirschman Index (HHI) of firms by payroll[25]
- GMV002 – Herfindahl-Hirschman Index (HHI) of firms by number
- GMV003005 – Tax intensity as a % of GDP[26]

Spatial aggregation

GMV001 and GMV002 were supplied on a per-municipality basis and were aggregated to micro-region level by GDP weights. GMV003005 was supplied on a per-state basis and state values were utilized as proxies for the micro-regions.

Standardization

GMV001 and GMV002 were log-transformed. All variables were z-score standardized.

Variable aggregation

Weights were selected using Principal Component Analysis (PCA). The indicator produced explains 62.7% of the total variance in the sample.

Table 63: Indicator and its weight – Goods Market

#	INDICATOR	WEIGHT
178	Points in the Herfindahl Index - Calculated with the Payroll of firms	-0.6666
179	Points in the Herfindahl Index - Calculated with the Number of firms	-0.6656
180	Social Contribution on Net Profits (CSLL) - R$	-0.3355
181	Tax on the Circulation of Goods and Services (ICMS) - R$	
182	Tax on Services (ISS) – R$	

Source: FGV

[25] The HHI is a measure of concentration. Payroll HHI is defined as , where is the share of firm in the total firm payroll of a given municipality. Number HHI is simply equal to , where is the number of firms.
[26] Including the following taxes: CSLL (excise tax on corporate profits), ICMS (goods VAT) and ISS (services VAT).

LABOR MARKET

Variable selection and grouping

The following variables were selected:

- LMV001 – Unemployment rate
- LMV002 - % working age population in the labor force
- LMV004 - % of young people (15-29) who neither study nor work
- LMV009 - Share of the population aged 18 to 64 born in another municipality (Census)
- LMV010 - Share of the population aged 18 to 64 born in another state (Census)
- LMV011 - Share of the population aged 18 to 64 in employment for pay
- LMV012 - Share of the male population aged 18 to 64 in employment for pay
- LMV013 - Share of the female population aged 18 to 64 in employment for pay
- LMV014 - Share of the population aged 18 to 24 looking for a job
- LMV015 - Share of the population aged 18 to 25 that is neither employed nor in school
- LMV016 - Share of the population aged 18 to 64 born in another municipality (PNAD)
- LMV017 - Share of the population aged 18 to 64 born in another state (PNAD)
- LMV018 - Share of the population aged 18 to 64 living in another state for the last 5 years
- LMV019 - Ratio of those born in one state but living in another, to the population of the sending state
- LMV020 - Ratio of migrants from a state, to the population of that state

Spatial aggregation

LMV004, LMV009, LMV010 were supplied on a per-municipality basis and were aggregated to micro-region level by population weights. The remaining variables were supplied on a per-state basis and state values were utilized as proxies for the micro-regions.

Standardization

All variables were z-score standardized.

Variable aggregation

Weights were selected using Principal Component Analysis (PCA). The indicator produced explains 50.1% of the total variance in the sample.

Table 64: : Indicator and its weight – Labor Market

#	INDICATOR	WEIGHT
183	Full Employment	0.3260
184	Employment to Population Ratio	0.2652
185	Male Employment Rates	0.3282
186	Female Employment Rates	0.3035
187	Unemployment Rate	-0.2639
188	Youth Unemployment – Censo	0.2463
189	Youth Unemployment – PNAD	-0.1826
190	Youth neither in Employment nor in School	-0.2975
191	Internal Migration – Municipality – Censo	0.2218
192	Internal Migration – Municipality – PNAD	0.2946
193	Internal Migration – State – Censo	0.1660
194	Internal Migration – State – PNAD	0.2085
195	Ratio of Long-term Migrants to (sending) State Population	0.1883
196	Ratio of Recent Migrants to (sending) State Population	0.1611
197	Ratio of migrants from a state and that state's population	0.0336

Source: FGV

ENERGY RESOURCES

Variable selection and grouping

The following variables were selected:

- EEV001 – Wind-power potential
- EEV002 – Solar insolation

Spatial aggregation

Both variables were supplied on a per-municipality basis and were aggregated to micro-region level by area weights.

Standardization

All variables were z-score standardized.

Variable aggregation

Principal Component Analysis (PCA) presented economically unsuitable weights for this set of variables. A simple average was thus used.

AGRICULTURAL AND EXTRACTIVE RESOURCES

Variable selection and grouping

The following variables were selected:

- AEV001004 – Total employment in agriculture and extractive activities
- AEV005008 – Value of agricultural and extractive production
- AEV009020 – Size of herd
- AEV021024 – Slaughter value of herd
- AEV025 – Sugarcane production

Spatial aggregation

AEV025 was supplied on a per-state basis and state values were utilized as proxies for the micro-regions. The remaining variables were supplied on a per-municipality basis and were aggregated to micro-region level by population weights.

Standardization

All variables were log-transformed and z-score standardized.

Spatial aggregation

Weights were selected using Principal Component Analysis (PCA). The indicator produced explains 40.5% of the total variance in the sample.

Table 65: Indicator and its weight – Agricultural and Extractive Resources

#	INDICATOR	WEIGHT
200	Total Employment	0.1275
201	Employment in Mining	
202	Employment in Fishing	
203	Employment in Forestry	
204-205	Production from Extractive and Silviculture Industries	0.5763
206-207	Production from Permanent and Temporary Cropland	
208	Production from Sugarcane	0.0272
209-220	Volume of Livestock	0.5942
221-224	Slaughter Value	0.5457

Source: FGV

METHODOLOGY – COMPETITIVENESS INDEX

The regional competitiveness index is built from the 14 dimensions described in the previous section. It is worth remembering that each dimension corresponds to an indicator for the 558 micro-regions. To calculate the regional competitiveness index, these 14 indicators were all z-score standardized and then aggregated. The aggregation weights, once again selected using Principal Component Analysis, are presented.

Table 66: Dimension and its aggregation weight

DIMENSION	WEIGHT
Basic Education – BE	0.3139
Higher & Vocational Education – HE	0.3042
Social Infrastructure – IF	0.2814
Sustainability – SU	0.2836
Health – HH	0.3179
Public Sector Performance – IS	0.2579
Logistics – LO	0.2174
Business Sophistication – BS	0.3281
Innovation – IN	0.3249
Market Size – MS	0.2473
Goods Market – GM	0.2847
Labor Market – LM	0.2656
Energy Resources – EE	0.0397
Agricultural and Extractive Resources – AE	-0.0854

Source: FGV

As the first principal component of this sample space, the regional competitiveness index explains 62.1% of the total variance of the 14 dimensions. Considering that these dimensions correspond to variables that are in principle completely unrelated, this is a very successful summary of the inter-sample variability. This is a reflection of the strong correlation between dimension indicators.

Table 67: Correlation matrix

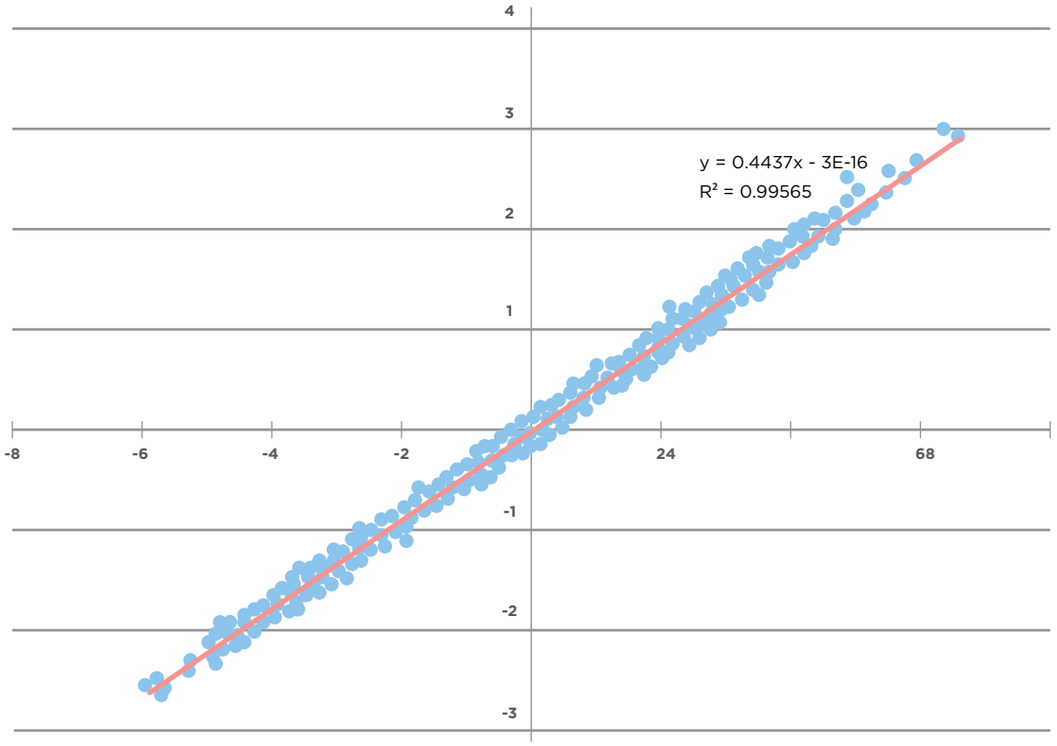
index	IS	IN	BS	EE	LO	IF	AE	BE	SU	HE	GM	HH	MS	LM
IS	1,00	0,67	0,71	0,03	0,44	0,57	-0,32	0,68	0,69	0,58	0,58	0,72	0,41	0,64
IN	0,67	1,00	0,93	0,13	0,65	0,80	-0,16	0,90	0,74	0,91	0,79	0,88	0,74	0,68
BS	0,71	0,93	1,00	0,07	0,64	0,81	-0,18	0,88	0,76	0,86	0,83	0,89	0,73	0,74
EE	0,03	0,13	0,07	1,00	0,04	0,18	-0,18	0,12	0,09	0,18	-0,02	0,07	0,05	0,05
LO	0,44	0,65	0,64	0,04	1,00	0,67	0,25	0,51	0,33	0,67	0,46	0,46	0,66	0,26
IF	0,57	0,80	0,81	0,18	0,67	1,00	-0,04	0,73	0,64	0,81	0,63	0,70	0,61	0,50
AE	-0,32	-0,16	-0,18	-0,18	0,25	-0,04	1,00	-0,24	-0,46	0,00	-0,21	-0,36	0,16	-0,60
BE	0,68	0,90	0,88	0,12	0,51	0,73	-0,24	1,00	0,81	0,84	0,73	0,90	0,58	0,72
SU	0,69	0,74	0,76	0,09	0,33	0,64	-0,46	0,81	1,00	0,69	0,61	0,86	0,38	0,82
HE	0,58	0,91	0,86	0,18	0,67	0,81	0,00	0,84	0,69	1,00	0,69	0,79	0,76	0,52
GM	0,58	0,79	0,83	-0,02	0,46	0,63	-0,21	0,73	0,61	0,69	1,00	0,79	0,74	0,67
HH	0,72	0,88	0,89	0,07	0,46	0,70	-0,36	0,90	0,86	0,79	0,79	1,00	0,58	0,82
MS	0,41	0,74	0,73	0,05	0,66	0,61	0,16	0,58	0,38	0,76	0,74	0,58	1,00	0,38
LM	0,64	0,68	0,74	0,05	0,26	0,50	-0,60	0,72	0,82	0,52	0,67	0,82	0,38	1,00

Source: FGV

Furthermore, it can be observed that the weights for 12 of the 14 dimensions can be considered approximately equal (between 0.21 and 0.33). The two exceptions are Renewable Energy Resources and Agricultural and Extractive Resources – precisely the two dimensions relating to natural endowments rather than to human or social development – which obtain near-zero weights, due to their generally low correlation with the remaining dimensions.

As an exercise, on the right, the index resulting from this aggregation is compared with that one obtained by a simple average of the 14 dimensions. One notes that the choice of PCA weights, instead of equal weights, produces substantially similar scores: although the exact orderings change, the cardinal changes are never extreme.

Figure 35: Dispersion Graph Aggregation x Mean



Source: FGV

INPUT-OUTPUT ANALYSIS

Input-output analysis is a quantitative methodological framework respected and widely used, combining perfectly with the objectives of this study. This enshrined approach is much appreciated in assessing the importance of industrial sectors or individual projects for the economy as a whole, whether on a regional, national or even international scope (IBGE. 1997; Fundação Cide. 1996; Montoya. 2001). These models start by splitting the economy into *economic activities* or sectors, each with its own accounts for production and consumption of goods and services, representing the so-called *social accounting* of that particular economy.

Each sector's accounts satisfy certain *accounting identities*, the following having special importance:

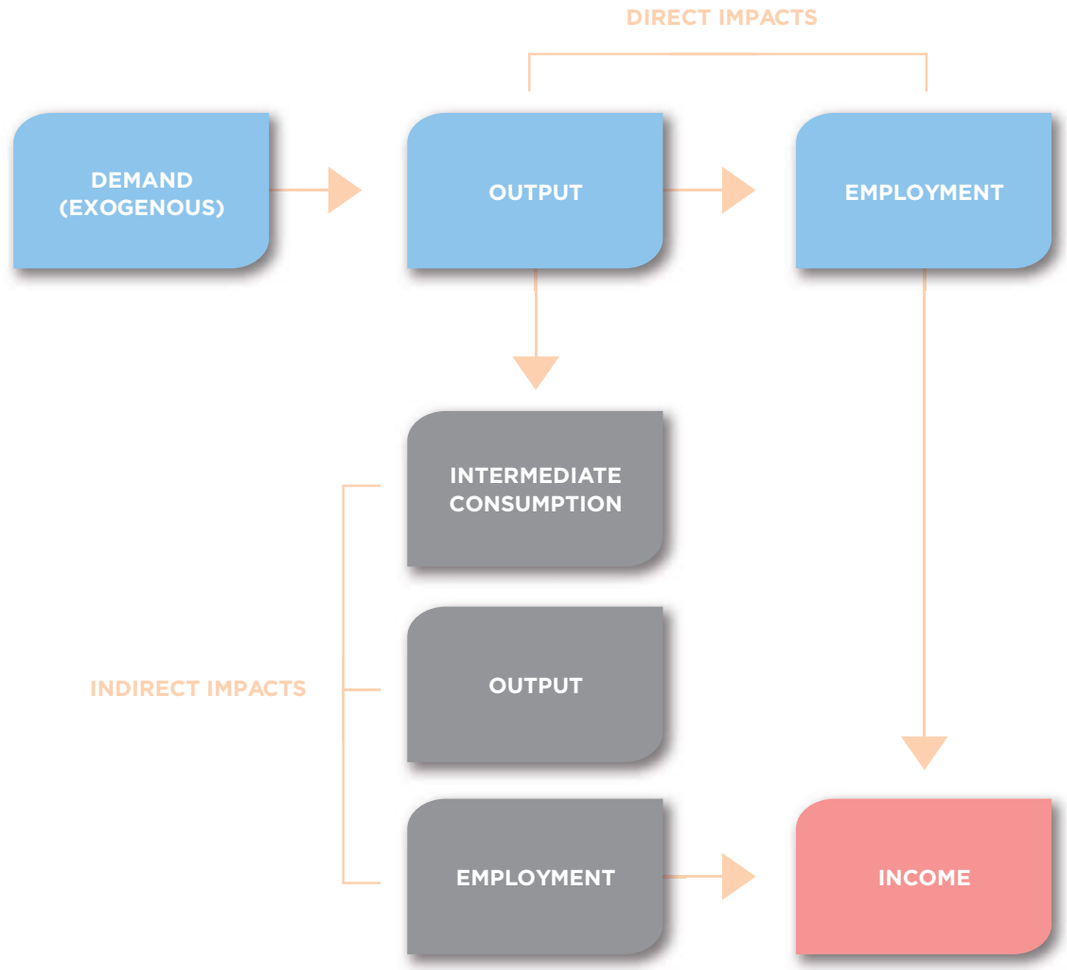
$$\begin{aligned} x_1 &= c_{11} + c_{12} + \ldots + c_{1n} + d_1 \\ x_2 &= c_{21} + c_{22} + \ldots + c_{2n} + d_2 \\ &\ldots \\ x_n &= c_{n1} + c_{n2} + \ldots + c_{nn} + d_n \end{aligned} \qquad (1)$$

These identities express the division of the production value of goods and services in accordance with their use:

- *Intermediate consumption,* that is, consumption on the part of the productive sectors of the economy; and
- *Final demand,* that is, absorption of the products otherwise, for instance: gross fixed-capital formation (investments), exports, variation of stock, public-administration consumption and family consumption.

Input-output analysis permits capturing not only the effects of the final demand for steel on the economic activities directly involved in its production (*direct effect*), but also the *indirect effects* on the activities making up the productive chain of steel, caused by the intermediate consumption between these activities, as shown below.

Figure 36: Input-Output Matrix Methodoogy



Source: FGV

The **Input-Output Matrix** of **IBGE** encompasses 110 products (goods and services) and 56 economic activities (including the government). An algorithm will be developed and applied to update this matrix, along with the use of more recent sectorial data disclosed by **IBGE** and data from other official surveys, namely:

- **IBGE Input-Output Matrix** – This matrix organizes, by origin and destination, the data on the economic flows that occur in Brazil. It shows production, intermediate consumption, imports, exports, investments (capital expenditures), household and public-sector consumption, along with generation and distribution of income between wages and company earnings.

- **System of National Accounts** – These are prepared based on the **Input-Output Matrix**, and consist of a set of tables (**Sources and Use of Goods and Services and Integrated Economic Accounts**) that describe the flows of production and intermediate consumption among economic sectors, households, government and the external sector. This is an important tool for consistent calculation and analysis of the nation's **gross domestic product.**

- **Brazilian Regional Accounts** – These detail the components of the production value of various economic activities in all **states** in the country, in each of the years analyzed. They are prepared based on sectorial and household surveys conducted by **IBGE** and decompose the national GDP, permitting analysis of intermediate consumption and value added to the economy on a regional level, structured in 17 sectors, compatible with the aggregation employed in the **System of National Accounts**.

Thus, $\mathbf{x}_1$ is the value of the production of sector **i**, $\mathbf{c}_{ij}$ represents the value consumed by sector **j** of goods and services produced by sector **i**, and $\mathbf{f}_i$ is the final demand for these goods or services. The fundamental hypothesis of a output-input model is that *the intermediate consumption by each sector is directly proportional to its own production*: $\mathbf{c}_{ij} = \mathbf{a}_{ij}\,\mathbf{x}_{ij}$, where the coefficients are called *technical coefficients* of production. This hypothesis can be easily understood as the postulation of a fixed technology for each sector, where the use of inputs is required in direct proportion to the volume of production, without economies of scale, substitute or complementary goods.

Based on this hypothesis, the accountable identities (1) can be written in the matricial form

$$x = A x + d \qquad (2)$$

or else, if the matrix **(I - A)** is invertible[27]

$$x = (I - A)^{-1} d \qquad (3)$$

is the so-called *Leontief matrix,* which shows how much each sector must produce to attend not only to the final demand for its products but also to the intermediate consumption on the part of all the other activities that use them as inputs.

In particular, should a – shock occur, for instance an increase or decrease in the volume of exports, in public or private investments, or in public-administration consumption, then, by linearity, the level of production of the activities will change to , which includes the direct impact of the increased demand and the impact induced by the increase in the intermediate consumption of the sectors.

The IBGE has a output-input model for the Brazilian economy divided into 56 sectors and 110 products and using the year 2009 as a reference. This model is considered to be an appropriate starting point inasmuch as it enables individualized identification of the inter-connections between the productive and institutional sectors. The following stages were completed using the IBGE Output-Input Matrix:

- Definition and characterization of the productive chain (institutions and products considered);
- Analysis of the IBGE output-input model and identification of the productive chain in the classifications employed; and
- Implementation of an updated and extended output-input model based on the IBGE model.

[27] Here **I** is the matrix identity