

# POLITECNICO DI MILANO

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## **Abstract**

This study examines the influence of remote work potential on rental property prices in São Paulo, particularly in the context of the COVID-19 pandemic, which accelerated the adoption of remote work across various economic sectors. The research employs the hedonic pricing methodology, utilizing data collected through web scraping of real estate advertisements and geocoded geographic data. Linear regression models are employed to identify the relationship between specific property variables and rental prices. The optimized regression model achieved a coefficient of determination ( $R^2$ ) of 0,6286, indicating that approximately 62,86% of the variability in rental prices is explained by the independent variables included in the model. Furthermore, a moderately strong linear relationship was observed between the compound annual growth rate (CAGR) of rents and the potential for remote work in downtown São Paulo. The coefficient of determination ( $R^2$ ) was 0,6564.

**Keywords:** *Work from Home; Remote work, Web Scraping; Hedonic Pricing Method, Linear Regression, Rental property prices, São Paulo real estate market, COVID-19 impact.*

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# Introduction

The objective of this study is to analyze the influence of remote work potential on rental property prices in São Paulo, particularly in the context of the global pandemic caused by the novel coronavirus (COVID-19), which has accelerated the adoption of remote work in various economic sectors. The research employs the hedonic pricing methodology and utilizes data collected through web scraping of real estate advertisements, as well as geographic data obtained through geocoding. The analysis employs linear regression models to identify the relationship between specific property variables and rental prices.

This work is structured into five main chapters. Chapter 1 presents a comprehensive literature review, addressing both classical and contemporary economic theories on the determination of property prices. This section reviews the land rent theory developed by David Ricardo, which explores the distribution of resources in an agricultural context and its implications for land rent. Furthermore, the text discusses Johann Heinrich von Thünen's location theory, which examines the spatial allocation

of economic activities, and William Alonso's urban model, which adapts von Thünen's principles to the urban environment. Finally, the distinction between differential and absolute rent is presented in order to provide a comprehensive understanding of the factors influencing urban land valuation.

Chapter 2 outlines the methodology employed in the study, with particular emphasis on the application of the hedonic pricing method. This approach is employed to quantify the value of non-market characteristics of properties that exert a significant influence on their market prices. Furthermore, the chapter discusses the classification of occupations suitable for remote work, using the methodology of Dingel and Neiman (Dingel & Neiman, 2020), adapted to the Brazilian context by Barbosa, Veloso, and Perucheki (Barbosa Filho, et al., 2022). The adaptation includes the consideration of essential home infrastructure for remote work, such as continuous access to electricity, internet connection, and the presence of a computer.

The third chapter of this dissertation is devoted to an analysis of the real estate market in the city of São Paulo. This section provides an overview of the economic and social context of the city, with a particular focus on the zones and districts that were the subject of analysis. A long-term analysis of the impact of remote work on the housing market is conducted, with a view to identifying changes in property demand in different regions of the city and the factors influencing these changes.

Chapter 4 outlines the methodology employed in the data collection and analysis. The web scraping technique is employed to extract data from real estate advertisements on the Viva Real<sup>1</sup> website, while address geocoding is applied to obtain precise geographic coordinates of the properties. The data were subjected to a series of treatments, including the removal of duplicates and the standardization of addresses. This process was undertaken in order to ensure the quality and consistency of the dataset used. The data utilized in this study are accessible on GitHub at the repository

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<sup>1</sup> <https://www.vivareal.com.br/>

<https://github.com/halefmichel/halef-thesis>. The "Regression" folder of this repository contains two notebooks<sup>2</sup> containing the regression results.

In Chapter 5, the regression analysis results are presented. The quality of the adjustments made is evaluated through the discussion of model diagnostics. The search for the optimal model is conducted in detail, with consideration given to different variable transformations in order to optimize the model's explanatory power. The results are subjected to a comprehensive analysis, with particular attention paid to the relationship between remote work potential and rental prices. Additionally, the limitations and constraints encountered in data collection are highlighted.

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<sup>2</sup> Rent: [https://github.com/halefmichel/halef-thesis/blob/main/regression/main/regressions\\_rent.ipynb](https://github.com/halefmichel/halef-thesis/blob/main/regression/main/regressions_rent.ipynb)  
Sell: [https://github.com/halefmichel/halef-thesis/blob/main/regression/main/regressions\\_sell.ipynb](https://github.com/halefmichel/halef-thesis/blob/main/regression/main/regressions_sell.ipynb)

# Chapter 1

## Literature review

### 1.1 Land Rent Theory

#### Introduction

The cost of land rent is strongly influenced by the attractiveness of the location, which is determined by where economic activities, including both residential and commercial activities, are geographically located. When households or businesses show a preference for a certain location, they are willing to pay more for access to that land.

When entities consider relocating<sup>3</sup>, they evaluate important details about the new location's characteristics. This evaluation reflects the value and significance of the land parcel and contributes to its pricing. The geographic location is viewed as an economic asset, and the pricing of such an asset, like a plot of land, acts as a shadow price<sup>4</sup>. This term refers to an implicit cost that encapsulates numerous attributes of the specific region.

In the real estate sector, the emergence of land rent is based on optimization mechanisms resulting from a dynamic equilibrium between the supply and demand of land. This sector is characterized by the rational behavior of individuals and corporate entities who aim to maximize utility and profitability, in line with classical economic theories. The market operates in a competitive paradigm, characterized by the presence of numerous consumers and producers. Their individual actions are insufficient to exert a significant impact on price levels. Consequently, market participants engage in competitive interactions, striving to secure optimal locations that align with their specific preferences and objectives. According to Alonso's (Alonso, 1964) research, central locations in urban areas are more attractive than peripheral ones, leading to a competition for these prime spots. Those with greater financial resources are able to secure these locations, while those with less financial means are forced to settle for peripheral areas. Transportation costs influence the spatial distribution of individuals and entities, affecting their willingness to be situated away from central areas.

Moving from a micro-territorial to a macro-territorial analysis, a clear distinction between rural and urban land emerges. Rural land, similar to a primary commodity,

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<sup>3</sup> Based on the principle of the individual rationality. As Milton Friedman stated, "under a wide range of circumstances individual firms behave as if they were seeking rationally to maximize their expected returns (generally if misleadingly called "profits") and had full knowledge of the data needed to succeed in this attempt" (Friedman, 1953)

<sup>4</sup> Shadow price is an estimated monetary value assigned to something that is not normally priced or sold in the market.

contrasts starkly with urban land, which is characterized by human activities such as the aggregation of economic activities and the development of infrastructure, giving it a unique status. Furthermore, changes to urban landscapes, such as real estate developments or the introduction of new infrastructure projects, are typically associated with high costs, long implementation periods, and extended longevity. These attributes make the urban land supply markedly inelastic and slow to respond to changes. As a result, any positive external shock to urban land demand leads to rapid and significant price increases due to the supply's inability to adjust quickly<sup>5</sup>.

The next topics in Chapter 1.1 Land Rent Theory will discuss different perspectives and conventional wisdom on land rent. The discussion begins with the emergence of land rent and the economic conditions that underlie it. It also examines the contributions of renowned scholars, such as David Ricardo, Von Thünen, and William Alonso, particularly in the field of locational theories. The discussion concludes with an analysis of the Marxist perspective on urban land rent, emphasizing its dualistic nature through the differentiation between differential and absolute rent components.

## **Conditions for the emergence of land rent**

In economics, the concept of rent arises when the supply of a particular good is constrained for some reason, resulting in payments that exceed the cost of production. As articulated by Robert Tollison (1982), rent represents "a return in excess of the resource owner's opportunity cost," essentially denoting the excess returns over the normative returns expected in perfectly competitive markets. From this broad economic perspective, the emergence of rent depends on two fundamental conditions:

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<sup>5</sup> In a standard market where supply can adjust immediately, a positive shock in demand will result in a rapid increase in supply to meet the new demand. This will establish a new equilibrium with higher quantities and prices, but the increase in prices will be less than proportional to the increase in quantities.

1. Scarcity: the availability of the good in question is severely limited, characterized by inelastic supply or a vertical supply curve;
2. Exploitable demand: there is a market demand willing to pay for the commodity at a price above the cost of production.

The two criteria are illustrated by the real estate market. In urban areas, the supply of housing, including houses and apartments, is inherently limited by structural constraints. Despite efforts to quickly adjust housing supply in response to external demand shocks, there is an inevitable lag before these properties become available on the market (condition 1). In addition, within urban areas, there is typically demand willing to pay premium prices for locations that are considered more desirable or prestigious (condition 2). As a result, cities often serve as places where land rent phenomena are observed.

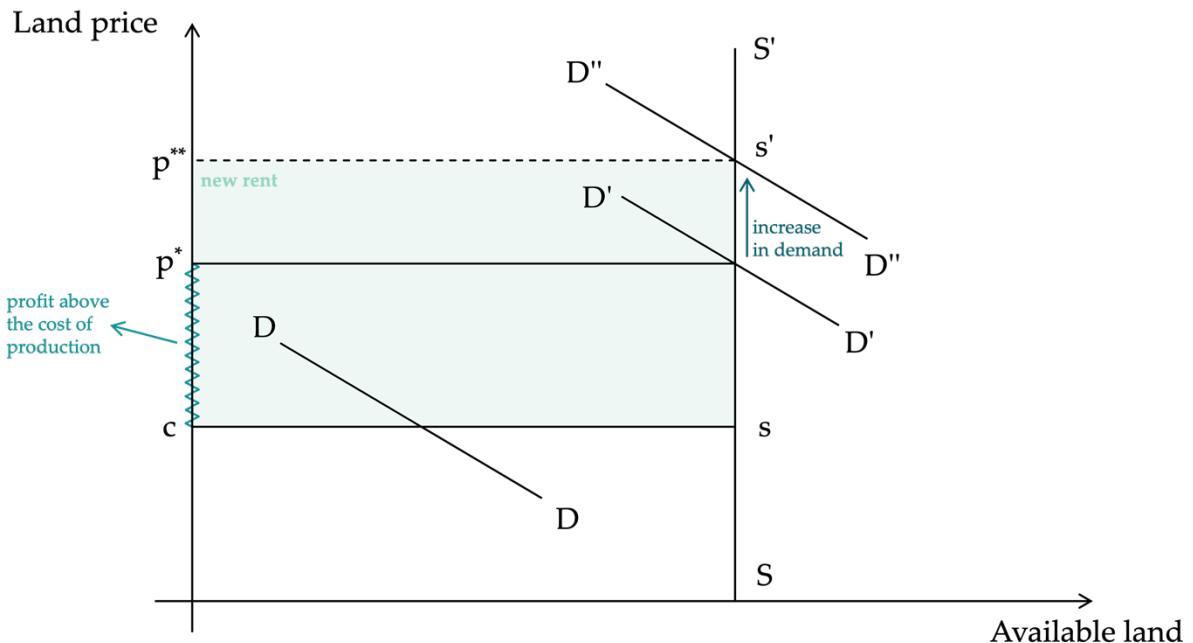
Graph 1 illustrates the short-term interplay between supply and demand in the real estate sector. The horizontal axis represents the amount of land available, while the vertical axis represents land prices. A key observation is the vertical orientation of the supply curve ( $SS'$ ), which indicates that supply remains constant in the short run, regardless of fluctuations in demand (indicative of inelastic<sup>6</sup> supply). This scenario emphasizes a direct correlation between increases in demand and proportional increases in prices. For example, a 10% increase in demand for commercial space would directly translate into a 10% increase in prices. As shown in Graph 1, land rents materialize after a positive exogenous demand shock ( $DD$  to  $D'D'$ ) that raises prices from  $c$  (the cost of production) to  $p^*$ . The difference between  $p^* - c$  represents the excess return, or the profit above the cost of production. A subsequent positive demand shock

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<sup>6</sup> Price elasticity measures how the demand for or supply of a product responds to changes in price. In general, normal goods have a supply that increases with price and a demand that decreases with price. However, short-term real estate behaves differently, exhibiting price inelasticity with a vertical supply curve, indicating no supply response to price changes.

( $D'D'$  to  $D''D''$ ), which raises prices from  $p^* - p^{**}$ , defines the new rent as the area within  $css'p^{**}$ .

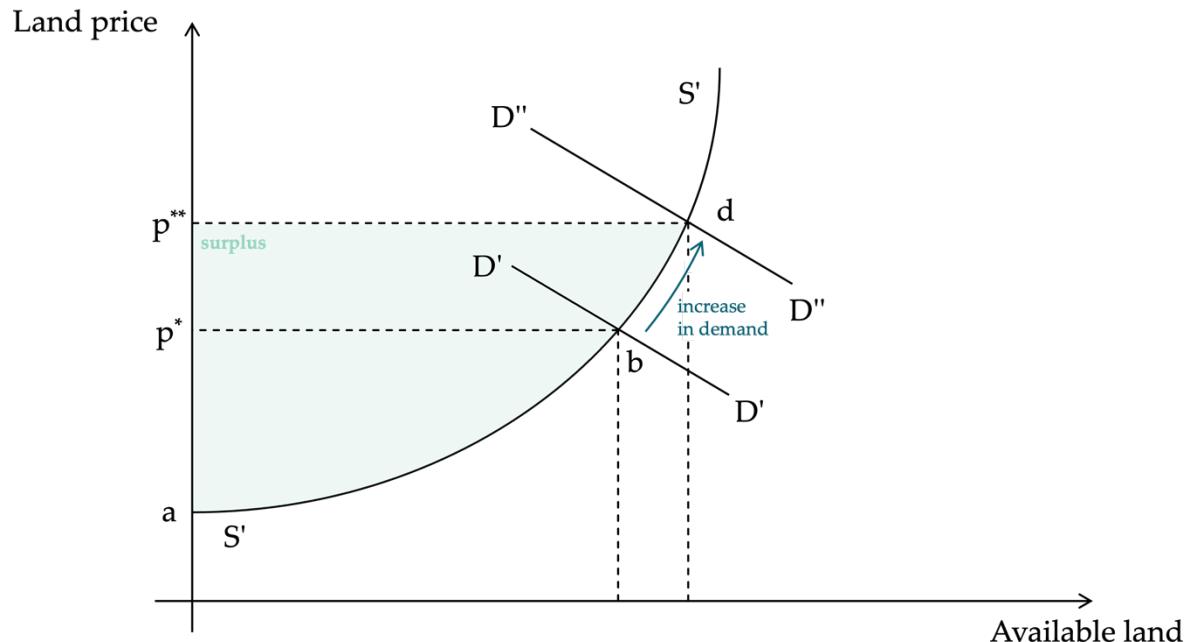
*Graph 1: Short run equilibrium between supply and demand in real estate markets*



In the long run, the supply curve for real estate shifts to a positive slope, consistent with the characteristics of a normal good. This shift occurs because, over time, producers have the opportunity to invest in real estate development, thereby expanding supply to meet increased demand. This adjustment leads to a new equilibrium characterized by moderate prices. Graph 2 illustrates this scenario, mirroring the situation in Graph 1, but with the supply curve ( $SS'$ ) showing elasticity. For example, with a shift in demand to  $D''D''$ , the resulting rent can be illustrated as the area  $adp^{**}a$ , which represents the surplus of producers<sup>7</sup>.

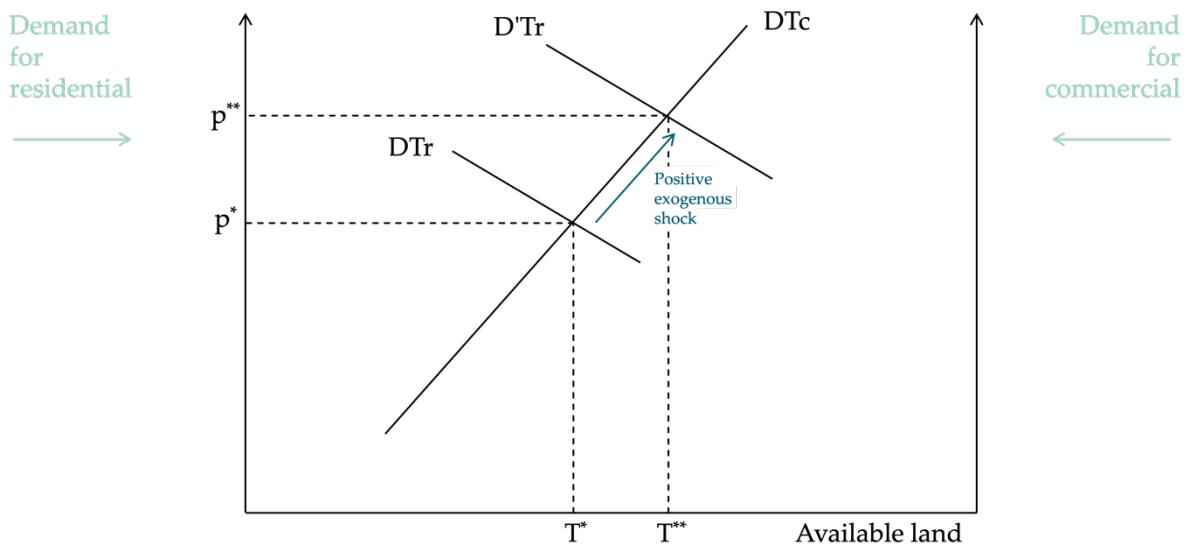
<sup>7</sup> The difference between what a supplier is paid for a good or service and what it costs to provide it. When added to consumer surplus, it provides a measure of the total economic benefit of a sale.

Graph 2: Long run equilibrium between supply and demand in real estate markets



A model can be developed to illustrate the competition between two distinct land uses. Graph 3 shows the total amount of land available in a specific city on the horizontal axis, which remains fixed in the short term but can expand over the long term as the supply adjusts. The vertical axis, featuring two symmetric sides, depicts land prices. The chart displays the demand for residential real estate ( $D^{Tr}$ ) from left to right and the demand for commercial real estate ( $D^{Tc}$ ) from right to left. Both demand curves slope downwards, indicating a negative response to price increases. The point where these competing demands intersect,  $[T^*, p^*]$  in the baseline scenario, is identified as the equilibrium. If there is a sudden increase in demand for residential real estate ( $D'^{Tr}$ ) due to factors such as a rise in population income, a new short-term equilibrium will be established at  $[T^{**}, p^{**}]$ . This will lead to an increase in overall prices ( $p^{**} > p^*$ ) due to the higher market demand. Additionally, the proportion of land allocated for residential purposes will increase as its relative willingness to pay exceeds that of commercial uses. Conversely, a positive shock to the demand for commercial real estate would lead to an overall increase in prices. This could result in commercial use encroaching upon areas previously designated for residential purposes due to a higher willingness to pay.

Graph 3: Competition between two alternative land uses

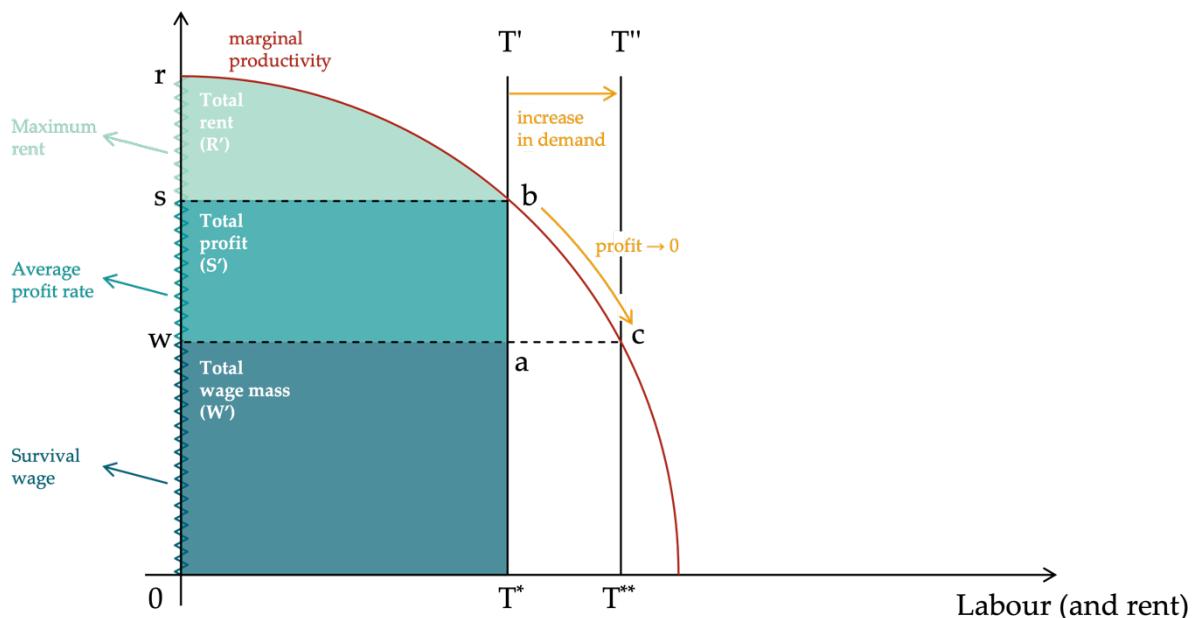


The discussion of insights and models leads to several key conclusions. Firstly, rent only arises when there is limited supply or exploitable demand. Secondly, the real estate market differs from a perfectly competitive market and instead resembles a scenario of monopolistic competition. This does not imply the presence of a single supplier, but rather emphasizes that supply is significantly constrained and structurally limited in the short term. Thirdly, this analysis applies primarily to urban contexts where high demand competes for prestigious land segments, driving up prices for prime locations due to the scarcity of supply. This scenario is not mirrored in rural areas. Fourthly, an increase in land demand leads to a rise in both price and rent in the short term. Over time, as supply adjusts, the long-term rent aligns with the producer surplus. Lastly, urban areas generate positive rent due to their value to consumers, which is underscored by their unique appeal and irreplaceable nature in the market.

## 1.2 Distribution theory: Ricardo's model

David Ricardo (1772-1823) was a British political economist from the classical school who made a significant contribution to the macroeconomic understanding of land rent in (Ricardo, 1821). He developed a concise yet impactful model that elucidates the distribution of resources (or incomes) within an agricultural setting, known as Ricardo's Model. Graph 4 depicts a model that focuses on the interaction among three principal agents: capital, labor, and land. The model illustrates the competitive dynamics and resource allocation in an agricultural economy.

*Graph 4: David Ricardo's distribution of resources model*



The downward sloping curve of the model represents the decreasing marginal returns to land. The x-axis arranges land from most to least productive, left to right. In the initial scenario, the total demand for land ( $T^*T'$ ) intersects with the land's marginal productivity at point b, establishing an economic equilibrium. The area  $0T^*br$  denotes the aggregate income generated from utilizing all available land. The aggregate income is divided into three components, which correspond to the three main agents:  $W'$ ,  $S'$ , and  $R'$ .  $W'$  represents the total wages earned by workers, based on a minimum wage level  $w$ , which is presumed to be constant and sufficient for their survival.  $S'$

represents the profits accrued by producers (or employers) from land use, and  $R'$  is the rent paid to landowners.

The model provides a key insight that land is compensated according to its productivity. The land at point  $T^*$  is the least productive and yields no rent, while the most fertile land on the far left of the x-axis commands the highest rent ( $r-s$ ). The concept of land rent is fundamentally based on marginal and differential principles, derived from the decreasing marginal productivity of land. The profit, represented by the area "swab", is what remains after the payment of wages to workers and rent to landowners. This highlights the distribution of income among the different agents based on land productivity.

When there is an increase in demand for land, several outcomes occur. Initially, at point  $c$ , the marginal productivity curve intersects the fixed wage level. Beyond this point, it becomes unfeasible to incorporate additional land into the production system, as its output would not be sufficient to cover the minimal subsistence wages for labor. If land demand increases from  $T^*$  to  $T^{**}$ , the total compensation for land, illustrated by the area "wcr", exceeds the previous level represented by "sbr". The reason for this is that the more fertile land is more productive than the less fertile land, resulting in higher compensation. At this point, the increase in land compensation completely replaces the portion of production that was previously allocated for capital remuneration, resulting in zero profits. Moreover, although individual workers maintain their earnings, the collective wage bill increases from  $0T^*aw$  to  $0T^{**}cw$ , indicating an overall rise in the proportion of production allocated to wages.

Ricardo's model gives an idea of the distribution of land payments according to productivity. The model emphasizes that the more productive a piece of land is, the higher its remuneration, underscoring the differential nature of land rent. However, one notable limitation of Ricardo's model is its assumption that the least productive land receives no rent, implying that such land would be utilized without any

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compensation. This overlooks the reality that, in practice, all land, regardless of its productivity, commands some form of rent. To address this discrepancy, section 1.4 Urban rent: Differential vs. Absolute Rent will introduce the concept of absolute rent, providing a more comprehensive understanding of land rent that reflects real-world dynamics.

### **1.3 Location theories: von Thünen and Alonso models**

Location theories “seeks to explain the distribution of activities in space, the aim being to identify the factors that influence the location of individual activities, the allocation of different portions of territory among different types of production, the dividing of a spatial market among producers, and the functional distribution of activities in space” (Capello, 2006). This section introduces two models that optimize location choices within agricultural and urban settings: von Thünen's model from 1826 and Alonso's model from 1964. While many scholars, such as Weber (1909), Hotelling (1929), Lösch (1940), and Christaller (1933), have contributed to this field, this dissertation will not explore their theories and models.

#### **The location of agricultural activities: von Thünen model**

Johann Heinrich von Thünen developed the initial model for location theory based on the concept of an unbroken production space and a single punctiform final market. The model relies on a set of standard assumptions that have been used in later theoretical developments in the field. Von Thünen's model assumes:

- a) Equally fertile land and uniform transport infrastructure (isotropic space);
- b) A single market center (medieval town) for all trades;
- c) Unlimited demand, highlighting a supply-driven model equilibrium;

- d) Even spatial distribution of production factors, negating land allocation based on production factor variability;
- e) Fixed production functions with constant returns for each agricultural good, setting uniform output and production costs;
- f) Perfect market competition, with farmers accepting fixed goods prices;
- g) Constant per-unit transport costs, varying only by distance and production volume, with potential differences by crop type.

In this case, it is considered that the producer's willingness to pay a unit rent may be represented as follows:

$$r(d) = (p_x - c_x - \tau \cdot d) \cdot x \quad (1.1)$$

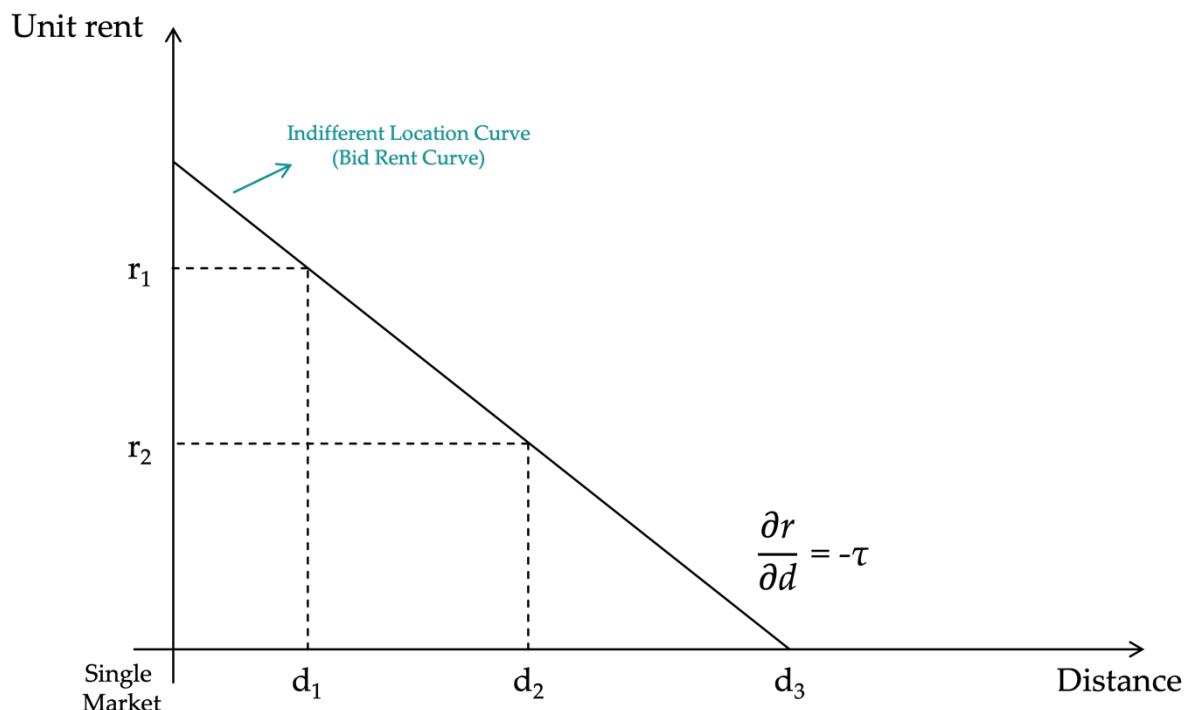
Where:

- $r$  is the rent per square meter paid for the use of land;
- $p_x$  is the unit price that the good faces on the market;
- $c_x$  is the unit cost of producing one unit of the good  $x$ , with profit included;
- $\tau$  is the unit transportation cost per unit of good;
- $d$  is the distance traveled from the farm to the village center;
- $x$  is quantity of good produced in one square meter of land (constant).

Graph 5 shows the bid rent curve, also known as the indifference location curve, as described by Equation 1.1. The curve illustrates the rent amounts that farmers are willing to pay for land at different distances from the village center. It indicates that a farmer would be equally satisfied paying rent  $r_1$  at distance  $d_1$  as they would be paying rent  $r_2$  at distance  $d_2$ , since their profit would not be affected in either case. Any increase in transportation costs due to greater distance is exactly balanced by a corresponding decrease in land rent, resulting in a stable profit. The given condition remains consistent throughout the entire curve. The gradient of the bid rent curve represents the rate of change in rent with respect to distance and is equal to the unit transportation

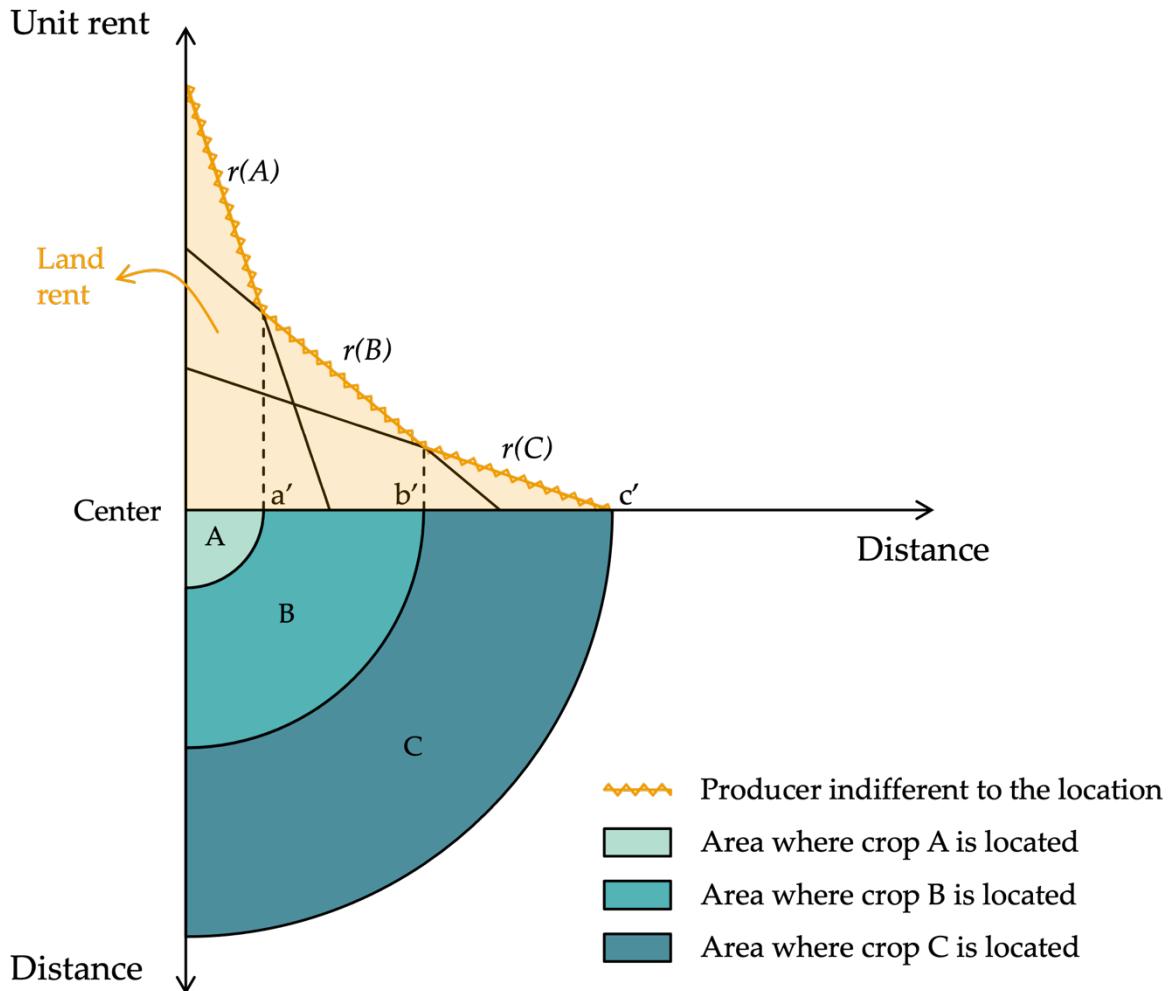
cost, symbolized by  $\tau$ . The curve also indicates a point,  $d_3$ , at which the farmer's willingness to pay rent drops to zero because the total of production and transportation costs equals the market price of the product. Beyond  $d_3$ , cultivating the land is no longer economically viable.

*Graph 5: Farmer bid rent curve in von Thünen's model*



The next step in this analysis is to include additional categories of farmers. Graph 5 displays the bid rent curve for a group of farmers who grow the same crop. However, other categories of farmers may have bid rent curves with different slopes, indicating different unit transportation costs due to varying perishability rates of their products. Goods that are more perishable generally have higher transportation costs compared to less perishable goods. Graph 6 shows three groups of producers, labeled A, B, and C, each with their own bid rent curves.

Graph 6: Bid rent curves and location of producers in von Thünen's model



The unit transportation costs of goods are different, with good A being the most expensive to transport, followed by good B, and good C being the least expensive ( $\tau_A > \tau_B > \tau_C$ ). Along their respective bid rent curves  $r(A)$ ,  $r(B)$ , and  $r(C)$ , producers of goods A, B, and C are indifferent to their location. However, land can only be used by one producer at a time. This leads to competition among producer groups, with the highest bidder securing the land.

In Graph 6, the land up to point  $a'$  - where curves  $r(A)$  and  $r(B)$  intersect - is occupied by group A, as they offer the highest rent for this proximity to the village center. Between  $a'$  and  $b'$ , where  $r(B)$  and  $r(C)$  intersect, group B acquires the land. Beyond point  $b'$  to point  $c'$ , where cultivation is no longer profitable, the land is used to produce

good C. The lower part of the figure visually represents this allocation of land as areas A, B, and C.

This model, based on spatial general equilibrium, explains the concentration of economic activities in space. It follows von Thünen's concept, where rent is an income transfer from the producer to the landowner. The resulting distribution of land use is optimal, maximizing land value for the landowner and ensuring socially optimal outcomes by minimizing transportation costs, leading to a situation where all parties are better off than they would be under any other land allocation.

It's worth noting that while von Thünen's and Ricardo's models are different, they have some similarities. Both models consider prices to be exogenous, set by perfect competition without the influence of individual producers. They analyze the effects of marginal changes in land attributes-fertility for Ricardo, location for von Thünen. In both cases, rent is the residual - the amount remaining after production and transportation costs are subtracted from the price. Furthermore, both models illustrate how landowners reap the surplus generated by land fertility (in Ricardo's case) or location (in von Thünen's case).

## The urban location of firms: the Alonso model

Alonso's urban model adapts von Thünen's agricultural framework to cities under these simplified conditions:

- a) A single city center attracts productive activities and acts as a prime location;
- b) The layout of the city is uniform, allowing distance to the center to be the sole determinant of travel time, without regard to congestion or barriers;
- c) A fixed unit transportation cost ( $\tau$ ) implies that total transportation costs vary directly with distance;

- d) Homogeneous urban productivity ensures that location decisions of profit-maximizing firms depend only on transportation costs;
- e) Market-determined prices prevail in a perfectly competitive economic environment.

The assumption in this model is that the unit rent that firms are willing to pay can be expressed by the Equation 1.2:

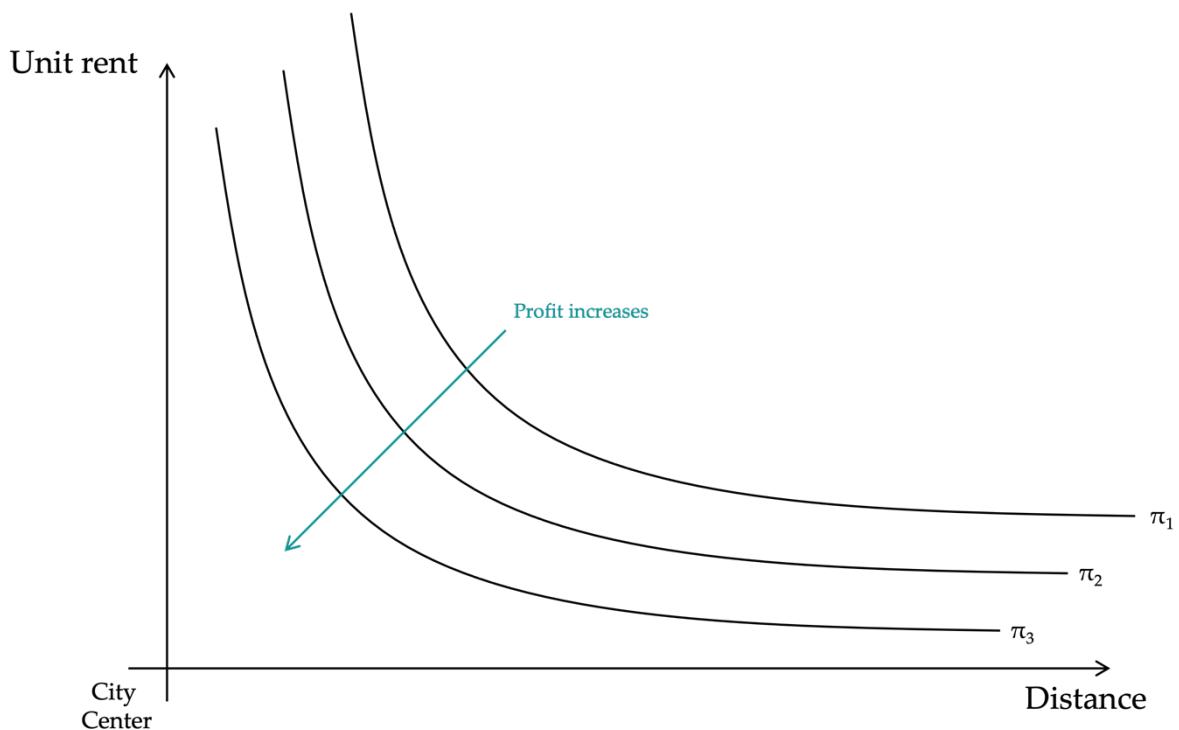
$$r(d) = (p_x - \pi - c(d)) \cdot x(d) \quad (1.2)$$

Where:

- $r$  is the rent per square meter paid for the use of urban land;
- $p_x$  is the unit price that the good/services sold by the firm faces on the market;
- $\pi$  is level of profit per unit of good;
- $c$  is the production cost per unit of good, including the transportation cost;
- $d$  is the distance to the city center;
- $x$  is quantity of good/service produced in one square meter of land.

The main difference between Equation 1.2 and the bid rent curve in von Thünen's model (Equation 1.1) is the inclusion of the quantity produced ( $x$ ) as a variable that depends on the distance from the city center. Occupying prestigious urban areas provides better market access, which leads firms to scale up production in order to maximize profits. As in the agricultural scenario, firms located closer to the center face lower transportation costs and can therefore afford to pay higher rents for land while maintaining their profit levels. This results in a negatively sloped curve, as shown in the accompanying Graph 7.

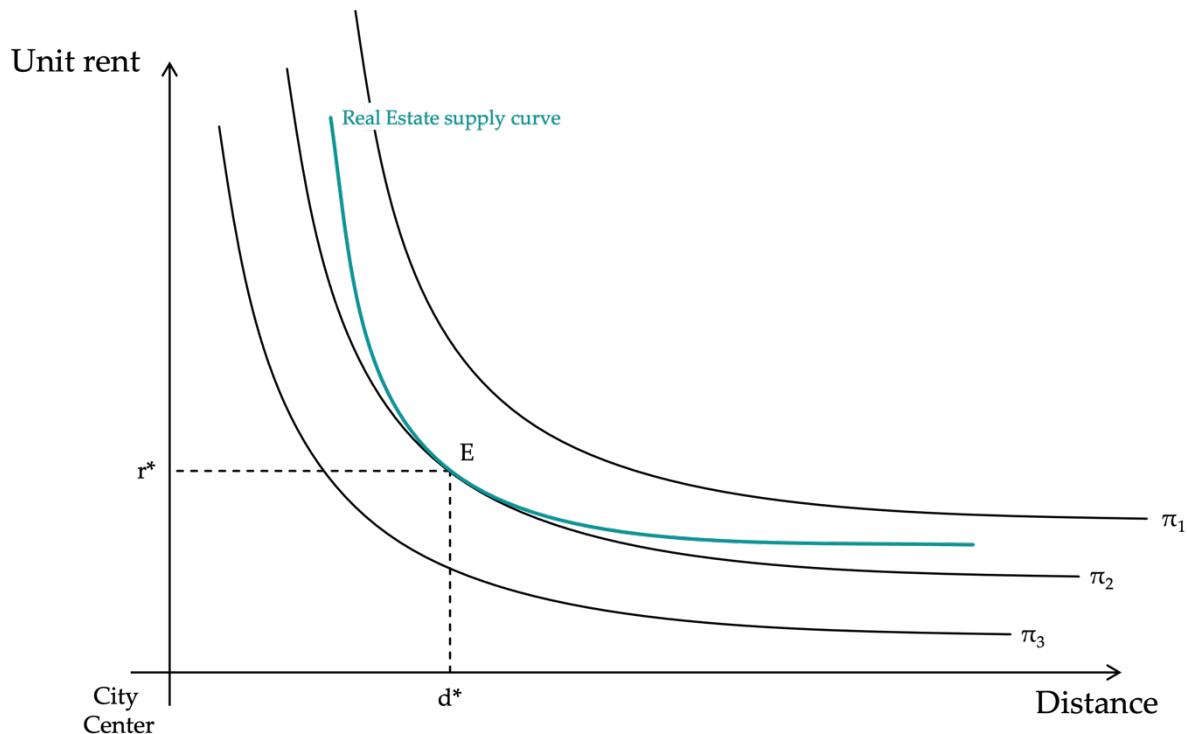
Graph 7: Bid rent curves for different levels of profit in Alonso's model



Graph 7 shows three different bid rent curves, representing only a subset of the infinite potential scenarios, each corresponding to different profit levels, denoted by  $\pi_1$ ,  $\pi_2$ , and  $\pi_3$ . An examination of these curves reveals an ascending gradation of profits ( $\pi_1 < \pi_2 < \pi_3$ ), as evidenced by the decreasing unit rents for a fixed spatial location. Proximity of a bid rent curve to the origin indicates an elevated profit level. Conversely, if a firm chooses to decrease its profit margins while maintaining its spatial position, it has the ability to offer escalated rents. Consistent with previous observations, a firm's location preference along a given bid rent curve-proximal or distal to the center-does not affect its profit, which remains invariant.

However, the graph in question lacks a crucial component: the prevailing supply curve, which is intrinsic to the real estate market. A firm's prerogative to choose the higher profit level of  $\pi_3$  is not determined solely by its desirability; it must also take into account the availability of land at a corresponding price in the market. Graph 8 integrates this crucial aspect by introducing the real estate supply curve that exists in the market.

Graph 8: Location equilibrium for one firm in Alonso's model



Firms tend to choose configurations that result in the highest possible profit, known as the optimal choice, based on different location and profit-level options. This choice is represented by point E, which is the point where a hypothetical bid rent curve intersects with the supply curve. Point E is characterized by a specific distance ( $d^*$ ), a unit rent ( $r^*$ ), and is aligned with the bid rent curve  $\pi_2$ . Although intersections of the supply curve with alternate bid rent curves positioned above the tangent ( $\pi_2$ ) may seem like feasible alternatives, choosing such options would be irrational as they would miss opportunities to enhance profit. Additionally, bid rent curves positioned beneath the tangent curve do not present feasible solutions because they do not intersect with the supply curve.

Examining the eventual distribution of urban land among distinct firms is facilitated by expanding upon the model. These firms are differentiated by the slopes of their bid rent curves, with steeper slopes indicating a stronger inclination towards locations

proximal to the city center. To gain a better understanding of this phenomenon, it is important to differentiate Equation 1.2 with respect to distance. This will shed light on how distance influences firms' strategic decisions when allocating urban land.

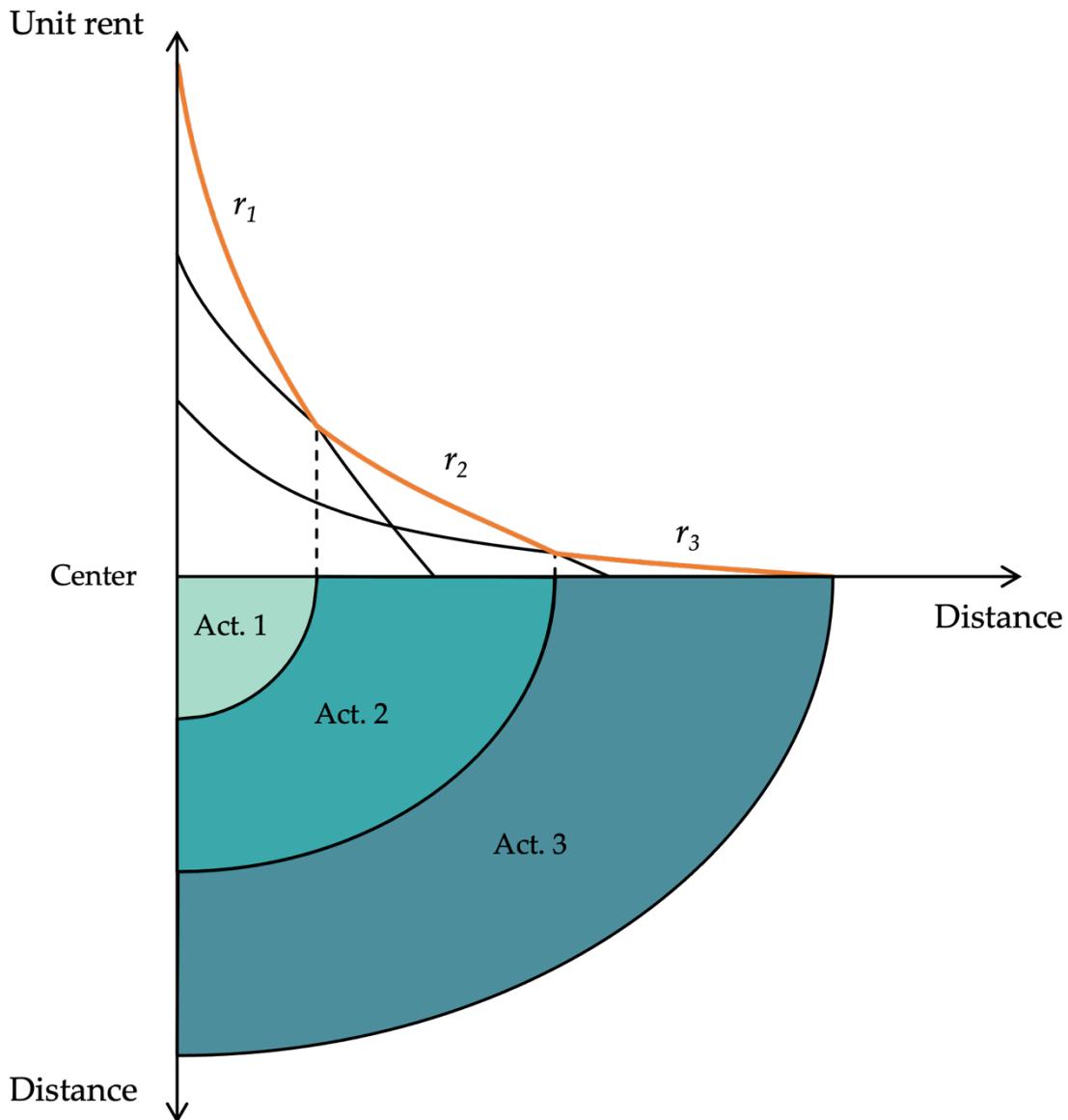
$$\frac{\partial r(d)}{\partial d} = (p_x - \pi - c(d)) \cdot \frac{\partial x(d)}{\partial d} - \frac{\partial c(d)}{\partial d} x(d) \quad (1.3)$$

Equation 1.3 contains four main components, each of which has different implications. These components include:

- $(p_x - \pi - c(d))$ : This component, referred to as "extra profit," reflects the profit margin a firm can earn above and beyond the standard profit level. For example, fashion boutiques may have significantly high extra profits;
- $\frac{\partial x(d)}{\partial d}$ : This indicates the effect of proximity to the city center on the sales volume of goods. The effect of this variable is much more pronounced for a fashion store than for a baker;
- $\frac{\partial c(d)}{\partial d}$ : This represents the impact of distance from the city center on production costs;
- $x(d)$ : This is the quantity of goods or services sold per unit area. For example, travel agencies can conduct sales in a much smaller space, while retail stores require a larger area to facilitate their sales.

The interaction of these factors determines the slope of the bid rent curves for different business sectors, thereby influencing their likelihood of locating near the city center. By considering three different commercial enterprises, each associated with their unique bid rent curves  $r_1$ ,  $r_2$  and  $r_3$  it is possible to construct Graph 9. This graph illustrates the different spatial preferences of the business segments based on the above components.

*Graph 9: Urban location of three different commercial activities in Alonso's model*



Like von Thünen's model, the urban landscape is characterized by the competitive allocation of land among three distinct activities. This competition is governed by the optimization principle of land rent. The spatial distribution of activities is such that each activity opts for the land segment where it can outbid the others in terms of rent offered. Activity 1 has the highest inclination to position itself near the urban center, offering the highest rents. Therefore, it will occupy the land extending from the center to point  $d_1$ . The land between  $d_1$  and  $d_2$  is allocated to Activity 2, while the segment from  $d_2$  to  $d_3$  is utilized by Activity 3. This distribution ensures an optimal arrangement

for both landowners and firms, emerging from the principle of marginal changes in accessibility across the available land.

This conceptual framework applies equally to the residential real estate market. It concludes that individuals with a stronger preference for proximity to the city center, typically those with higher incomes, are willing to pay premium rents for such locations and are therefore allocated these spaces. Conversely, those with less inclination, generally lower-income groups, settle in more peripheral zones. However, some critiques have been raised against Alonso's model due to its inability to account for the variance in land rents between different cities, even for equally distanced locations from the city center. Additionally, the model suggests that rent converges to the value of land in agricultural use at the city's outermost boundary, which some find incongruous. Similar to Ricardo's model, the concept of absolute rent is not present but is discussed in the following section, indicating a progression in the theoretical analysis.

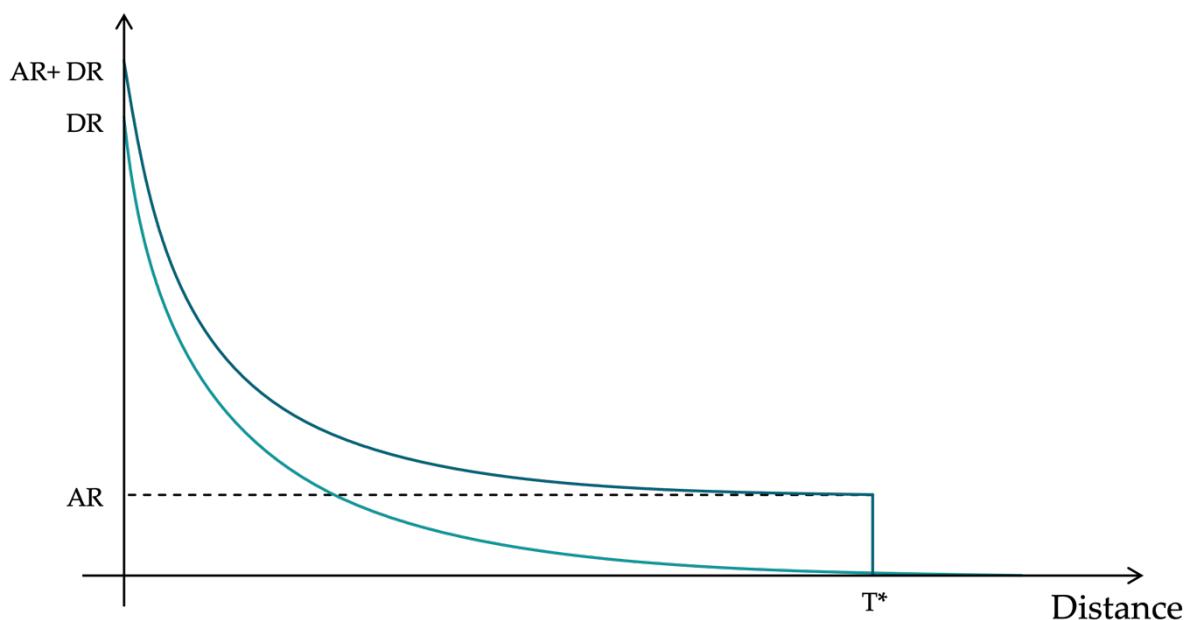
## 1.4 Urban rent: Differential vs. Absolute Rent

As explained by Ricardo's Model, the concept of land rent is inherently differential, arising from disparities in land fertility, or from positional variance as seen in the models developed by von Thünen and Alonso. To answer this question, it is necessary to examine several factors. However, it is important to consider whether this differential concept can solely account for the actual valuation of land rent within a specific urban locale. Therefore, a negative response is suggested by the evidence for several reasons:

- Alonso's model assumes that the rent for a square meter of land located two kilometers from the center of city A would be identical to the rent for a square meter located the same distance from the center of city B, regardless of the different characteristics that cities A and B may have. However, this assumption may not always be accurate in practice;
- Alonso's framework suggests that the value of urban land at the interface between urban and agricultural zones is equivalent to that of adjacent agricultural land. However, empirical observations do not support this assertion;
- Ricardo's theory implies that the rent for the least fertile land in demand is zero, suggesting that such land can be acquired without cost. Nevertheless, in reality, no land is available for free. Furthermore, Ricardo's model would assign a null rent value to all parcels of land if they possessed uniform fertility, which contradicts practical realities.

Therefore, the concept of absolute rent is essential in fully elucidating the genuine valuation of land rent. The Graph 10 will further explain and illustrate this missing element.

*Graph 10: Differential vs. Absolute rent*



Absolute rent differs from the concept of rent determined by variations in land fertility or proximity to the city center (micro-territorial value). Instead, it focuses on a broader characteristic: the land's association with a specific city (macro-territorial value). The distinct agglomeration economies and resulting benefits for both individuals and businesses that choose to locate within different cities directly influence land prices. Notably, in a single urban context, the absolute rent remains consistent regardless of the distance from the city center. Graph 10 represents differential rent with the curve DR, while the curve AR+DR includes the addition of absolute rent.

To recognize the influence of an agricultural element on the final rent valuation, which remains the same in all locations, the following formula can be articulated:

$$r_i = r_{ag} + r_{diff} + r_{abs_i} \quad (1.4)$$

Where:

- $r_i$  is the final land rent of city  $i$ ;
- $r_{ag}$  is the agricultural rent;
- $r_{diff}$  is the differential rent;
- $r_{abs_i}$  is the absolute rent of city  $i$ .

Equation 1.4 effectively addresses the limitations inherent in the Ricardo and Alonso models by facilitating:

- (i) the establishment of variable land rent values for similarly accessible locations across diverse cities, influenced by differing absolute rent values;
- (ii) differentiation between urban rent values at the city's edge and agricultural rent, thereby negating their previously assumed equality;
- (iii) ensure that rent is attributed to all land required for use, even if it is not very fertile.

The concept of land rent, which includes both differential and absolute elements, was introduced by philosopher Karl Marx about three decades after the initial propositions by Ricardo and von Thünen. Marx's critique not only acknowledges the differential aspect of rent but also illuminates, in response to the deficiencies of classical models, the macro-territorial dimension of land rent known as absolute rent. This advanced classification emphasizes the inherent demand for the city rather than the comparative advantage of specific land segments.

# Chapter 2

## Methodology

### 2.1 Hedonic Price

#### Introduction

The Hedonic Pricing Methodology is a useful tool in public economics for evaluating the externalities generated by significant urban developments at a societal level. This methodology aims to quantify the value of non-market attributes of goods that significantly influence their market price, despite their absence in conventional markets. Multidimensional goods, which are characterized by complex attributes that define their market value, serve as prime examples. These goods can be exhaustively

defined through a vector of objectively measured characteristics, as posited by (Rosen, 1974).

The hedonic pricing approach is a micro-econometric methodology that assumes the market price, or equilibrium price, of a composite good reflects the cumulative value contribution of its defining characteristics. According to (Rosen, 1974), hedonic prices, which are the implicit valuations of attributes, arise from the observed prices of differentiated products and the specific attribute quantities they embody. Using a rigorous econometric framework, this methodology extracts individual component prices from a statistically significant sample of composite goods.

It is important to note that the attributes of multidimensional goods include both tangible and intangible aspects. Housing exemplifies a good where the final price reflects not only physical dimensions such as size and amenities, but also intangible factors such as location, environmental quality, and accessibility to urban amenities. The disparity in prices for identical housing units, based solely on their situational context, underscores the market's valuation of these non-physical attributes. The Hedonic Pricing Methodology extends its usefulness to capturing the monetary value of intangible characteristics.

By utilizing an array of objective attributes, it is possible to deduce the final prices of houses with specific characteristics. Additionally, adjusting the quantities of these attributes allows for the generation and analysis of various hypothetical scenarios within the real estate market. According to (Watkins, 1999), the regression of physical and locational traits of properties against their sale prices enables appraisers to determine the value of specific property features. This allows for the creation of value estimates for properties with known characteristics.

Hedonic price analysis can be used for various purposes. The recent surge in the availability of real estate transaction databases has led to an increase in their usage in literature for appraising land rents. This method is particularly advantageous for

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valuing individual characteristics of houses, especially those that are non-structural. While the construction costs of homes can be used to appraise their structural attributes to a certain extent, non-physical characteristics such as externalities - both beneficial (e.g. proximity to commercial zones) and detrimental (e.g. air pollution) - can be effectively valued through the hedonic pricing approach.

This methodology was chosen to evaluate the societal impacts of the shift towards remote work and its influence on housing preferences. This trend could significantly affect real estate prices. As remote work becomes more prevalent, it fundamentally alters the criteria by which individuals select their residences. This could potentially prioritize space and comfort over proximity to urban centers. The hedonic pricing method quantifies the value of non-traditional house characteristics and externalities. This allows for an ex-ante analysis to forecast the real estate market's response in various regions. Property valuations mirror the adjustment in housing preferences, offering a tangible measure of the social benefits attributed to the widespread adoption of remote work. It is important to note that this approach is particularly relevant in urban settings where the real estate market dynamics can capture the nuanced shifts in housing demand driven by remote work. This scenario is less applicable in non-urban environments where such market-based evaluations are less feasible.

## Rosen's approach

Sherwin Rosen (1974) elucidated the concept of competitive equilibrium within the market for multidimensional goods, raising the question of whether hedonic prices are influenced by demand, supply, or an amalgamation of both. Rosen posited that a comprehensive hedonic price analysis necessitates considering both supply and demand factors. His primary objective was "to demonstrate a mechanism generating the data observed in a competitive context and to elucidate the significance and interpretation of the implicit prices derived from estimates" (Rosen, 1974).

Rosen initiated his analysis by conceptualizing a multidimensional space where any point can be defined by a vector of coordinates  $z = (z_1, z_2, \dots, z_n)$ , with  $z_i$  representing the quantity of the  $i^{th}$  characteristic in the good, and  $n$  signifying the total count of objectively measured characteristics. He articulated that products could be exhaustively described by the values of  $z$ , presenting a diverse array of potential combinations. Transactions in this framework occur via "tied sales," allowing consumers to select a bundle of characteristics from the market offerings. Rosen further introduced an implicit price function, operational at every point within this multidimensional space, which influences the locational decisions of both consumers and producers.

$$p(z) = (z_1, z_2, \dots, z_n) \quad (2.1)$$

Equation 2.1 shows that the price  $p$  of a composite good is a function of the quantities of its defining attributes  $z_i$ , assuming competitive market conditions. In such a market, individual participants do not influence the overall dynamics of the market, and prices are taken as given for their decision-making processes. Both buyers and sellers behave to maximize their respective utility or profit, with prices resulting from the interplay between consumer preferences and production costs. Market equilibrium is reached at the point where the quantity of goods demanded by consumers equals the quantity supplied by producers.

Rosen further posits that the market features an abundance of differentiated product combinations available to consumers, facilitating a seamless selection process among the various attribute bundles. This abundance ensures that consumers are constantly making choices, even though their perceptions of the available options are consistent, and their consumption preferences may vary. In this context, the identity of sellers becomes irrelevant, as each unique combination of attributes is associated with a singular price point. Consequently, when identical packages are offered by different sellers at different prices, consumers will invariably choose the less expensive option.

## The Consumption Decision

Suppose consumers purchase only a single unit of a bundle of products characterized by a particular value of  $(z)$ . In this context, the utility function can be expressed as  $U(x, z_1, z_2, \dots, z_n)$ , which is strictly concave, with  $(x)$  representing the quantity of all other goods consumed. By normalizing the price of  $(x)$  to 1 and expressing income  $(y)$  in units of  $(x)$  plus the price of the bundle  $(p(z))$ , such that  $(y = x + p(z))$ , consumers seek to maximize their utility. This maximization is done by choosing  $(x)$  and the attributes  $(z_1, \dots, z_n)$  that satisfy the budget constraint, guided by the resulting first-order condition:

$$\frac{\partial p(z)}{\partial z_i} = p_i = \frac{U_{z_i}}{U_x}; \quad i = 1, \dots, n \quad (2.2)$$

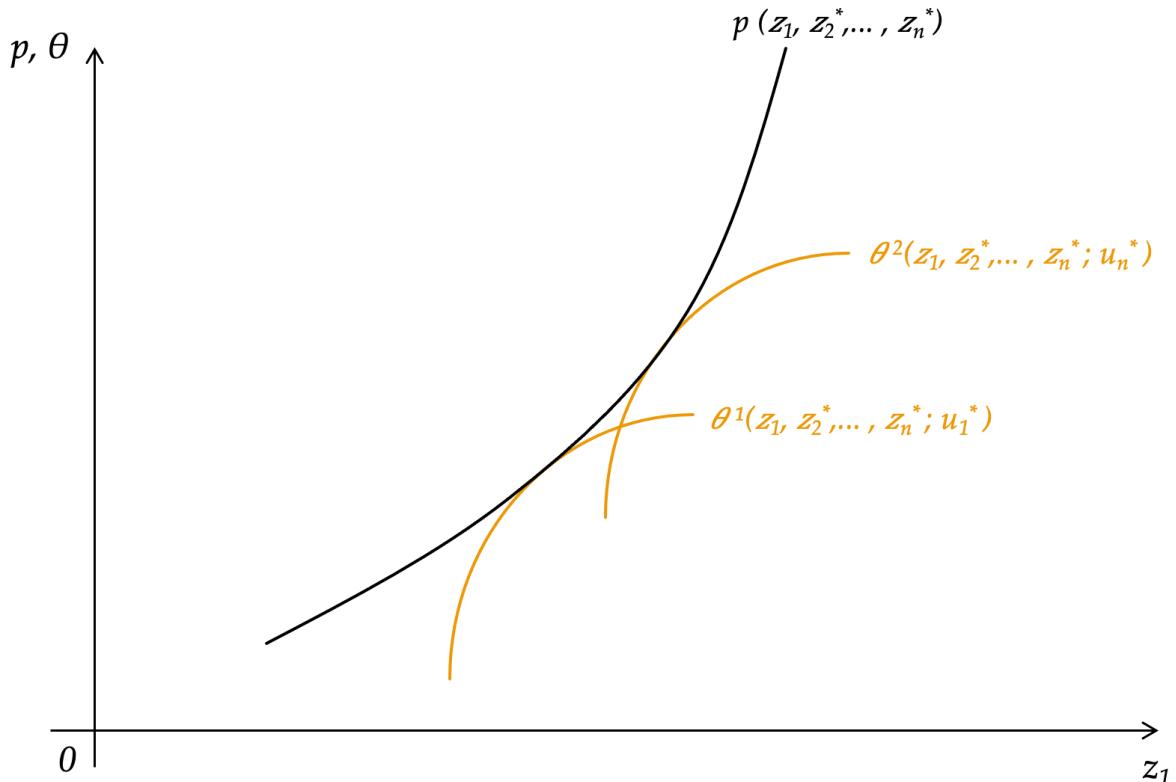
Note that  $p_i$ , the first derivative of  $p$  with respect to  $z_i$  is the hedonic price of the determinant characteristic  $i$ . Let's define the consumer bid function  $\theta(z_1, \dots, z_n; u, y)$  according to:

$$U(y - \theta, z_1, \dots, z_n) = n \quad (2.3)$$

Rosen (Rosen, 1974) describes the consumer's expenditure for varying attribute values  $(z_1, \dots, z_n)$  at a fixed level of utility and income as  $\theta(z; u, y)$ . This expenditure function delineates a set of indifference surfaces that correlate the attributes  $z_i$  with the concept of "money" (i.e., the equivalent value in  $x$  that is foregone). This approach has been widely used in the field of urban economics. Graph 11 visually illustrates a dimension of consumer equilibrium where utility peaks at  $\theta(z^*, u^*, y) = p(z^*)$  and  $\theta_{zi}(z^*, u^*, y) = p_i(z^*)$ , where  $z^*$  and  $u^*$  represent the optimal levels of attributes and utility, respectively. In the scenario illustrated, equilibrium is reached at the point where the consumer's supply function  $\theta(z^*, u^*, y)$  intersects tangentially with the

market price  $p(z^*)$ . The graph illustrates two different consumers,  $\theta_1$  and  $\theta_2$ , where the latter shows a preference for a bundle containing a higher quantity of  $z_1$  than the former.

*Graph 11: One dimension consumer equilibrium*



## The Production Decision

Firms determine their locations in a manner like consumer decision making, but with a focus on profit maximization rather than utility enhancement. The quantity of units produced by a firm, each offering a bundle of characteristics  $z$ , is represented by  $M(z)$ . (Rosen, 1974) (pp. 41) posits a model of non-joint production in which each production unit within a firm focuses on a single product design with no cost spillovers from one plant to another. Consequently, a "firm" is a conglomerate of atomistic production units, each operating independently.

The aggregate cost of production for a bundle  $z$  within a firm is denoted by  $C(M, z; \beta)$ , where  $\beta$  embodies the variables relevant to cost minimization. The cost function  $C$  is characterized by convexity, with  $C(0, z) = 0$  and both  $C_M$  and  $C_{zi} > 0$ , indicating that the marginal cost of producing an additional unit of  $z$  is positive and increasing in production. Furthermore, the production of each characteristic  $z_i$  within the good incurs positive and increasing marginal costs. The goal of each firm producing  $z$  is to maximize its profit by making optimal choices of  $M$  and  $z$ . The profit is calculated as follows the Equation 2.4:

$$\pi = M \cdot p(z) - C(M, z_1, \dots, z_n) \quad (2.4)$$

Note that  $p(z)$  and  $M$  are independent, as the firms operate in a competitive market and assume a price-taking behavior. The optimal choices for  $M$  and  $z$  are determined based on the following expressions:

$$p_i(z) = \frac{C_{z_i}(M, z_1, \dots, z_n)}{M}, \quad i = 1, \dots, n \quad (2.5)$$

$$p(z) = C_M(M, z_1, \dots, z_n) \quad (2.6)$$

The point at which profits are maximized is characterized by the satisfaction of two specific conditions: first, the marginal revenue from the additional attributes must equal their marginal cost of production per unit sold; second, the revenue from producing an additional unit of good  $z$  must equal its marginal cost of production. Analogous to the demand-side supply function  $\theta$ , the supply function  $\phi(z_1, \dots, z_n; \pi, \beta)$  can be defined. This function represents the unit prices (per bundle of characteristics  $z_i$ ) that a firm is willing to accept for different models under the condition of constant profit, assuming that the quantities produced of each model are optimally chosen. A family of production indifference surfaces is then defined by  $\phi$ . To determine  $\phi(z_1, \dots, z_n; \pi, \beta)$ , one can eliminate the variable  $M$  from the relevant equations and solve for  $\phi$  in terms of  $z$ ,  $\pi$ , and  $\beta$ .

$$\pi = M \cdot \phi - C(M, z_1, \dots, z_n) \quad (2.7)$$

$$\phi = C_M(M, z_1, \dots, z_n) \quad (2.8)$$

Upon differentiating Equations 2.7 and 2.8, it is derived that  $\phi_{z_i} = \frac{C_{z_i}}{M} > 0$  and  $\phi_\pi = \frac{1}{M} > 0$ .

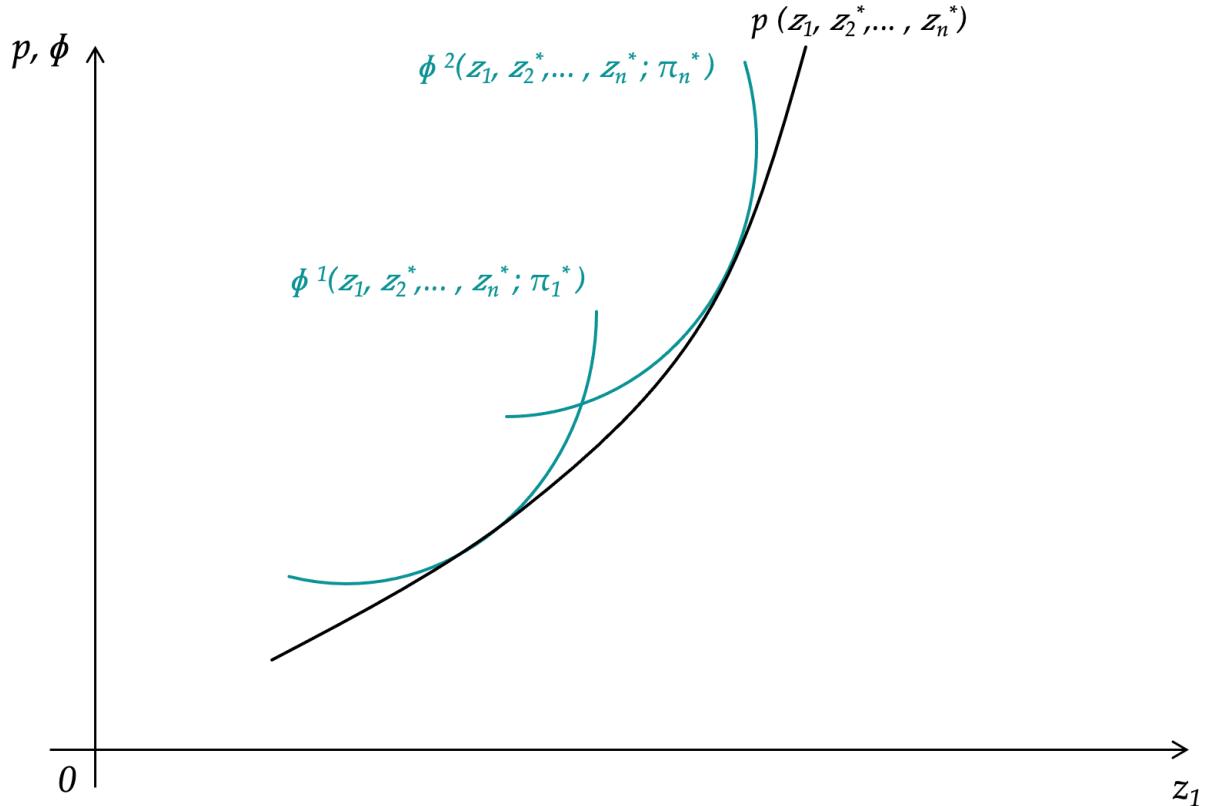
The firm will accomplish its objective of maximizing profits when the offered price for model  $z$ , subject to the constraint  $p = \phi$ , is maximized. Under these circumstances, the following two conditions are verified:

$$p_i(z^*) = \phi_{z_i}(z_1^*, \dots, z_n^*; \pi^*, \beta) \quad (2.9)$$

$$p(z^*) = \phi(z_1^*, \dots, z_n^*; \pi^*, \beta) \quad (2.10)$$

The two conditions above establish an equilibrium where there is a tangent between the indifference surface of the profit characteristics and the implicit surface of the market characteristics. This equilibrium, particularly from the producer's perspective, is illustrated in Graph 12. Two different producers,  $\phi^1$  and  $\phi^2$ , are shown.  $\phi^1$  operates under production and cost conditions that favor producing a smaller quantity of the characteristic  $z_1$ , while  $\phi^2$  finds it more advantageous to produce a larger quantity of  $z_1$ .

Graph 12: One dimension producer equilibrium



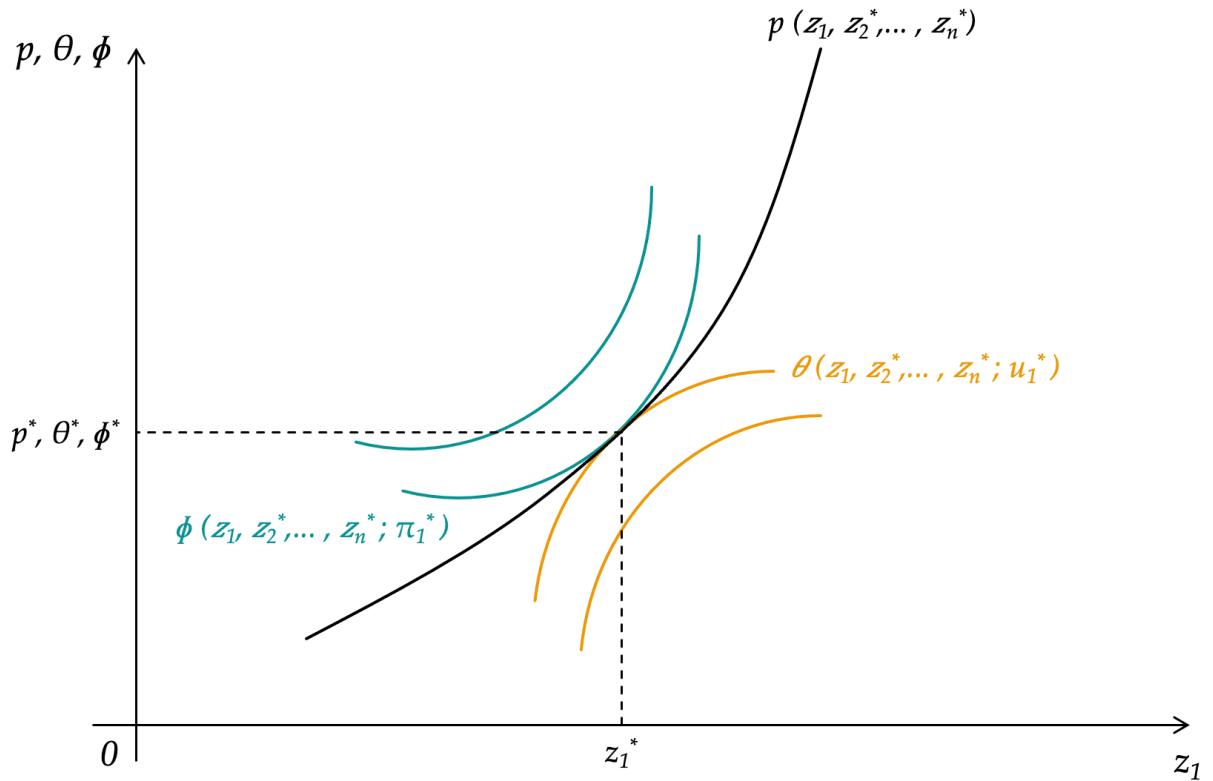
## The Market Equilibrium

In the economic framework, we consider both the family of consumer bid functions, defined as  $\theta(z_1, \dots, z_n; u, \beta)$ , and producer offer functions, defined as  $\phi(z_1, \dots, z_n; \pi, \beta)$  as functions of the same variables. Equilibrium within this market occurs at the juncture where these functions are not only equal, but also tangent to each other. This tangency indicates that the rate at which consumers are willing to pay matches the rate at which producers are willing to sell, based on their respective utility and profit optimization behaviors. Additionally, it is critical to note that at the equilibrium point, both functions  $\theta$  and  $\phi$  exhibit identical gradients with respect to the implicit price functions denoted as  $p$ . This is characterized by the equality of their first derivatives with respect to any good, specifically  $\theta_{z1}$  and  $\phi_{z1}$ , at the equilibrium point,  $z_1^*$ . Thus, the equilibrium condition is established by the equation  $\theta_{z1}(z_1^*) = \phi_{z1}(z_1^*)$ .

$$\theta_{z_1} = \phi_{z_1} = \frac{\partial p}{\partial z_1} = p_1 \quad (2.11)$$

In Equation 2.11, the first derivative of  $p$  with respect to  $z_1$ , designated as  $p_1$ , is identified as the hedonic price for  $z_1$ . This definition underscores that hedonic prices, as theorized by Rosen, originate from the equilibrium price determined by the intersection of demand ( $\theta$ ) and supply ( $\phi$ ). This equilibrium scenario is illustrated in Graph 13.

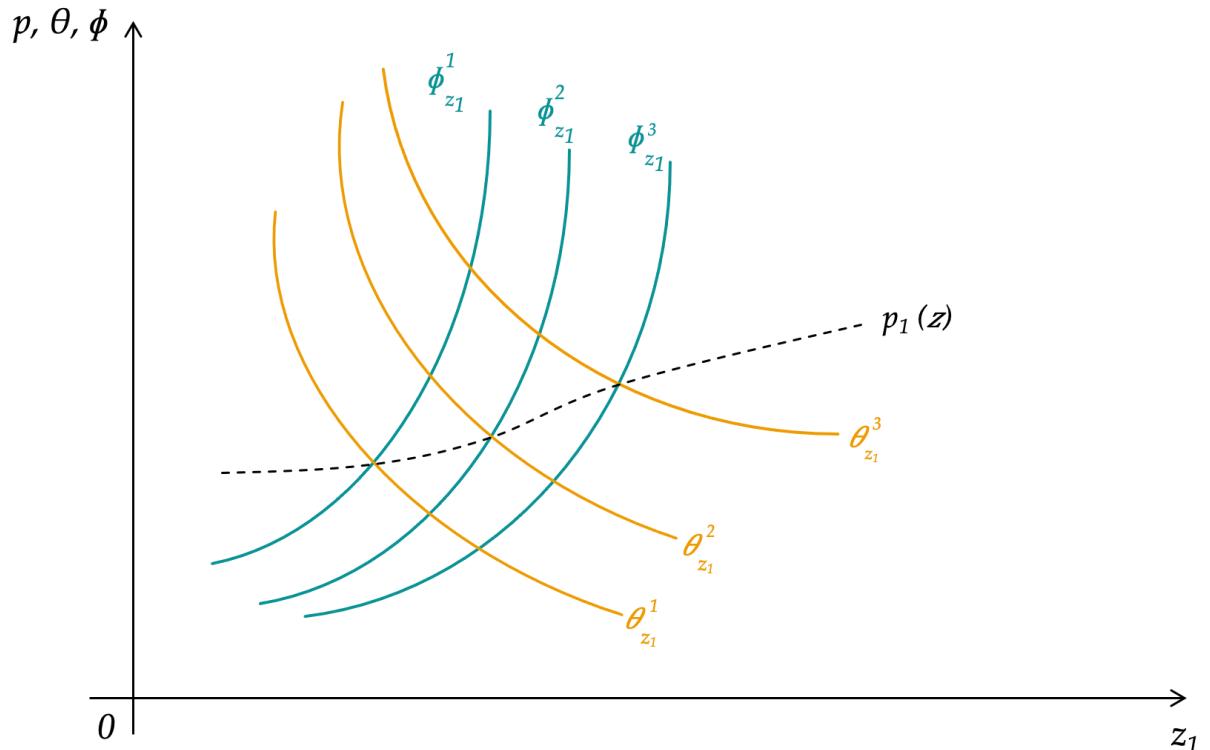
*Graph 13: One dimension market equilibrium*



The equilibrium previously discussed is also depicted in Graph 14. Here, the first derivatives previously mentioned ( $\theta_{z_1}$ ,  $\phi_{z_1}$ , and  $p_1$ ) are plotted along the dimension  $z_1$ . This graphical representation reaffirms that the equilibrium is characterized by the intersection of the supply and demand functions. In this specific diagram, there are three buyers, represented by the variables  $\theta_1$ ,  $\theta_2$  and  $\theta_3$ , and three sellers, represented

by the variables  $\phi_1$ ,  $\phi_2$ , and  $\phi_3$ . The dashed line  $p(z)$  illustrates the common marginal cost that all buyers face.

*Graph 14: Market equilibrium as the intersection of supply and demand function*



## The Hedonic Price Function

The most straightforward functional form for conducting a hedonic price analysis is the linear model. This model assumes a linear relationship between the independent variable, denoted by the letter  $y$ , and the dependent variables, denoted by the letters  $z_n$ . The relationship can be mathematically expressed as follows:

$$y = \beta_0 + \sum_{i=1}^n \beta_i z_i + \varepsilon \quad (2.12)$$

Where:

- $y$  is an observation on the dependent variable (e.g. price of multidimensional good);
- $\beta_0$  is a constant term, also known as intercept;

- $\beta_i$  are the unknown parameters to be estimated, i.e. the hedonic prices;
- $z_i$  are the determinant characteristics of the multidimensional good;
- $\varepsilon$  is the standard error.

The application of the Equation 2.12 to the real estate market allows us to conceptualize that the price of a house, denoted by  $y$ , is determined by a constant value,  $\beta_0$ , plus the sum of the products of each of  $n$  key characteristics,  $z_i$ , and their respective hedonic prices,  $\beta_i$ . Additionally, the model includes an error term,  $\varepsilon$ , which accounts for estimation inaccuracies.

Given that the relationships between the dependent and independent variables in real-world scenarios are not always linear, variable transformations, such as logarithmic, quadratic etc. transformations, can be introduced into the model. These transformations are aimed at enhancing the model's capacity to explain the underlying phenomena accurately and reliably. Further discussion will be devoted to the specifics of implementing such transformations and their interpretations.

Moreover, the hedonic price function can be represented using its flexible functional form, which allows for the incorporation of more complex interactions between variables.

$$\frac{y^\theta - 1}{\theta} = \beta_0 + \sum_{i \in D} \beta_i x_i + \sum_{j \in C} \beta_j \frac{x_j^\lambda - 1}{\lambda} + \varepsilon \quad (2.13)$$

Equation 2.13 builds upon the fundamental linear model by incorporating non-linear forms of the hedonic price function, facilitated by the parameters  $\theta$  and  $\lambda$ . These parameters enable the model to adapt to diverse relationships between the characteristics of a property and its price.

- When both  $\theta$  and  $\lambda$  are equals to 0, the model assumes a logarithmic relationship between the dependent and independent variables. This type of relationship is

useful for handling exponential growth patterns where increases in  $z$  lead to proportionally larger increases in  $y$ .

- If the values of  $\theta$  and  $\lambda$  are equals to -1, the relationship takes on an inverse linear form. This scenario is typically used when the influence of increasing  $z$  is expected to decrease the outcome  $y$  in a reciprocal manner.
- Conversely, when both  $\theta$  and  $\lambda$  are set to 1, a linear relationship is established, making Equation 2.12 and 2.13 equivalent. This setting retains the simple additive relationship where the impact of  $z$  on  $y$  is directly proportional.

Consequently, the adaptability introduced by  $\theta$  and  $\lambda$  in Equation 2.13 permits a more comprehensive and flexible modelling of the influence of property characteristics on their prices, accommodating a range of functional relationships observed in real-world data.

## **Advantages and Limitations**

As with any methodological approach to evaluating transformations in urban environments, the hedonic price method is a valuable tool that has both merits and constraints. In the realm of its application, it stands out as a formidable instrument for the reasons elucidated below:

- It operates as an equilibrium technique, corroborated by (Rosen, 1974) and explicated in section 2.1 Hedonic Price, considering the actual choices made by consumers.
- The real estate market demonstrates considerable efficiency. This efficiency is evidenced by the close alignment between the time consumers invest in seeking optimal housing alternatives and the prices of houses, which tend to closely reflect their intrinsic values.
- The cadastral data employed as inputs in this method are typically of high reliability. In scenarios where such data are absent, alternative sources can provide

accessible compilations of housing prices and their attributes. For instance, externalities — interactions among economic agents occurring outside the market and challenging to quantify economically — are often effectively appraised in monetary terms through this method.

Nevertheless, the hedonic price method is not devoid of limitations, necessitating vigilant attention and critical evaluation during its application.

- It can only measure externalities that directly influence real estate prices. Those that do not impact housing prices, whether directly or indirectly, remain beyond its evaluative capacity.
- This methodology captures consumer willingness to pay solely for the perceptible differences in housing characteristics. In samples where houses and apartments share similar features, the accuracy and significance of the estimates may be compromised.
- The exclusion of explanatory variables related to housing characteristics can diminish the model's explanatory power. These variables must be selected judiciously to circumvent such issues. Moreover, external factors like taxes and interest rates, which can disrupt the real estate market equilibrium, are not amenable to analysis through hedonic price techniques. Instead, more sophisticated financial methods would be requisite.
- The selection of the hedonic price function's form exerts a significant impact on the analytical outcomes. It is of the utmost importance to accurately identify the causal relationships between the dependent and independent variables to prevent errors, such as employing a linear form when a quadratic or logarithmic relationship is more appropriate.
- The hedonic price methodology necessitates considerable statistical expertise for both model construction and result interpretation.

## 2.2 Work From Home (WFH) Classification

### Introduction

An analysis of the economic consequences of the "social distancing" measures implemented to mitigate the spread of COVID-19 raises a key question regarding the structure of the modern economy: how many jobs can be performed from home? In a study conducted by researchers Jonathan Dingel and Brent Neiman (Dingel & Neiman, 2020), the feasibility of working at home for all occupations was classified and then merged with occupational employment counts.

In developing nations such as Brazil, the absence of sufficient connectivity infrastructure often prevents the feasibility of remote work for certain occupations, despite their inherent suitability for such arrangements. A notable deficiency in existing research is the lack of consideration for the requisite home infrastructure necessary for workers to execute their tasks remotely. In response, Barbosa, Veloso, and Peruchetti (Barbosa Filho, et al., 2022) have adapted Dingel and Neiman's (2020) methodology to the Brazilian context. The adaptation incorporates the essential domestic infrastructure needed for remote work, which encompasses continuous access to electricity, a reliable internet connection, and the availability of at least one microcomputer

### Dingel & Neiman Methodology

In order to assess the potential number of workers who can perform their tasks from home, Dingel and Neiman utilized two surveys from version 24.2 of the Occupational Information Network (O\*NET)<sup>8</sup>, a program sponsored by the U.S. Department of Labor. The objective of this study is to gain a deeper understanding of the

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<sup>8</sup> The O\*NET Program is the main source of occupational information in the U.S. (O\*Net, 2024)

characteristics of each occupation and the workforce engaged in these roles. To this end, the O\*NET occupational codes provide hundreds of standardized descriptions for nearly 1,000 different occupations, facilitating the classification of tasks that can be performed remotely. In their 2020 methodology, Dingel and Neiman employ a set of questions to categorize activities that cannot be performed at home, drawing on the results of two distinct surveys: Work Context and Generalized Work Activities (O\*Net Center, 2021).

The first survey, *Work Context Questionnaire*<sup>9</sup>, focuses on assessing the physical and social factors that shape work environments. This includes examining interpersonal relationships, physical conditions at work, and structural job characteristics. The second survey, the *Generalized Work Activities Questionnaire*<sup>10</sup>, evaluates common job behaviors across various roles, such as information processing, interactions with others, mental activities, and work output. On average, each question in the *Work Context* survey had responses from 26 participants, and each question in the *Generalized Work Activities* survey had responses from 25 participants.

If any of the following conditions in the *Work Context* survey responses are true for an occupation, that occupation will be classified as incompatible with remote working:

- Average respondent says they use email less than once per month (Q4)
- Average respondent says they deal with violent people at least once a week (Q14)
- Majority of respondents say they work outdoors every day (Q17 & Q18)
- Average respondent says they are exposed to diseases or infection at least once a week (Q29)
- Average respondent says they are exposed to minor burns, cuts, bites, or stings at least once a week (Q33)
- Average respondent says they spent majority of time walking or running (Q37)

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<sup>9</sup> [https://www.onetcenter.org/dl\\_files/MS\\_Word/Work\\_Context.pdf](https://www.onetcenter.org/dl_files/MS_Word/Work_Context.pdf)

<sup>10</sup> [https://www.onetcenter.org/dl\\_files/MS\\_Word/Generalized\\_Work\\_Activities.pdf](https://www.onetcenter.org/dl_files/MS_Word/Generalized_Work_Activities.pdf)

- Average respondent says they spent majority of time wearing common or specialized protective or safety equipment (Q43 & Q44)

If any of the following conditions in the *Generalized Work Activities* survey responses are true for an occupation, that occupation will be classified as incompatible with remote working:

- Performing General Physical Activities is very important (Q16A)
- Handling and Moving Objects is very important (Q17A)
- Controlling Machines and Processes [not computers nor vehicles] is very important (Q18A)
- Operating Vehicles, Mechanized Devices, or Equipment is very important (Q20A)
- Performing for or Working Directly with the Public is very important (Q32A)
- Repairing and Maintaining Mechanical Equipment is very important (Q22A)
- Repairing and Maintaining Electronic Equipment is very important (Q23A)
- Inspecting Equipment, Structures, or Materials is very important (Q4A)

Applying the previously described methodology, Dingel and Newman obtained the results displayed in Table 18 of the appendix, which pertain to occupations classified in accordance with the O\*NET classification system.

### **Brazilian reality: Barbosa, Veloso and Peruchetti Methodology**

In the article "*Trabalho Remoto no Brasil*" (Barbosa Filho, et al., 2022), the authors adapted Dingel and Neiman's methodology to the Brazilian context, including the need for a minimum infrastructure to enable remote work. While the original methodology of Dingel and Neiman (2020) identifies occupations that can be performed remotely based on their intrinsic characteristics, the authors of this study introduced an essential adaptation: the consideration of the domestic infrastructure necessary for teleworking. This infrastructure includes continuous access to electricity,

an Internet connection, and the presence of at least one computer at home. This adjustment is crucial to reflect the realities of developing countries, where many households may lack the basic conditions necessary to support remote work, even if the occupations are compatible with this modality.

The authors use two different data sources for their analyses: the 2019 Continuous National Household Survey (PNAD Contínua<sup>11</sup>) and the COVID-19 National Household Survey (PNAD-COVID<sup>12</sup>). The *PNAD Contínua* is used to characterize the potential for telecommuting, providing detailed information on the characteristics of workers, their occupations, and the characteristics of their households. This allows the authors to assess whether workers have the minimum infrastructure necessary for remote work.

On the other hand, the *PNAD-COVID* is used to evaluate the remote work effectively adopted in Brazil during the months of May to November 2020. This survey adapts the methodology of the *PNAD Contínua* to the pandemic context, although with a less detailed classification of occupations and without information on household characteristics. Nevertheless, the *PNAD-COVID* provides specific data on workers who effectively worked from home during the pandemic.

In order to apply the methodology to the Brazilian context, it is essential to translate the occupational codes used by the authors to the occupational codes utilized in Brazil.

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<sup>11</sup> The *PNAD Contínua* (PNADC - *Pesquisa Nacional por Amostra de Domicílios Contínua*) is a survey conducted by the IBGE with the principal objective of furnishing continuous data on the socioeconomic characteristics of the Brazilian population. The survey collects monthly data, thereby enabling the monitoring of the evolution of the labor market. This information is provided in the form of data on employment, unemployment, income, and other characteristics related to the labor force in Brazil. (IBGE | PNAD Contínua, 2022). The survey methodology is detailed in the document *Pesquisa Nacional por Amostra de Domicílios Contínua – Notas Metodológicas* (IBGE | PNAD Contínua , 2014)

<sup>12</sup> The PNAD COVID (*Pesquisa Nacional por Amostra de Domicílios – COVID*) was a survey conducted by the IBGE in 2020 with the objective of monitoring the effects of the COVID-19 pandemic on the labor market and the living conditions of the Brazilian population. This survey collected information on health, work, income, and people's perception of the symptoms associated with the coronavirus. It was released on a weekly basis, allowing for a continuous analysis of the impacts of the pandemic. (IBGE | PNAD COVID19, 2020)

The “*Classificação de Ocupações para Pesquisas Domiciliares*” (COD<sup>13</sup>) was developed by the Brazilian Institute of Geography and Statistics (IBGE), based on the International Standard Classification of Occupations 2008 (ISCO-08) by the International Labour Organization (ILO). The COD is equivalent to the ISCO-08 at the most aggregated level (major groups) and reorganizes some main subgroups, subgroups, and basic groups. To ensure the compatibility of the O\*NET codes with the codes used by IBGE, a multi-step translation process was employed. Firstly, the 968 occupations from O\*NET were translated to the 2010 Standard Occupational Classification (SOC-2010), which is used in the American household survey (Current Population Survey – CPS). Subsequently, these occupations were reclassified from SOC-2010 to ISCO-08, and then translated to the COD used in the *PNAD Contínua*. This reclassification process was executed in accordance with the diagram below.

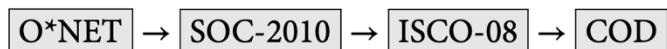


Figure 1: Translation<sup>14</sup> of the O\*NET Code for COD Brazil

The minimum infrastructure for the analysis of the feasibility of remote work in Brazil considered by the authors does not include the evaluation of an adequate physical workspace for home-based work, but rather focuses on the essential basic requirements mentioned above: continuous access to electricity, availability of a computer, and internet connection.

<sup>13</sup> The COD (*Classificação de Ocupações para Pesquisas Domiciliares*) was designed with the objective of enhancing the collection and analysis of data on occupations in Brazil. Its implementation commenced in household surveys conducted as part of the 2010 Demographic Census. The COD is compatible at the two-digit level with the ISCO-08 (International Standard Classification of Occupations) and, furthermore, achieves compatibility with the ISCO-08 at the most disaggregated level, four digits, in eight of the ten major groups. In the remaining two groups, compatibility is achieved at three digits in one group and two digits in the other, ensuring robust integration between occupational classifications (IBGE | COD, 2010).

<sup>14</sup> I contacted the authors of the article to request the final version of the conversion table related to occupational classifications. The author, Fernando Barbosa, transmitted the table (Table 19) via email for future use it. It is included in the appendix of this document.

In this context, three questions from the *PNAD Contínua* were selected to measure the presence of this minimum infrastructure, allowing for the creation of a dummy variable to evaluate these characteristics. Furthermore, the respondent's occupation was recorded. The questions and the occupation field in the first visit<sup>15</sup> questionnaire, along with their respective codes, are as follows:

- How often is electricity from the general network usually available for this household? (S01015)
- Does this household have a computer (including portable ones such as laptops, notebooks, ultrabooks, or netbooks)? (S01028)
- Does any resident have internet access at home through a computer, tablet, mobile phone, television, or other equipment? (S01029)
- Occupation code (position or function) (V4010)

This variable takes the value of 1 for workers whose households possess all three specified items and 0 for those who do not meet any of these criteria.

To complement the analysis, the authors make use of data from the *PNAD-COVID* survey, which includes a specific question regarding the status of the employee in relation to their working environment: The question posed was as follows: "**Were you working remotely (i.e., from home or via teleworking) last week?**" (C013). This enables the assessment of both the potential for remote work and its effective usage. However, the *PNAD-COVID* has a lower level of occupational disaggregation compared to the *PNAD Contínua*, necessitating the occupations to be grouped into only 10 categories for comparison. The categorization of COD occupations by the *PNAD-COVID* adheres to the logic delineated in Table 1.

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<sup>15</sup> In the *PNAD Contínua*, selected households are surveyed once each quarter for five consecutive quarters before being removed from the sample. The rotation scheme of the *PNAD Contínua* sample is designed so that each quarter includes households being surveyed for the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> time. Each survey instance is referred to as a visit (IBGE | PNADC, 2024).

Table 1: Grouping of occupational groups and activities from the PNAD Contínua followed by the PNAD COVID; Source: (IBGE | PNAD COVID, 2020)

<b>Major Group</b>	<b>Occupational groups in the main job</b>	<b>Selection from COD codes</b>
1	Senior Officers in Public Administration, Directors of Companies, and Managers	1111 ≤ V4010 ≤ 1439
2	Intellectual, Scientific, and Artistic Professionals	2111 ≤ V4010 ≤ 2659
3	Middle-Level Technicians	3111 ≤ V4010 ≤ 3522
4	Administrative Support Workers	4110 ≤ V4010 ≤ 4419
5	Service Workers, Shop and Market Salespersons	5111 ≤ V4010 ≤ 5419
6	Agricultural, Forestry, and Fishery Workers	6111 ≤ V4010 ≤ 6225
7	Production of Industrial Goods and Services, Craftsmen, and Related Workers	7111 ≤ V4010 ≤ 7549
8	Machinery Operators and Drivers	8111 ≤ V4010 ≤ 8350
9	Elementary Occupations	9111 ≤ V4010 ≤ 9629
0	Armed Forces, Police, and Firefighters	0110 ≤ V4010 ≤ 0512
-	Ill-defined occupations	V4010 = 0000

One of the most significant challenges associated with *PNAD-COVID* is the lack of information regarding households. This lack of information prevents direct adjustments to remote working potential based on the available infrastructure. Therefore, it is assumed that the loss of potential due to the lack of infrastructure is equivalent to that observed in the 2019 *PNAD Contínua*. The calculation of remote work potential in the *PNAD-COVID* is based on the available aggregate categories. Adjustments are made by considering the ratio between the potential adjusted for infrastructure and the unadjusted potential of the *PNAD Contínua* for each specific group under analysis, as demonstrated by the following Equation 2.14:

$$POT_{PNAD-COVID\ INFRA}^K = POT_{PNAD-COVID}^K \cdot \frac{POT_{PNADC\ INFRA}^K}{POT_{PNADC}^K} \quad (2.14)$$

Where:

- $POT_{PNAD-COVID\ INFRA}^K$  is the potential remote work of *PNAD-COVID* adjusted for infrastructure;

- $POT_{PNAD-COVID}^K$  is the potential remote work of PNAD-COVID, i.e. everyone who answered yes to question C013 on the survey form;
- $POT_{PNADC\,INFRA}^K$  is the remote work potential of the *PNAD Contínua 2019* with infrastructure adjustment, i.e. values adjusted by the answers to questions S01015, S01028, S01029 of the survey form;
- $POT_{PNADC}^K$  is the remote work potential of the *PNAD Contínua 2019*.

# Chapter 3

## Case Study

In urban areas, the supply of housing, including houses and apartments, is constrained by structural limitations. Despite efforts to rapidly adjust the housing supply in response to external demand shocks, there is an inevitable lag until these properties become available on the market. External changes can create housing shortages, presenting market opportunities in the real estate sector.

The following chapters will examine how the theories and methodologies presented form a study that seeks to demonstrate how the housing choices in São Paulo have been impacted by COVID-19 and how the real estate market behaved between 2018 and 2022, despite the time lag required for the sector to adapt to these new habits.

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The objective of this article is to analyze the impact of remote work on the apartment choices of São Paulo residents through extensive data collection, detailed in Chapter 4, and to quantify this impact on property price variations across different neighborhoods using the hedonic pricing method. The research aims to identify the key features that buyers prioritize in a scenario of increased remote work adoption and to measure how these preferences influence property prices.

It is hypothesized that, with reduced transportation costs, São Paulo residents will prefer to live in more suburban areas, opting for larger houses or apartments, as they will spend more time working from home and less time commuting. Such a shift could result in significant changes to demand patterns and price dynamics within the real estate market. By understanding these trends, we aim to provide insights into how the real estate market in São Paulo is adapting to the growing prevalence of remote work.

Additionally, we will examine how remote work is perceived globally post-pandemic and its implications for urban living. The analysis will include an overview of São Paulo's demographic and economic landscape, highlighting key factors that influence housing preferences. The article will examine trends in the local real estate market, including price variations, housing supply and demand, and neighborhood desirability. Furthermore, it will discuss the global shift towards remote work accelerated by the pandemic, examining studies and data that reveal how this trend is reshaping urban living and housing choices worldwide.

By providing this broader context, the article aims to offer a well-rounded understanding of the factors driving changes in housing preferences in São Paulo. This will help validate the hypothesis that, with reduced transportation costs and increased time spent at home, residents may prefer larger living spaces in suburban areas, leading to significant shifts in the real estate market.

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### 3.1 São Paulo City and the Real Estate Market

#### São Paulo overview

São Paulo is the largest city in Brazil and one of the largest metropolises in the world, situated in the Southeast region of the country, Figure 2. With an estimated population of over 12 million<sup>16</sup> inhabitants, the city is notable for its high population density, which exceeds 7.500 inhabitants per square kilometer.

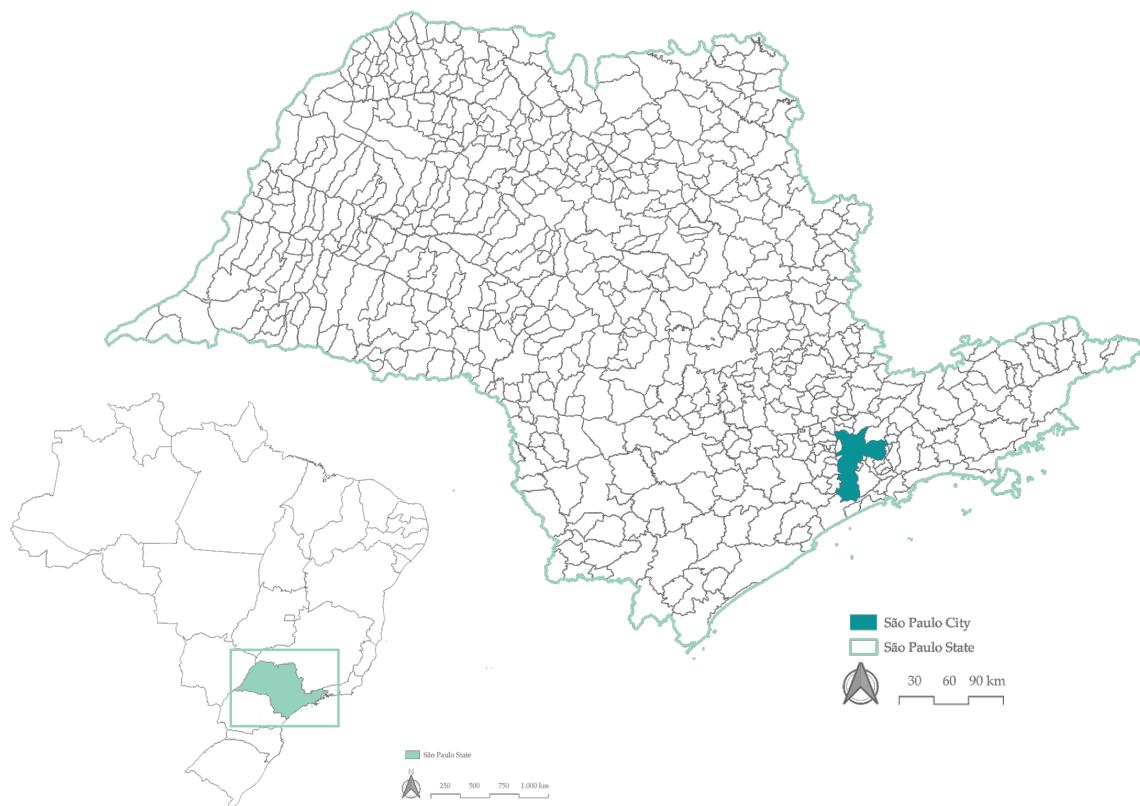


Figure 2: São Paulo city location; Author: Own authorship

The city of São Paulo is organized into five main zones: the Central Zone, the North Zone, the South Zone, the East Zone, and the West Zone, Figure 3. These zones are divided into 32 sub-prefectures, which in turn are subdivided into 96 districts. There is no official subdivision, made by the city hall or any other government body, smaller

<sup>16</sup> Source: IBGE, 2022 <https://cidades.ibge.gov.br/brasil/sp/sao-paulo/panorama>

than the districts, which can represent a challenge for the analysis of certain data, as this territorial division groups together neighborhoods with very different characteristics. This can result in regions analyzed containing significantly diverse neighboring areas. For instance, the wealthy *Morumbi* region is adjacent to a *favela*<sup>17</sup> and both are located in *Morumbi* district.

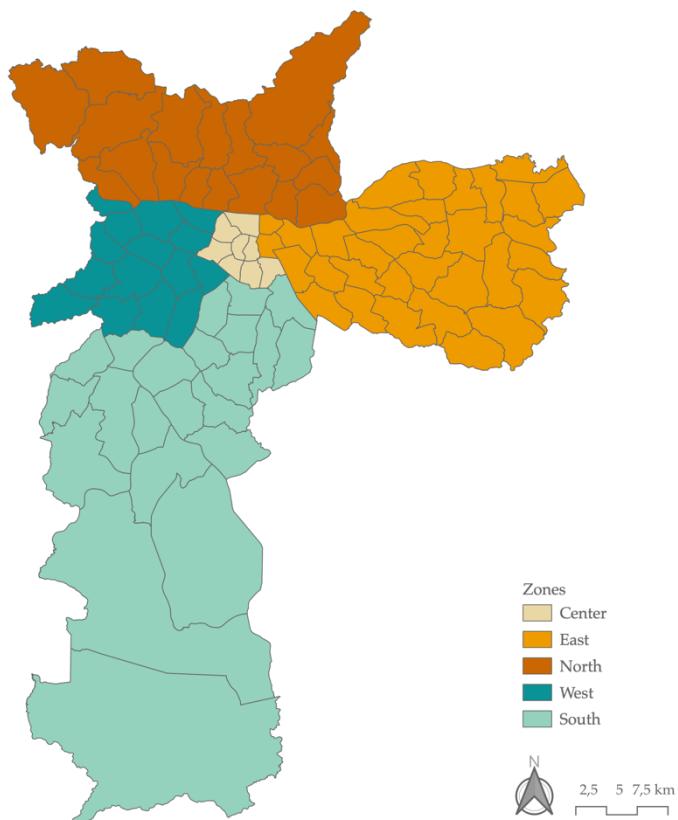


Figure 3: Zones and districts of São Paulo; Source: (São Paulo, 2023); Author: Own authorship

The city is Brazil's principal economic center, with a gross domestic product (GDP) exceeding R\$ 700 billion<sup>18</sup>, representing approximately 11% of the national GDP. The primary contributors to São Paulo's economy are the services, commerce, industry, and finance sectors. The city is the headquarters of numerous significant financial

<sup>17</sup> A *favela* is a densely populated informal settlement with substandard housing and limited access to essential services.

<sup>18</sup> At the exchange rate of May 18, 2024, one R\$ is equivalent to 0,18€. Source: Google finance

institutions, including the São Paulo Stock Exchange<sup>19</sup> (B3), and is also a technological and innovation hub.

However, São Paulo also stands out for its high degree of socioeconomic inequality. Despite its significant GDP, the city faces challenges such as income disparity, wealth concentration in specific neighborhoods, and large peripheral areas with limited access to basic services and infrastructure. This inequality impacts residents' quality of life, resulting in stark differences in access to education, health, and housing across various regions of the city.

One way to quantify this inequality is through socioeconomic indicators. *Rede Nossa São Paulo*<sup>20</sup> is an independent organization comprising NGOs, social movements, companies, universities, media outlets, and citizens. It publishes materials such as the Inequality Map, the Indicators of Well-Being in the Municipality (IRBEM), Indicator Booklets, Annual Reports, and Thematic Research. These publications facilitate a more transparent, efficient, and inclusive public administration. The Inequality Map includes a "*desigualtômetro*<sup>21</sup>" (inequality meter) for each indicator and a performance ranking<sup>22</sup> by district, which reveals the existing disparities in the city. The considered indicators are listed on Table 2.

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<sup>19</sup> The main financial market in Brazil, providing a platform for trading stocks, commodities, and other financial instruments.

<sup>20</sup> An independent organization that annually publishes materials to promote transparency, efficiency, and inclusivity in public administration.

<sup>21</sup> Ratio between the highest and lowest number in an indicator. In the case of indicators that have a best/worst district of zero, the calculation for the Inequality Meter considers the first non-zero value, so that the relationship can be established mathematically (Rede Nossa São Paulo, 2013 - 2023)

<sup>22</sup> The district performance evaluation method employs a ranking system that assigns scores to each district based on their relative position. The scores range from 96 points for the district with the highest value to 1 point for the district with the lowest value. In the event of a tie, weighted scores are applied. The final performance metric is the sum of the scores divided by the number of indicators with data. Population indicators are excluded from consideration, and all indicators are given equal weight (Rede Nossa São Paulo, 2013 - 2023)

Table 2: Indicators used by Rede Nossa São Paulo to rank the districts; Source: (Rede Nossa São Paulo, 2013 - 2023)

<b>Thematic Area</b>	<b>Indicators</b>
Population	Total population, Black and brown population, Female population, Youth population, Child population, Homeless population
Housing	Families in provisional housing assistance due to risk and emergency situations, Households in favelas
Mobility	Traffic deaths, Average bus speed, Average commute time by public transport, Access to mass transport, Access to cycling infrastructure
Digital Infrastructure	Mobile internet access by area, Mobile internet access by population
Work and Income	Formal job offers, Average monthly income from formal employment, Wage inequality (formal employment)
Health	Teenage pregnancy, Maternal mortality, Infant mortality, Average age at death, Average waiting time for primary care consultations, COVID-19 mortality
Education	Waiting time for daycare spots, Enrollments in basic education in public schools, Age-grade distortion in municipal public elementary schools, Dropout rate in municipal public elementary schools, IDEB (public schools - early years), IDEB (public schools - final years), Teacher qualification adequacy, Teacher effort
Culture	Cultural centers, Public cultural facilities, Cinemas, Independent cultural spaces
Sports	Public sports facilities, Sports courts in public schools
Human Rights	Violence against women, LGBTQIAP+ violence, Racial violence
Public Safety	Femicide, Homicides, Youth homicides, Assaults by police intervention, Deaths by police intervention, Average travel time for reporting violence against women
Environment	Emission of atmospheric pollutants by area, Green coverage, Drop-off points for voluntary recycling, Number of contaminated areas

Upon mapping the districts using the described performance evaluation methodology, it is observed that the western regions of the city exhibit superior conditions, represented in dark green in Figure 4, while suburban regions exhibit inferior performance, indicated in dark orange. It is important to highlight that a common characteristic of large urban centers in developed countries is the poor performance of central neighborhoods, which often have high levels of poverty and low levels of security. As an illustration of this phenomenon, one may consider the districts of *República*, *Sé*, and *Brás*, which are represented by the positions 67<sup>th</sup>, 61<sup>st</sup>, and 64<sup>th</sup>, respectively.

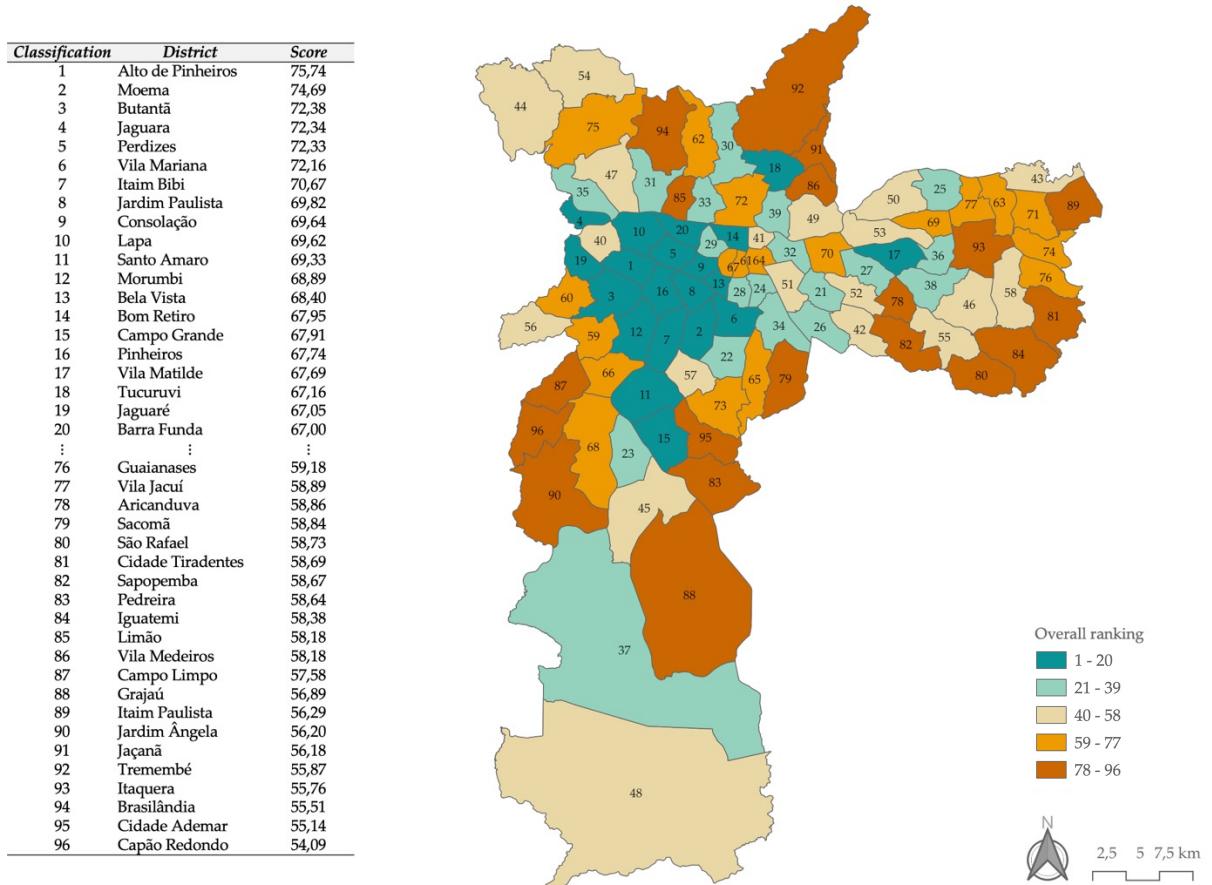


Figure 4: Performance analysis for the districts of São Paulo for the year 2023; Source: (Rede Nossa São Paulo, 2013 - 2023); Author: Own authorship

## Residential Real Estate market

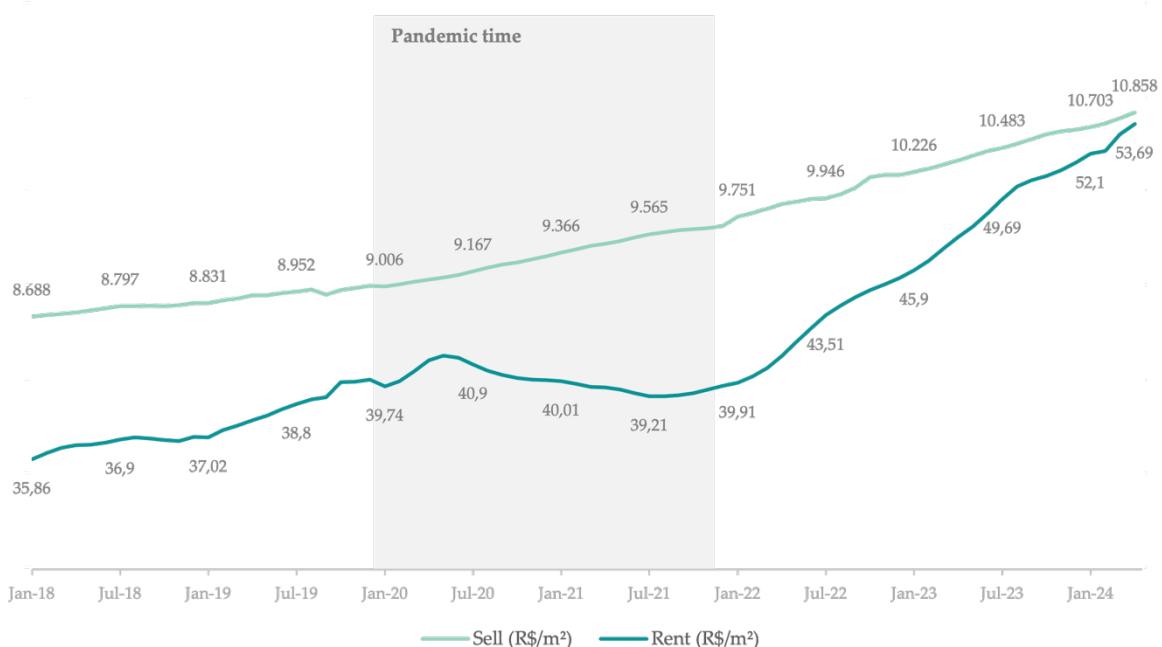
The city of São Paulo is on the verge of establishing a new historical record by delivering 818 new condominiums in 2024, nearly double the number from the previous year (Globo - G1, 2024). Of these, 36% are mid-range, with 295 developments averaging R\$ 15,2 thousand per square meter and R\$ 710 thousand per unit. Neighborhoods like *Vila Mariana*, *Perdizes*, *Pinheiros*, and *Moema* are leading the launches. This surge is driven by low interest rates and revisions to the Master Plan<sup>23</sup>, which permit vertical expansion near public transport hubs.

<sup>23</sup> The Master Plan of São Paulo (*Plano diretor*), developed by the municipal government, is a strategic urban planning document that provides guidance on the city's sustainable growth, zoning, and infrastructure improvements.

Experts caution that this growth does not address the housing deficit of 400,000 homes (Globo - G1, 2023) and may lead to increased traffic and excessive property value appreciation. Additionally, there is a growing trend towards studios and micro-apartments, particularly in central and well-located areas, catering to the demand for smaller, more affordable housing for young professionals and students. The price trends before and after the pandemic indicate shifts in demand and supply. There has been a significant increase in rental prices post-pandemic, reflecting economic recovery and a higher demand for flexible housing options.

The price trend as illustrated in Graph 15 for average sale and rental prices per square meter in São Paulo shows that before the pandemic, prices grew moderately and steadily. During the pandemic, sale prices continued to rise while rental prices saw a temporary dip due to lower demand for rentals. Subsequent to the pandemic, rental prices exhibited a notable surge, outpacing the growth in sale prices. This suggests a recovery in rental demand and a heightened necessity for temporary or flexible housing.

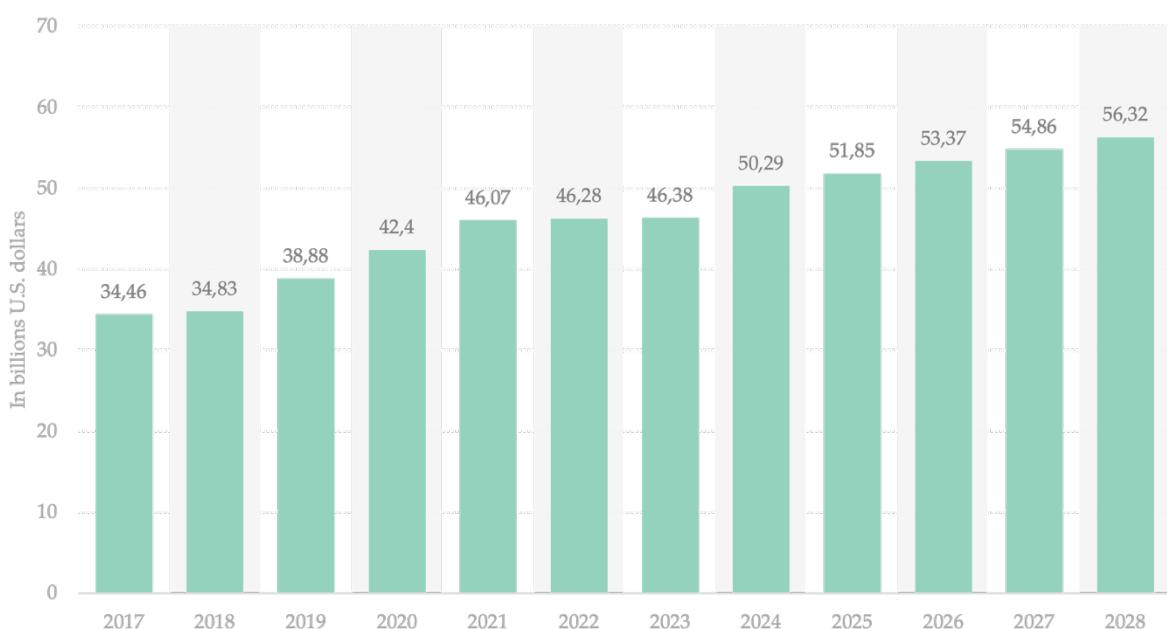
*Graph 15: São Paulo city average monthly residential sales and rents in R\$/m<sup>2</sup> from Jan-18 to Apr-24; Source: (Fipe Zap, 2024); Author: Own authorship*



The confluence of low interest rates, incentive policies, and Master Plan revisions has propelled the expansion of São Paulo's real estate market. However, challenges persist. Property value appreciation and vertical expansion may exacerbate traffic congestion and the housing crisis. The emergence of studios and micro-apartments represents a partial solution to the housing crisis, yet accessibility remains a critical issue.

Following the rise in rental prices and the projected growth of the market over the next several years, as evidenced by Graph 16, leading businesses in Brazil have commenced investigating the long-stay multifamily market. JFL Living, Vila 11, and Greystar have incorporated mid to high-standard developments into their portfolios, catering to a clientele seeking ease and quality. Located in upscale neighborhoods of São Paulo, these developments reflect an adaptation to urban lifestyle changes where flexibility and convenience have become essential. In response to the emergence of remote work trends, these companies have incorporated coworking areas into their lobbies, as evidenced by the VO699, Ayra, and Vila 11 Jardins developments. The decision to focus on São Paulo as a case study in the multifamily sector reflects the city's appeal and the potential for growth in this market.

*Graph 16: Revenue in the real estate market in Brazil from 2017 to 2028(in billion U.S. dollars); Source: (Statista, 2023)*



### 3.2 Impact of WFH on the Housing Market: Long-Term Shift

The surge in house prices between December 2019 and November 2021 in the United States, with an unprecedented increase of 23.8%, was significantly influenced by the shift to remote work due to the COVID-19 pandemic. Studies indicate that remote work is responsible for at least half of this increase. By November 2021, approximately 42.8% of employees were working remotely, and this trend is expected to continue indefinitely. The analysis by (Mondragon & Wieland, 2022) highlights that areas with higher pre-pandemic levels of remote work saw greater increases in house prices during the pandemic.

The study found that a 1 percentage point increase in remote workers during the pandemic correlated with a 0.93% rise in house prices. This shift contributed to a 15.1% overall increase in U.S. house prices. Additionally, regions with higher remote work rates experienced similar increases in rental prices, while commercial rents in these areas declined. This indicates that remote work not only boosts housing demand but also changes the dynamics of the rental and commercial real estate markets.

The demand for housing has been fundamentally altered by remote work. Many Americans have moved away from traditional urban centers to more distant locations where they can afford larger homes, facilitated by the elimination of daily commutes. Zillow's research (Zillow Research, 2020) indicated that nearly two million renters were able to purchase homes in more remote areas due to remote work flexibility. This demographic shift has led to divergences in home and rental price trends across different regions.

Overall, the permanence of remote work is reshaping the housing market by driving up demand and prices, particularly in regions that offer better living conditions for remote workers. The continuing prevalence of remote work suggests that these changes in housing demand and market dynamics are here to stay, rather than being

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a temporary response to the pandemic. This new reality indicates a lasting impact on the real estate market, with remote work becoming a key factor in determining housing demand and pricing.

# Chapter 4

## Data collection and treatment

In order to prove the hypothesis of this article, data needs to be gathered from two sources: the values of real estate advertisements from 2018 to 2022 and the number of formal jobs in São Paulo (occupations).

Related to the real estate market transactions the best option to run a regression model in this case is to use the real transaction values, which guarantees highly realistic results. However, the real transaction values published by the City of São Paulo (ITBI data<sup>24</sup>)

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<sup>24</sup>ITBI (Imposto sobre Transmissão de Bens Imóveis = Real Estate Transfer Tax) is a municipal tax applied in Brazil on the transfer of property ownership, whether urban or rural. ITBI is a tax that must be paid

only contain property price values and do not contain any information about the characteristics of the property (for instance: an apartment located on Paulista Avenue with 200 m<sup>2</sup> and price equals to R\$300k). The ITBI data has no information related to the number of bedrooms, toilets, garages... Because of that, was chose to use the asked prices (advertisement prices) to make the analysis.

The data was extracted from Brazil's largest real estate advertising website (Semrush, 2023), *Viva Real*<sup>25</sup>. However, since the analysis spans the years 2018 to 2022, it was necessary to retrieve data from past advertisements. For this purpose, the Wayback Machine<sup>26</sup> portal was utilized. It is important to note that other websites such as *Zap Imóveis* and *Quinto Andar*, second and third biggest real estate Brazilian websites, were considered for data extraction; but, only a few records of past advertisements were found for these platforms.

The Wayback Machine is an online service that allows users to view archived versions of web pages over time. Acting as a digital archive of the internet, it captures and stores copies of web pages at regular intervals. This tool is valuable for accessing historical web content and proved instrumental in retrieving data from old real estate advertisements, thus contributing to the temporal scope of the analysis.

For the specific case of *vivareal.com* records in the Web Archive, it was observed that there was at least one file per week for all the years under examination, documented for both sales and rental advertisements in the city of São Paulo, as illustrated in Figure 5. Although the consideration of district-specific searches was contemplated, the number of available past records significantly declined. This led to the recognition of certain limitations with this adopted model. When conducting searches for specific

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whenever ownership of a property is transferred, whether by purchase and sale, donation, inheritance, exchange, or any other legal means. For the city of São Paulo, it is possible to find the data at (São Paulo, 2023).

<sup>25</sup> Viva Real: <https://www.vivareal.com.br/>

<sup>26</sup> Wayback Machine: <https://web.archive.org/>

districts in São Paulo, there were notable concentrations in central areas. Additionally, there was a restriction to access only 10 past pages, and surpassing this limit prompted an error in the web archive, where the second page consistently mirrored the first.

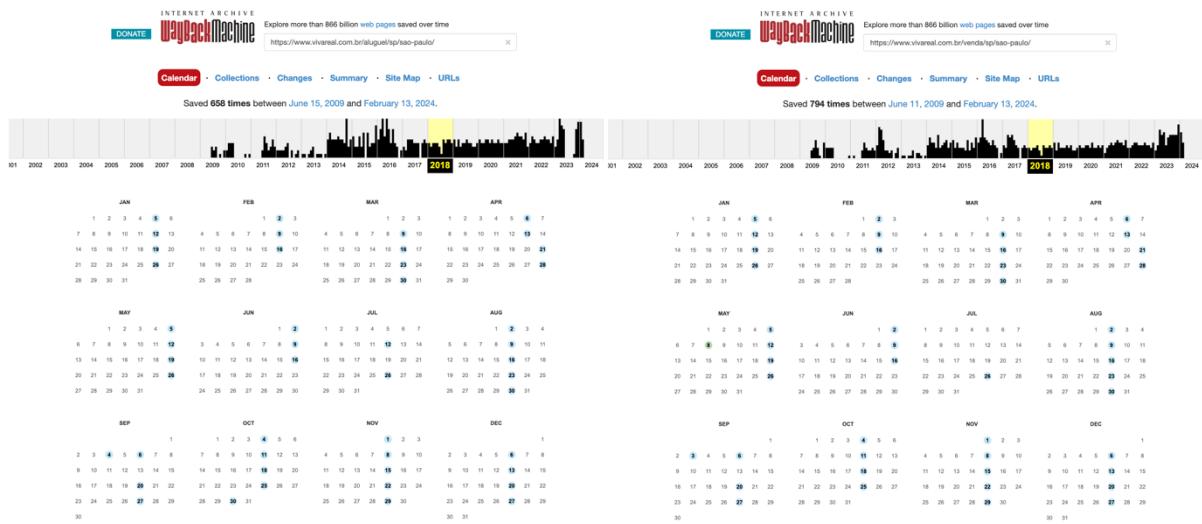


Figure 5: Wayback Machine a web archive with a record of previous vivareal.com ads for the city of São Paulo, where the record on the left reports rental ads and the one on the right sales ads

Despite the limitations, it was viable to extract data with a significant sample for the various years using the web scraping technique. This technique will be explained in section 4.1 Web Scraping as indicated by the values for each year of the advertisements in Table 3. Furthermore, the geospatial distribution across the districts of São Paulo can be observed in Figure 6 for sales ads and Figure 7 for rental ads.

Table 3: Amount of data extracted from previous years' ads on vivareal.com to São Paulo's city

Year	Quantity of rental ads	Quantity of sales ads <sup>27</sup>
2022	3.433	10.034
2021	4.950	9.142
2020	4.121	7.253
2019	10.081	25.248
2018	6.905	40.927
<b>Total</b>	<b>29.490</b>	<b>92.604</b>

<sup>27</sup> In 2018 and 2019, some of the data for sales advertisements were sourced from a data analysis website called Kaggle.

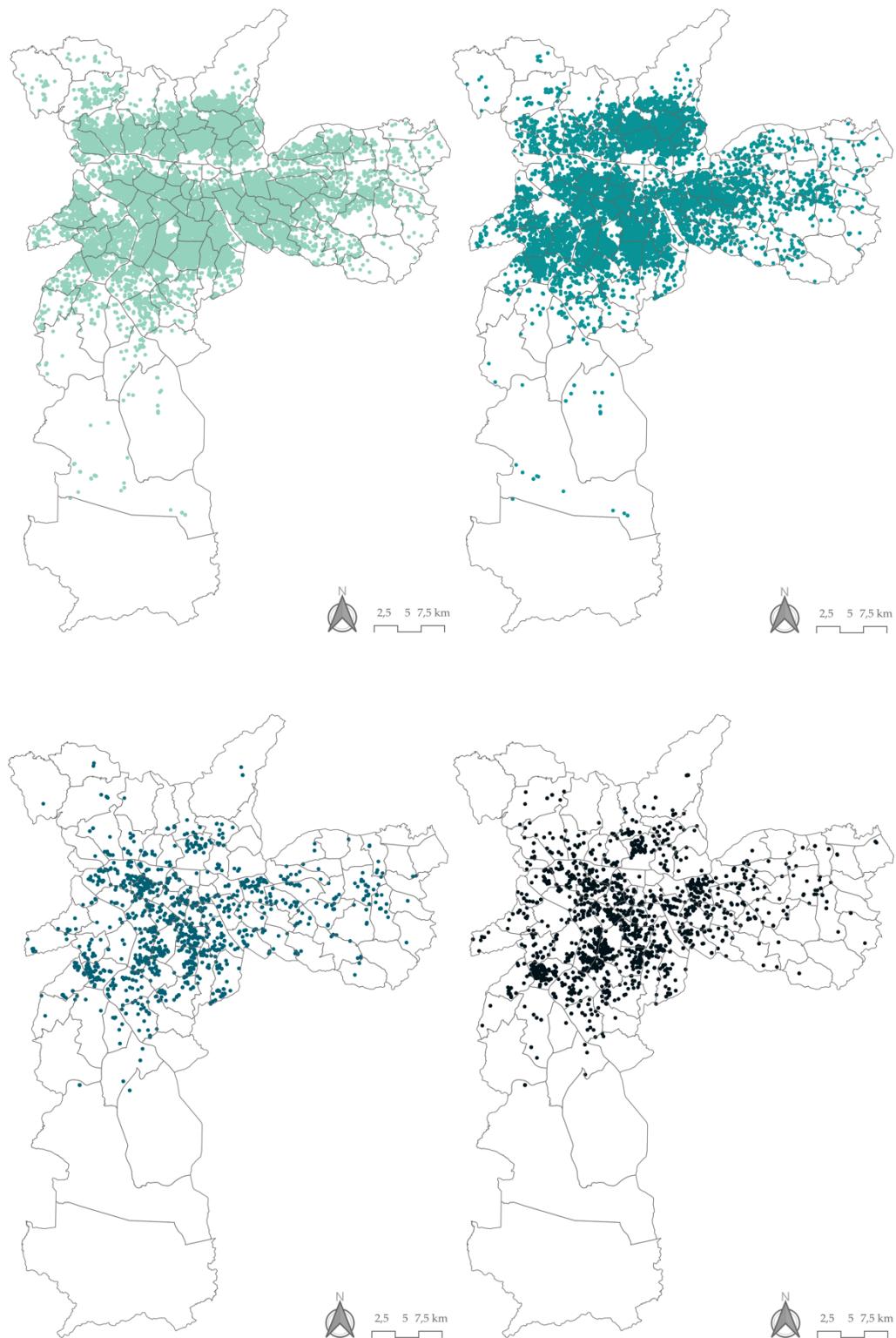


Figure 6: Geospatial distribution of sales ads for the years: 2018 (top left), 2019 (top right), 2020 (bottom left), and 2021 (bottom right); Source: vivareal.com; Authorship: Own authorship

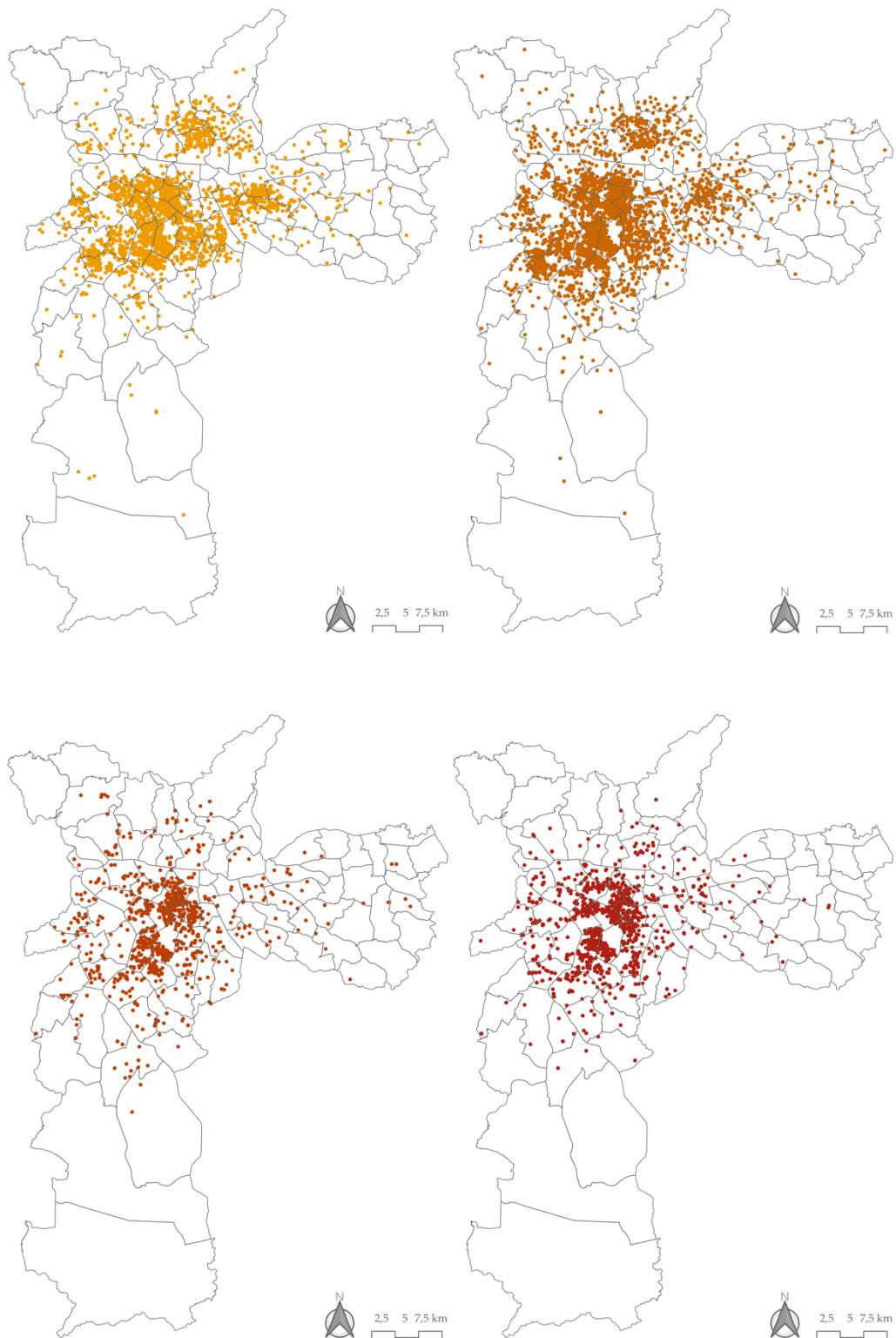


Figure 7: Geospatial distribution of rental ads for the years: 2018 (top left), 2019 (top right), 2020 (bottom left), and 2021 (bottom right); Source: vivareal.com; Authorship: Own authorship

In addition to the intrinsic real estate data, it was necessary to collect information related to formal occupations and their geospatial distribution in the city of São Paulo. Initially, a Business Intelligence (BI)<sup>28</sup> (PBI - Ministério do trabalho, 2023) was identified, as shown in Figure 8, provided by the federal government through the MTE - *Ministério do trabalho* (Ministry of Labor). This BI provides data on the number of professionals per occupation and is part of the *Guia Brasileiro de Ocupações* (Brazilian Occupational Guide) (GBO - Ministério do trabalho, 2023), "which aims to facilitate public access to information about existing occupations in the Brazilian job market, their components, and key indicators". The BI uses data sources from the RAIS<sup>29</sup> and the New CAGED<sup>30</sup>, which are available on the Ministry of Labor's website.

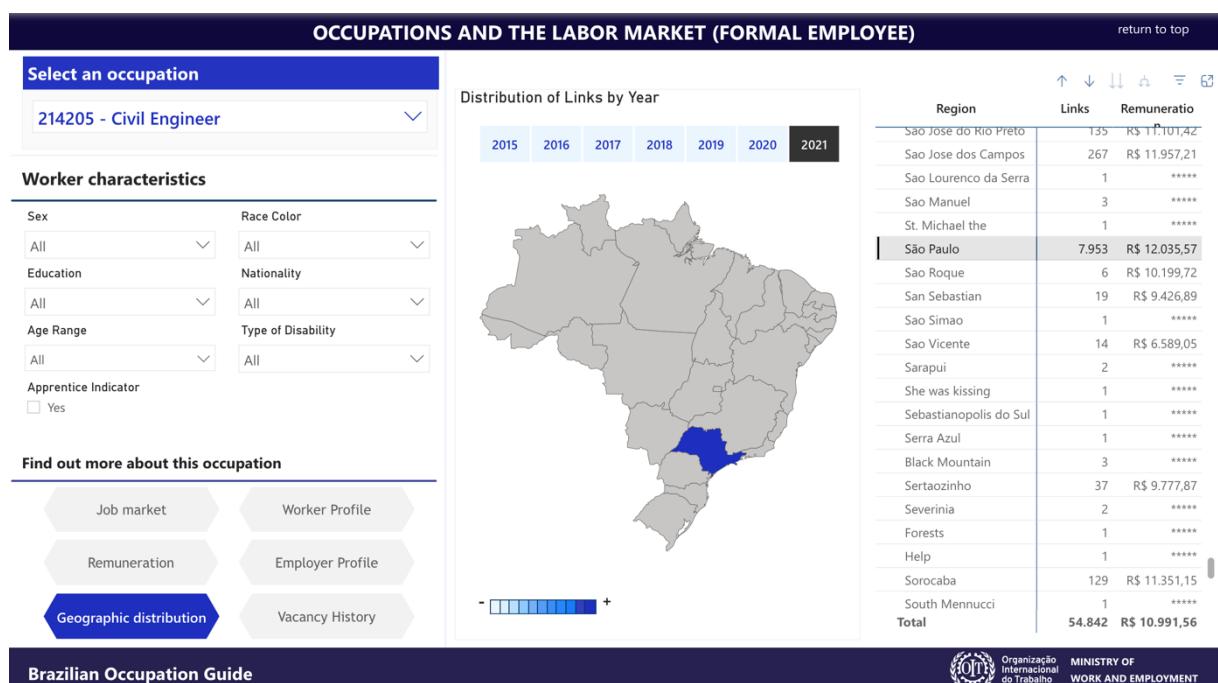


Figure 8: Power BI available by the MTE in the Brazilian guide of occupations; Source: (PBI - Ministério do trabalho, 2023)

<sup>28</sup> The Power BI displays occupations and the formal labor market, providing access to the geographical distribution on page 6.

<sup>29</sup> RAIS (*Relação Anual de Informações Sociais* - Annual Social Information Report) is an administrative record that collects annual data on formal employment and is essential for analyzing the labor market (RAIS - Ministério do trabalho, 2020).

<sup>30</sup> CAGED (*Cadastro Geral de Empregados e Desempregados* - General Register of Employed and Unemployed) is a Brazilian registry that tracks movements in the labor market, recording the hiring and dismissal of workers (CAGED - Ministério do trabalho, 2020).

The microdata was collected via the federal government's FTP server (RAIS + CAGED - Ministério do trabalho, 2022), allowing access to company admissions and dismissals. The annual volume of data, shown in Table 4, describes the information collected by occupation in each firm registered in the city of São Paulo. This approach made it easier to determine the number of professionals, classified by the Brazilian Classification of Occupations (CBO), working in certain districts of São Paulo. Section 4.3 Occupation will cover the reasoning behind the extraction and processing of occupation data, including its alignment with the American classification, a necessary step in order to use the Dingel and Nieman (Dingel & Neiman, 2020) methodology.

*Table 4: Volume of data on all companies registered for admissions and dismissals in the state of São Paulo*

Year	Number of registers on RAIS	Published on <sup>31</sup>
2022	22.380.833	18/03/2024
2021	20.226.372	18/11/2022
2020	18.888.463	21/10/2022
2019	19.207.029	21/10/2022
2018	18.942.186	21/10/2022

## 4.1 Web Scraping

### Context of the Web Archive

The objective to analyze real estate price dynamics in São Paulo, Brazil, from 2018 to 2022, required an extensive data collection effort from Viva Real, Brazil's largest real estate advertising website. The study's temporal scope necessitated access to historical data, a challenge addressed by utilizing the Wayback Machine. This digital archive, which stores web page snapshots over time, became an invaluable resource for retrieving past real estate advertisements.

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<sup>31</sup> The RAIS contains detailed information about the workers of the employers. Typically, this report is submitted from January to March, and it refers to the previous year (RAIS - Ministério do trabalho, 2020).

## Initial Challenges in Data Collection

The use of web scraping began with the Chrome extension Web Scraper, the method shown in Figure 9, inspired by the methodology described in "Web-scraping housing prices in real-time: The Covid-19 crisis in the UK", by (Bricongne, et al., 2022). This study demonstrated the potential of Web Scraper for collecting real-time data on residential real estate prices, suggesting a promising approach for capturing historical data on real estate listings. Web Scraper's point-and-click interface offered a seemingly simple solution for defining and executing data extraction tasks directly in the browser, ideal for capturing text, links, and images from web pages in real time.

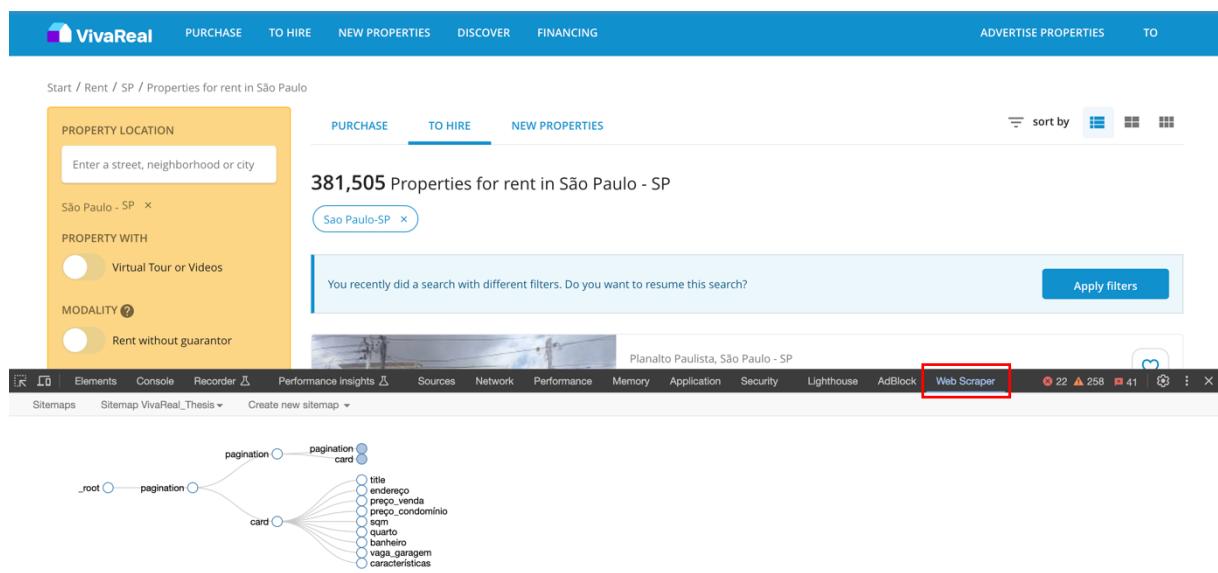


Figure 9: How the google chrome web scraper extension looks like

However, applying Web Scraper to pages archived by the Wayback Machine, we faced notable limitations, especially in the management of dynamic URLs, which are common in web archives. These URLs, which are crucial for accessing historical versions of web pages, presented a complex navigation challenge for which Web Scraper was not fully prepared. Specifically, in the context of the Wayback Machine, these URLs are often accessed via modals, as illustrated in Figure 10. This access

approach proved to be a significant obstacle for the Chrome extension, which demonstrated major difficulties in executing them effectively.

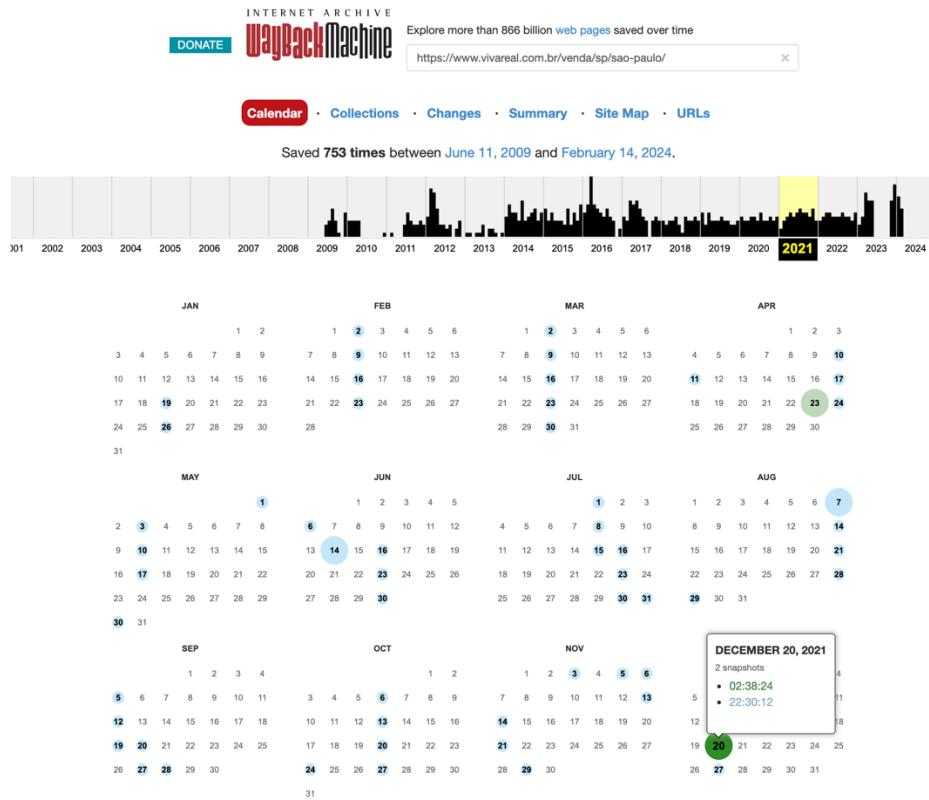


Figure 10: Locating hyperlinks in the days on the Wayback Machine website

## Transition to R Script Development

Given the difficulties encountered with the web scraper, efforts were directed toward developing a script in R. This strategy aimed to take advantage of the capabilities of the web scraping libraries available in R, such as "rvest", to process and analyze HTML content. However, when attempting to extract content rendered by JavaScript and encountering the complexity of dynamic URLs specific to the Wayback Machine, we encountered the limitations of R in performing web extraction tasks beyond the confines of static HTML contexts.

In addition, the need for individualized interactions on each page, coupled with a high number of requests, often resulted in sites being blocked due to exceeding response time limits (timeouts). Code 8 in the appendix is the version of the code used in R.

## Customized JavaScript Solution

The culmination of this data collection journey was the development of a custom JavaScript solution that directly addressed the challenges identified in the early stages. This solution involved creating year-specific scripts to navigate the evolving structure of Viva Real's website and ensure accurate and efficient data extraction.

The appendix contains a list of the codes that correspond to the main features (Code 9), cache (Code 10), and particular records over the years. Between 2018 and 2019, the Viva Real website experienced a comprehensive front-end redesign, difference shown in Code 11 and Code 12. This substantial overhaul necessitated critical adjustments to the scraping code to maintain its functionality and ensure efficient data extraction from the updated website structure.

The necessity for yearly customization presented a unique challenge, transforming what could have been a straightforward scraping task into a complex coding endeavor. Each year's website update required a fresh analysis and a new script, demanding:

- Flexibility: Adaptation to the shifting digital landscape of the Viva Real website required a flexible, problem-solving approach, ready to tackle unforeseen challenges;
- Technical Proficiency: A deep understanding of web development practices and scripting was essential, as was the ability to quickly learn and apply new techniques to overcome the peculiarities of each year's website structure;
- Innovation: The development of each script was an exercise in innovation, finding novel ways to interact with the website's code to extract needed data efficiently.

This JavaScript-based approach dramatically improved data collection speed, accuracy, and reliability, setting a new standard for web scraping efficiency. The project's evolution from using Web Scraper, through R scripting, to developing a bespoke JavaScript solution illustrates the iterative nature of digital research

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methodologies and the critical role of adaptability and technical skill in overcoming web scraping challenges.

## 4.2 Geocoding Addresses

The subsequent phase of the research methodology focused on the geocoding of addresses, an essential step for the spatial analysis and mapping of the geographical distribution of real estate ads in São Paulo. This process involved converting street addresses into geographical coordinates (latitude and longitude) to allow for a detailed spatial analysis of property prices in different neighborhoods, as well as calculating the distance of the ad address from the central business district (CBD).

### Utilizing Google Sheets for Address Preparation

The initial stage of geocoding involved compiling a comprehensive list of property addresses collected during the web scraping phase. These addresses, often in unformatted and varied structures due to the diverse listing formats on Viva Real, were consolidated into a Google Sheets document, shown in Table 5. This approach facilitated the organization and preliminary cleaning of the data, preparing it for the geocoding process.

Table 5: Data collected using the web scraping code (Code 9 to Code 12); Source: vivareal.com; Author: Own authorship

link	date	title	address	area	rooms	suite	bathrooms	garage	price	condo	zone	district	characteristics	createdAt	gym	field	elevator	furnished	swimming pool
https://web.archive.org/web/20180105/https://www.vivareal.com.br/a luguel/sp/sao-paulo/?pagina=2	2018-01-05	Apartamento com 2 Quartos para Aluguel, 60m <sup>2</sup>	Vila Madalena, São Paulo - SP	60	2	0	2	1	1850	611	Zona Oeste	Vila Madalena	["Academia","Segurança 24h","Elevador","Playground","Piscina","Sacada","Interfone"]	2023-07-25-21:53:38	1	0	1	0	1
https://web.archive.org/web/20180105/https://www.vivareal.com.br/a luguel/sp/sao-paulo/?pagina=3	2018-01-05	Apartamento com 2 Quartos para Aluguel, 65m <sup>2</sup>	Avenida Santa Marina, 1588 - Água Branca, São Paulo - SP	65	2	-	2	1	2200	-	-	-	["Perto de vias de acesso","Perto de shopping center","Próximo a hospitais","Garamgem","Lavanderia","Cozinha"]	2023-07-25-21:53:41	0	0	0	0	0
https://web.archive.org/web/20180105/https://www.vivareal.com.br/a luguel/sp/sao-paulo/	2018-01-05	Apartamento com Quarto para Aluguel, 50m <sup>2</sup>	9 de Julho, 1510 - Bela Vista, São Paulo - SP	50	1	0	1	1	1300	440	-	VivaReal	["Perto de vias de acesso","Perto de shopping center","Próximo a hospitais","Garamgem","Lavanderia","Cozinha"]	2023-07-25-21:53:34	0	0	0	0	0
https://web.archive.org/web/20180105/https://www.vivareal.com.br/a luguel/sp/sao-paulo/?pagina=3	2018-01-05	Apartamento com Quarto para Aluguel, 40m <sup>2</sup>	9 de Julho, 1510 - Bela Vista, São Paulo - SP	40	1	-	1	1	1200	-	-	-	["Segurança 24h","Condomínio fechado","Quadrada","Poliesportiva","Elevador","Playground","Interfone","Academia","Sala de festas","Perto de vias de acesso"]	2023-07-25-21:53:41	0	0	0	0	0
https://web.archive.org/web/20180105/https://www.vivareal.com.br/a luguel/sp/sao-paulo/	2018-01-05	Apartamento com 2 Quartos para Aluguel, 48m <sup>2</sup>	Rua Rui de Moraes Apocalipse, 312 - Jardim Do Tiro, São Paulo - SP	48	2	0	1	1	800	360	Zona Norte	Jardim Do Tiro	["Segurança 24h","Condomínio fechado","Quadrada","Poliesportiva","Elevador","Playground","Interfone","Academia","Sala de festas","Perto de vias de acesso"]	2023-07-25-21:53:34	1	1	1	0	0

## Implementing Google Maps API for Geocoding

To convert the unformatted addresses into standardized geographic coordinates, we employed the Google Maps API, renowned for its accuracy and extensive geographic database. Inspired by a technique detailed in "Google Maps & Google Sheets" by Amit Agarwal a Google Developer, a script was developed directly within Google Sheets to interact with the Google Maps API, shown in Code 13 in the appendix. This script automated the fetching of geocoded data for each address, including the standardized address format and the corresponding latitude and longitude.

The script made API calls for each address listed in the Google Sheets, retrieving the geocoded information, and populating adjacent cells with the structured address, latitude, and longitude. This automated process significantly streamlined the geocoding step, eliminating the need for manual data entry and ensuring consistency in the geocoded results.

	A	B	C	D	E	F	G	M
1	Address	Google_Address	Lat	Lng				
2	Avenida Santa Marina, 1588 - Água Branca, São Paulo - SP	=GOOGLEMAPS_FULL_ADDRESS(A2)	-23,5114256	-46,6929828				
3	9 de Julho, 1510 - Bela Vista, São Paulo - SP		23,5568432	-46,6522183				
4	9 de Julho, 1510 - Bela Vista, São Paulo - SP		23,5568432	-46,6522183				
5	Rua Rui de Moraes Apocalipse, 312 - Jardim Do Tiro, São Paulo - SP		-23,4723805	-46,6857685				
6	Avenida Corifeu de Azevedo Marques, 1284 - Butantã, São Paulo - SP		23,5736973	-46,7265643				
7	Rua Índio Peri, 54 - Jardim Peri, São Paulo - SP		23,4646426	-46,6540515				
8	Vila Nova Cachoeirinha, São Paulo - SP		-23,4722961	-46,6596712				
9	Rua Vinte e Dois de Agosto - Vila Nova Cachoeirinha, São Paulo - SP		23,4691287	-46,6591937				
10	Rua Gabriele D'Annunzio, 1432 - Campo Belo, São Paulo - SP		-23,6272528	-46,6712602				
11	Rua Tebas, 296 - Vila Mascote, São Paulo - SP		-23,63923	-46,6662781				
12	Rua Benjamin Costa, 34 - Jardim Aeroporto, São Paulo - SP		-23,6340008	-46,6661426				
13	Rua Celso Ramos, 280 - Vila Andrade, São Paulo - SP		-23,6265412	-46,7461728				
14	Rua Raul dos Santos Machado, 10 - Jardim Paris, São Paulo - SP		-23,6410256	-46,7709438				
15	Campo Limpo, São Paulo - SP		-23,6347959	-46,7549902				
16	Estrada dos Mirandas, 505 - Jardim Maria Duarte, São Paulo - SP		-23,6172127	-46,7520675				
17	Rua José Pereira Bueno - Vila Franca, São Paulo - SP		-23,6369051	-46,7476865				
18	Estrada do Campo Limpo, 5785 - Campo Limpo, São Paulo - SP		-23,6281094	-46,7674178				
19	Avenida Rubens Fraga de Toledo Arruda, 1000 - Engenheiro Goulart, São Paulo - SP		-23,4966038	-46,5119987				
20	Estrada de Itapecerica, 6575 - Capão Redondo, São Paulo - SP		-23,6710977	-46,7862302				
21	Rua Embaixadora Dora de Vasconcelos, 403 - Jardim Martiní, São Paulo - SP		-23,6777649	-46,6686001				
22	Rua Igarapé Águia Azul, 258 - Conjunto Habitacional Santa Etelvina II, São Paulo - SP		-23,593027	-46,408863				
23	Rua Bela Cintra, 521 - Consolação, São Paulo - SP		-23,5533118	-46,6573872				

Figure 11: Created function on Google Sheets using the Amit Agarwal technique to output the latitude and longitude

This geocoding phase not only facilitated the spatial representation of the real estate data but also laid the groundwork for in-depth geographic analysis. By leveraging

Google Sheets and the Google Maps API, we efficiently transformed raw addresses into valuable geospatial data, ready for mapping and analysis.

Once the latitudes and longitudes of each address were obtained, the distances between the advertised addresses and the CBD, as well as the distances to the metro stations, were calculated. These distances were computed using Excel, employing the Haversine formula as described in equation 4.1.

Once the latitudes and longitudes of each address were obtained, the distances between the advertised addresses and the CBD<sup>32</sup>, as well as the distance to the metro stations<sup>33</sup>, were calculated. These distances were computed using Excel, employing the Haversine formula as described in Equation 4.1.

$$d = r \cdot \cos^{-1} (\cos(90^\circ - \phi_1) \cdot \cos(90^\circ - \phi_2) + \sin(90^\circ - \phi_1) \cdot \sin(90^\circ - \phi_2) \cdot \cos(\Delta\lambda)) \quad (4.1)$$

Where:

- $d$  is the distance between two points (in km)
- $r$  is the Earth's radius (approximately 6.371 km)
- $\phi_1$  and  $\phi_2$  are the latitudes of the points (in radians)
- $\Delta\lambda$  is the difference between the longitudes of the two points (in radians)

## **Removal of duplicate and contaminated data**

The dataset contained multiple entries for some properties, reflecting the common practice of listing a single property across different ads or platforms. To ensure the

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<sup>32</sup> The Faria Lima area was selected as São Paulo's financial center due to its concentration of large financial institutions, corporate headquarters, and intense economic activity. The geographical center point was defined by the coordinates (-23,5904830; -46,6813220).

<sup>33</sup> The coordinates of the metro stations were obtained from the city's website (Prefeitura SP, 2018)

accuracy of the spatial analysis, it was imperative to remove these duplicates and contaminated data.

A built-in function within Google Sheets was utilized to identify and eliminate duplicate entries based on the standardized addresses and geocoded coordinates. This cleansing step was crucial for maintaining the integrity of the dataset, ensuring that each property was represented uniquely in the subsequent analysis.

When data were found to be contaminated, a manual removal was performed in cases where there was no apparent rationale. For instance, an apartment with a surface area of 42 m<sup>2</sup> was found to have a total of five bathrooms. The characteristics verified included the number of bathrooms, the number of bedrooms, the number of garage spaces, the abnormally low/high price, and the areas involved. Furthermore, all cases lacking intrinsic property characteristics, such as price, area, number of bedrooms, and number of bathrooms, were excluded.

### 4.3 Occupation

The objective of this topic is to identify the principal occupations offered in each district of São Paulo and to quantify the potential for remote work in these regions. In order to replicate the techniques of Dingel & Neiman (2020) and Barbosa Filho et al. (2022) for São Paulo city districts, logical steps are required, which are presented above.

1. Replicate Barbosa Filho et al.'s technique for São Paulo, utilizing remote work data from *PNAD COVID* and minimum working conditions data from *PNAD Contínua*, to generate a “teleworkability” score for each occupation on the COD's classification;

2. Use *RAIS* and *New CAGED* data to identify *CBO*'s occupations and their respective average remuneration in each district of São Paulo;
3. Associate remote work data with the districts using a conversion table between the *CBO* and *COD* classifications, thus providing a “teleworkability” score for each region.

The following sections will provide a comprehensive account of each step, accompanied by a detailed explanation and step-by-step instructions.

## Replicating the technique of Barbosa Filho et al.

In order to quantify the potential for remote work for each occupation classified in the *COD*, it was first necessary to replicate the technique presented in section 2.2 Work From Home (WFH) Classification for the professional market in São Paulo. For this, the results table from Dingel & Neiman (2020), specifically Table 18 in the appendix, was used, and a connection was established with the conversion table from Barbosa Filho et al. (2022), as shown in Table 19. The following SQL code, Code 1, performs this analysis. First, the occupation code and title are selected according to the *PNAD Continuous* classification from the Barbosa Filho conversion table. The AVG function is used to calculate the average of the teleworkable variable, which indicates the potential for remote work for each occupation. This process is analogous to the weighting logic utilized in Equation 2.14.

The query performs a LEFT JOIN between the Barbosa Filho conversion table (BF) and the Dingel & Neiman telework table (D), using the O\*NET-SOC 2010 code as the join key. Additionally, a filter (WHERE D.teleworkable IS NOT NULL) is applied to consider only records where the remote work potential is defined. The results are then grouped (GROUP BY) by the occupation code and title in the *PNAD Continuous* classification to calculate the average remote work potential for each group.

The code is structured as follows:

*Code 1: SQL query that calculates the average teleworkability for each PNAD Contínua code; Author: Own authorship in SQLite*

```
SELECT BF."PNAD CONTÍNUA _ COD(CÓDIGO)",
       BF."PNAD CONTÍNUA _ COD(TÍTULO)",
       AVG(D.teleworkable) AS avg_teleworkable
  FROM BF_conversion_table BF
    LEFT JOIN main.DN_ONET_Teleworkable D ON BF."O*NET-SOC 2010 (CÓDIGO)" = D."onetsoccode"
 WHERE D.teleworkable IS NOT NULL
GROUP BY BF."PNAD CONTÍNUA _ COD(CÓDIGO)",
         BF."PNAD CONTÍNUA _ COD(TÍTULO)";
```

For each COD classification, a one-to-many connection was established with the O\*Net classification, and then a grouping was performed to achieve uniqueness concerning the COD classifications. This resulted in an average value of remote work potential for the respective occupations in the COD, as indicated in Table 6. This value provides a representative measure of the capability for each analyzed occupation.

*Table 6: First rows of the output from Code 1; Source: (IBGE | PNAD Contínua, 2022) and (Dingel & Neiman, 2020); Author: Own authorship*

COD (CODE)	COD (TITLE)	Avg. Teleworkable
1112	Dirigentes superiores da administração pública	0,75
1114	Dirigentes de organizações que apresentam um interesse especial	0,90
1211	Dirigentes financeiros	1,00
1212	Dirigentes de recursos humanos	1,00
1219	Dirigentes de administração e de serviços não classificados anteriormente	0,75
1221	Dirigentes de vendas e comercialização	1,00
1222	Dirigentes de publicidade e relações públicas	1,00
1223	Dirigentes de pesquisa e desenvolvimento	0,80
1311	Dirigentes de produção agropecuária e silvicultura	0,00
1321	Dirigentes de indústria de transformação	0,00
1323	Dirigentes de empresas de construção	0,00
1324	Dirigentes de empresas de abastecimento, distribuição e afins	0,67

After replicating the methodology of Dingel & Neiman (2020), an adaptation was made regarding the minimum structural conditions required for remote work. For this purpose, the questionnaire from the first interview of the *PNAD Contínua* was used. It is important to note that the *PNAD Contínua* is conducted multiple times a year, on a quarterly basis, with five distinct questionnaires.

The responses from the first interview's questionnaire in the city of São Paulo were obtained through an R repository provided by the public server (Gabriel Assunção, 2024) from the Brazilian Institute of Geography and Statistics (IBGE). The data for each

question used to ensure the minimum conditions for remote work were extracted from this repository for all four quarters of the years 2018, 2019, 2020, 2021, and 2022. The following code, Code 2, generates this extraction:

*Code 2: R code to retrieve and filter 2022 PNAD Contínua data for São Paulo city; Author: Own authorship in R*

```
install.packages("PNADcIBGE")
library(PNADcIBGE)

dados <- get_pnadc(year = 2022, interview = 1)
dados_tabela_completa <- dados$variables

tabela_reduzida <- dados_tabela_completa %>% select(Ano, Trimestre, UF, Capital, S01015, S01028,
S01029, V4010)
pnad_continua_2022I1 <- tabela_reduzida %>% filter(UF == "São Paulo", Capital == "Município de São
Paulo (SP)")
```

The code initiates the installation and loading of the *PNADcIBGE* package, which provides access to *PNAD Contínua* data. Subsequently, the data pertaining to the 1<sup>st</sup> interview in each of the five years under consideration was used to illustrate the retrieval process via the *get\_pnadc* function, which was applied to the 2022 example. The complete dataset is stored in the *dados\$variables* object. A reduced table is created by selecting specific columns that are pertinent to the study. The variables included in the dataset are Ano (Year), Trimestre (Quarter), UF (Federative Unit), Capital (Capital City), and specific survey questions (S01015, S01028, S01029, V4010). Finally, the data is filtered to include only responses from São Paulo's municipality. The extracted data is of paramount importance for the assessment of the minimal conditions required for remote work in São Paulo.

A table analogous to Table 7 was thus generated for each year. The aforementioned tables were utilized to delineate the minimal requirements for each COD occupation across the five-year period under investigation.

Code 3 performs an analysis of the minimum conditions for remote work, combining data from different years. First, its unions the tables from each year (2018 to 2022) containing the data from the first interview of PNAD Contínua. The code then selects the year, quarter, and occupation code (V4010) from each record.

Table 7: First rows of the 2018 data from the initial interview of the PNAD Contínua; Source: (IBGE | PNAD Contínua, 2022); Author: Own authorship

Year	Quarter	UF	Capital	S01015	S01028	S01029	V4010
2018	2	São Paulo	Município de São Paulo (SP)	Diária, em tempo integral	Não	Não	NA
2018	2	São Paulo	Município de São Paulo (SP)	Diária, em tempo integral	Sim	Sim	NA
2018	2	São Paulo	Município de São Paulo (SP)	Diária, em tempo integral	Sim	Sim	NA
2018	2	São Paulo	Município de São Paulo (SP)	Diária, em tempo integral	Sim	Sim	2411
2018	2	São Paulo	Município de São Paulo (SP)	Diária, em tempo integral	Sim	Sim	NA
2018	2	São Paulo	Município de São Paulo (SP)	Diária, em tempo integral	Sim	Sim	NA
2018	2	São Paulo	Município de São Paulo (SP)	Diária, em tempo integral	Sim	Sim	NA
2018	2	São Paulo	Município de São Paulo (SP)	Diária, em tempo integral	Não	Sim	5223
2018	2	São Paulo	Município de São Paulo (SP)	Diária, em tempo integral	Não	Sim	5223
2018	2	São Paulo	Município de São Paulo (SP)	Diária, em tempo integral	Não	Sim	NA
2018	2	São Paulo	Município de São Paulo (SP)	Diária, em tempo integral	Não	Sim	NA
2018	2	São Paulo	Município de São Paulo (SP)	Diária, em tempo integral	Sim	Sim	1211

Finally, specific conditions are applied to verify the presence of minimum characteristics necessary for remote work:

- S01015\_binary checks if the work is full-time daily;
- S01028\_binary checks if there is access to a computer;
- S01029\_binary checks if there is access to the internet.

Code 3: SQL query to compute binary indicators and minimum conditions for full-time work and specific responses in PNAD Contínua data; Author: Own authorship in SQLite

```

SELECT PC.Ano,
       PC.Trimestre,
       PC."V4010",
       MIN(CASE WHEN PC."S01015" = 'Diária, em tempo integral' THEN 1 ELSE 0 END) AS S01015_binary,
       MIN(CASE WHEN PC."S01028" = 'Sim' THEN 1 ELSE 0 END) AS S01028_binary,
       MIN(CASE WHEN PC."S01029" = 'Sim' THEN 1 ELSE 0 END) AS S01029_binary,
       MIN(CASE WHEN PC."S01015" = 'Diária, em tempo integral' THEN 1 ELSE 0 END)
         * MIN(CASE WHEN PC."S01028" = 'Sim' THEN 1 ELSE 0 END)
         * MIN(CASE WHEN PC."S01029" = 'Sim' THEN 1 ELSE 0 END) AS minimum_conditions
FROM (SELECT * FROM pnad_continua_2018II
      UNION ALL
      SELECT * FROM pnad_continua_2019II
      UNION ALL
      SELECT * FROM pnad_continua_2020II
      UNION ALL
      SELECT * FROM pnad_continua_2021II
      UNION ALL
      SELECT * FROM pnad_continua_2022II) PC
WHERE PC."V4010" != 'NA'
GROUP BY PC.Ano,
         PC.Trimestre,
         PC."V4010";

```

Each of these conditions is represented by a binary value (1 for yes, 0 otherwise), and the minimum condition is calculated as the product of these binary variables, ensuring that all conditions are simultaneously met.

The results, presented in Table 8, are organized by year, quarter, and occupation code (V4010), enabling a comprehensive examination of the minimum requirements for each occupation across the various time periods under investigation.

*Table 8: First rows of the output from Code 3; Source: (IBGE | PNAD Contínua, 2022); Author: Own authorship*

Year	Quarter	V4010	S01015_binary	S01028_binary	S01029_binary	Minimum Conditions
2018	1	0210	1	1	1	1
2018	1	0412	1	0	1	0
2018	1	1120	1	1	1	1
2018	1	1211	1	0	1	0
2018	1	1212	1	1	1	1
2018	1	1213	1	1	1	1
2018	1	1219	1	1	1	1
2018	1	1221	1	0	1	0
2018	1	1222	1	0	0	0
2018	1	1223	1	1	1	1

This final step quantifies the teleworkability score for each COD occupation. The process involves joining the table generated by Code 1 (Table 6 – BF\_technic) and the table generated by Code 3 (Table 8 – PNADC\_vf). The query from Code 4 selects the year, quarter, and occupation code (V4010) from the PNADC\_vf table, along with the occupation title from the BF\_technic table.

*Code 4: Calculates average teleworkability, minimum conditions, and a teleworkable score for PNAD Contínua data by year, quarter, and code; Author: Own authorship in SQLite*

```
SELECT PNADC_vf.Ano,
       PNADC_vf.Trimestre,
       PNADC_vf."V4010",
       BF_technic."PNAD CONTÍNUA _COD(TÍTULO)",
       round(AVG(BF_technic.avg_teleworkable), 3) AS avg_teleworkable,
       MIN(PNADC_vf.minimum_conditions) AS minimum_conditions,
       round(AVG(BF_technic.avg_teleworkable) * MIN(PNADC_vf.minimum_conditions), 3) AS teleworkable_score
  FROM BF_technic
    LEFT JOIN PNADC_vf ON BF_technic."PNAD CONTÍNUA _ COD(CÓDIGO)" = PNADC_vf."V4010"
 WHERE V4010 IS NOT NULL
 GROUP BY PNADC_vf.Ano, PNADC_vf.Trimestre, PNADC_vf."V4010";
```

The average teleworkability (avg\_teleworkable) is calculated and rounded to three decimal places. The minimum conditions for remote work (minimum\_conditions) are determined using the MIN function. The final teleworkability score (teleworkable\_score) is computed by multiplying the average teleworkability by the minimum conditions and rounding the result to three decimal places.

The data is organized by year, quarter, and occupation code to facilitate a comprehensive analysis of the potential for remote work across different periods for each occupation (Table 9). This approach ensures a comprehensive understanding of the teleworkability for each profession, integrating both the average teleworkability and the structural conditions required for remote work.

*Table 9: Final score of the teleworking capacity of each occupation for each quarter from 2018 to 2022 in the COD replicating the Barbosa Filho technique; Source: (IBGE | PNAD Contínua, 2022); Author: Own authorship*

Year	Quarter	V4010	COD (Title)	Average Teleworkable	Minimum Conditions	Teleworkable Score
2018	1	1211	<i>Dirigentes financeiros</i>	1,000	0,000	0,000
2018	1	1212	<i>Dirigentes de recursos humanos</i>	1,000	1,000	1,000
2018	1	1219	<i>Dirigentes de administração e de serviços não classificados anteriormente</i>	0,750	1,000	0,750
2018	1	1221	<i>Dirigentes de vendas e comercialização</i>	1,000	0,000	0,000
2018	1	1222	<i>Dirigentes de publicidade e relações públicas</i>	1,000	0,000	0,000
2018	1	1223	<i>Dirigentes de pesquisa e desenvolvimento</i>	0,800	1,000	0,800
2018	1	1311	<i>Dirigentes de produção agropecuária e silvicultura</i>	0,000	1,000	0,000
2018	1	1321	<i>Dirigentes de indústria de transformação</i>	0,000	1,000	0,000
2018	1	1323	<i>Dirigentes de empresas de construção</i>	0,000	1,000	0,000
2018	1	1324	<i>Dirigentes de empresas de abastecimento, distribuição e afins</i>	0,667	1,000	0,667

## Districts and their main occupations

With the data from RAIS + CAGED (RAIS + CAGED - Ministério do trabalho, 2022), it is possible to associate CBO occupations with the districts of São Paulo through records of hires and dismissals of professionals. For this purpose, an SQLite code, Code 5, will be used, which performs the following operation:

*Code 5: Aggregates average salary, occupation, district data, and the total number of professionals from São Paulo;  
Author: Own authorship in SQLite*

```

SELECT r."CBO Ocupação 2002" AS "id CBO 2002",
       round(avg("Vl Remun Média Nom"), 2) AS "Salario medio",
       max(o.name) AS "CBO Ocupação 2002",
       r."Distritos SP" AS "id Distritos SP",
       max(d.code) AS "Distritos SP",
       count(*) - sum(CASE WHEN r."Mês Desligamento" > 0 THEN 1 ELSE 0 END) AS "total de
profissionais"
FROM rais_vinc_pub_sp_2019 r
JOIN city_lkup c ON r.Município = c.id AND r.Município = 355030 /*Identificador do
município de São Paulo capital*/
LEFT JOIN district_lkup d ON r."Distritos SP" = d.id
JOIN occupations.cbo_lkup o ON r."CBO Ocupação 2002" = o.id
WHERE "Vl Remun Média Nom" > 0 AND "Distritos SP" IS NOT NULL
GROUP BY r."CBO Ocupação 2002", r."Distritos SP" ORDER BY "Distritos SP", "CBO Ocupação 2002";

```

This code analyzes the CBO occupations in relation to the districts of São Paulo, using data from RAIS and CAGED. It selects the occupation code according to CBO 2002 (r."CBO Ocupação 2002"), calculates the average nominal remuneration rounded to two decimal places (round(avg("Vl Remun Média Nom"), 2)), and retrieves the occupation name from the occupations lookup table (max(o.name)). It also identifies the district of São Paulo (r."Distritos SP"), retrieves the district code from the districts lookup table (max(d.code)), and calculates the total number of professionals, subtracting those who were dismissed in the month (count(\*) - sum(CASE WHEN r."Mês Desligamento" > 0 THEN 1 ELSE 0 END)).

The query joins the rais\_vinc\_pub\_sp\_2019 table (r) with the city\_lkup table (c) to filter data for the municipality of São Paulo, identified by the code 355030. A LEFT JOIN is performed with the district\_lkup table (d) to obtain information about the districts. The occupations.cbo\_lkup table (o) is joined to obtain the occupation names. Only records with a nominal remuneration value greater than 0 and non-null districts are included in the analysis.

Finally, the results are grouped by CBO 2002 occupation and São Paulo district, allowing for a detailed analysis of average salaries and the number of professionals in each district over the years. The results are presented in a structured and organized manner, with each district and occupation listed in a specific order, as indicated in the Table 10.

Table 10: Number of professionals by CBO occupation in each district of the city of São Paulo; Source: (RAIS + CAGED - Ministério do trabalho, 2022); Author: Own authorship

<i>id CBO 2002</i>	<i>Avg Wage</i>	<i>CBO Ocupação 2002</i>	<i>id District SP</i>	<i>District SP</i>	<i># professionals</i>
716105	1576,14	<i>Acabador de Superfícies de Concreto</i>	5	A ALVIM	1
848510	1868,20	<i>Acougueiro</i>	5	A ALVIM	94
252105	2186,78	<i>Administrador</i>	5	A ALVIM	21
241005	3041,15	<i>Advogado</i>	5	A ALVIM	3
721315	2423,55	<i>Afiador de Ferramentas</i>	5	A ALVIM	4
352310	1600,00	<i>Agente Fiscal de Qualidade</i>	5	A ALVIM	0
351315	1500,00	<i>Agente de Recrutamento e Selecao</i>	5	A ALVIM	1
352210	1214,96	<i>Agente de Saude Publica</i>	5	A ALVIM	14
517310	3993,59	<i>Agente de Segurança</i>	5	A ALVIM	2
354120	1465,98	<i>Agente de Vendas de Servicos</i>	5	A ALVIM	5
354815	1769,54	<i>Agente de Viagem</i>	5	A ALVIM	0
763125	1133,77	<i>Ajudante de Confecção</i>	5	A ALVIM	17
783225	1575,38	<i>Ajudante de Motorista</i>	5	A ALVIM	28
741105	4150,88	<i>Ajustador de Instrumentos de Precisao</i>	5	A ALVIM	1
763005	2648,22	<i>Alfaiaite</i>	5	A ALVIM	1

## Scoring of districts' remote working capacity

As previously stated, the data for the districts of São Paulo City, employing the methodology of Dingel & Neiman (2020) with adjustments by Barbosa Filho et al. (2022), are associated with the Classification of Occupations for Household Surveys (COD), while the occupations practiced in each district are related to the Brazilian Classification of Occupations (CBO). To elucidate the respective roles of each, a concise delineation of their characteristics and distinctions is provided below.

The Classification of Occupations for Household Surveys (COD) is a simplified and aggregated version of the Brazilian Classification of Occupations (CBO), which is primarily employed in household surveys such as the *PNAD Continuous*. While the CBO provides comprehensive details of occupations for formal and administrative purposes, the COD groups these occupations into broader categories, facilitating data collection and analysis in household surveys.

To assess a district's capacity to facilitate remote work opportunities in the occupational sectors present within its boundaries, a straightforward conversion table

between O\*Net and the CBO would be sufficient. However, this approach does not consider the minimum conditions required for remote work. Consequently, it is essential to utilize data from the *PNAD Contínua*, which are expressed in occupations classified under the COD.

To perform this calculation, it is necessary to go a step beyond the conversion table used by Barbosa Filho, as expressed in Figure 1, by adding the CBO as a final conversion step. This necessitated the translation of the CBO to the ISCO-08 in order to establish a relationship between all the requisite classifications. This step was highly labor-intensive, necessitating consultations with professionals from a range of fields, including engineering, medicine, law, and design.

Once the conversion between the COD and the CBO had been established, the level of remote workability was calculated for each district on a quarterly basis. Each district presented a number of occupations with the respective number of professionals engaged in each. For each occupation, a level of teleworkability was assigned. The final calculation of the level of teleworkability for a district in a given quarter of the year is a weighted average. The average is calculated by multiplying the number of professionals by the teleworkability level of the given occupation and dividing the result by the total number of professionals in the district, as illustrated in Equation 4.2.

$$L_D^{QY} = \frac{\sum_1^n (N_{p_n}^{QY} \cdot T_{O_n}^{QY})_n}{\sum_1^n N_{p_n}^{QY}} \quad (4.2)$$

Where:

- $L_D^{QY}$  level of teleworkability in a district ( $D$ ) in a quarter of the years studied ( $QY$ )
- $N_{p_n}^{QY}$  number of professionals in an occupation ( $p_n$ ) in the district analyzed in a quarter of the years studied ( $QY$ )
- $T_{O_n}^{QY}$  teleworkability of an occupation ( $O_n$ ) in a quarter of the years studied ( $QY$ )
- $n$  number of occupations in a district

Due to the limitations of the available data, some simplifying assumptions must be made. The following assumptions were made:

- For all districts, the level of teleworkability for a given occupation in specific quarter will be the same;
- In the event that data is unavailable for a given occupation, it will be excluded from the respective quarters;
- In the event that an occupation has no professionals, it will be considered to have a null potential for teleworkability.

The Code 6 employs the methodology described in Equation 4.2. The objective is to calculate the teleworkability values for each district in São Paulo, with a weighted average of the teleworkable score for each district, considering the number of professionals per occupation as the weight, over the period from 2018 to 2021. Furthermore, the simplifying assumptions were considered.

*Code 6: Calculates teleworkability in São Paulo districts by year and quarter; Author: Own authorship in SQLite*

```

SELECT "Distritos SP",
       Ano,
       Trimestre,
       sum(cast("total de profissionais" as integer))           AS total_de_profissionais,
       round(avg(cast(teleworkable_score as real)), 3)          AS avg_teleworkable_score,
       round(sum(cast("total de profissionais" as integer) * cast(teleworkable_score as real)) /
             sum(cast("total de profissionais" as integer)), 3)   AS weighted_avg_teleworkable_score
FROM (SELECT teleworkable_score_COD."Ano",
            teleworkable_score_COD."trimestre",
            final_translator."CBO CÓDIGO",
            final_translator."CBO TÍTULO",
            final_translator."PNAD CONTÍNUA _ COD(CÓDIGO)",
            final_translator."PNAD CONTÍNUA _ COD(TÍTULO)",
            CBO."Distritos SP",
            CBO."total de profissionais",
            teleworkable_score_COD."teleworkable_score"
        FROM (SELECT *
              FROM CBO_2018_Distritos
              UNION ALL
              SELECT *
              FROM CBO_2019_Distritos
              UNION ALL
              SELECT *
              FROM CBO_2020_Distritos
              UNION ALL
              SELECT *
              FROM CBO_2021_Distritos) AS CBO
              LEFT JOIN final_translator ON CBO."id CBO 2002" = final_translator."CBO CÓDIGO"
              LEFT JOIN teleworkable_score_COD
                     ON final_translator."PNAD CONTÍNUA _ COD(CÓDIGO)" =
                     teleworkable_score_COD."V4010" AND
                     teleworkable_score_COD."Ano" = CBO."Year"
              WHERE final_translator."CBO CÓDIGO" IS NOT NULL
                AND CBO."total de profissionais" > 0) t
WHERE Ano IS NOT NULL
GROUP BY "Distritos SP", Ano, Trimestre
ORDER BY "Distritos SP", Ano, Trimestre;

```

The results of this query will be presented in tabular format, with the teleworkability scores for each district across different years and quarters detailed. Table 11 provides a clear and structured representation of the data, facilitating straightforward comparisons and analyses of the teleworkability levels in various districts over time.

*Table 11: Teleworkability by districts in quarters of 2018 to 2021; Source: (RAIS + CAGED - Ministério do trabalho, 2022) and (IBGE | PNAD Contínua, 2022); Auhtor: Ow authorship*

District SP	Year	Quarter	Total of profissionals	Avg. Teleworkable Score	Weighted Avg. Teleworkable Score
A Alvim	2018	1	3684	0,233	0,067
A Alvim	2018	2	3530	0,186	0,135
A Alvim	2018	3	3280	0,214	0,181
A Alvim	2018	4	3723	0,239	0,19
A Alvim	2019	1	3584	0,167	0,158
A Alvim	2019	2	3193	0,223	0,183
A Alvim	2019	3	3154	0,225	0,165
A Alvim	2019	4	3580	0,257	0,116
A Alvim	2020	1	3000	0,163	0,176
A Alvim	2020	2	2956	0,217	0,191
A Alvim	2020	3	2658	0,212	0,181
A Alvim	2020	4	3045	0,261	0,114
A Alvim	2021	1	3324	0,172	0,067
A Alvim	2021	2	3029	0,194	0,118
A Alvim	2021	3	3264	0,251	0,193
A Alvim	2021	4	3376	0,239	0,232
A Rasa	2018	1	23936	0,226	0,049
A Rasa	2018	2	24804	0,279	0,144
A Rasa	2018	3	22695	0,231	0,161
A Rasa	2018	4	26798	0,264	0,172
A Rasa	2019	1	24612	0,201	0,179
A Rasa	2019	2	21272	0,225	0,154
A Rasa	2019	3	22417	0,250	0,177
A Rasa	2019	4	24092	0,259	0,140
A Rasa	2020	1	23339	0,199	0,156
A Rasa	2020	2	20139	0,220	0,134
A Rasa	2020	3	20812	0,249	0,149
A Rasa	2020	4	22826	0,233	0,120
A Rasa	2021	1	24200	0,204	0,060
A Rasa	2021	2	23836	0,184	0,114
A Rasa	2021	3	21217	0,201	0,142
A Rasa	2021	4	24115	0,270	0,147
Anhanguera	2018	1	1367	0,198	0,076
Anhanguera	2018	2	1414	0,266	0,243
Anhanguera	2018	3	1221	0,175	0,115
Anhanguera	2018	4	1377	0,260	0,239
Anhanguera	2019	1	1631	0,269	0,196
Anhanguera	2019	2	1736	0,227	0,148

Subsequently, the results of the potential remote work for districts will be presented in maps, Figure 12, employing the technique of yearly grouping. This approach will facilitate the straightforward and transparent spatial correlation of the values with the districts of São Paulo.

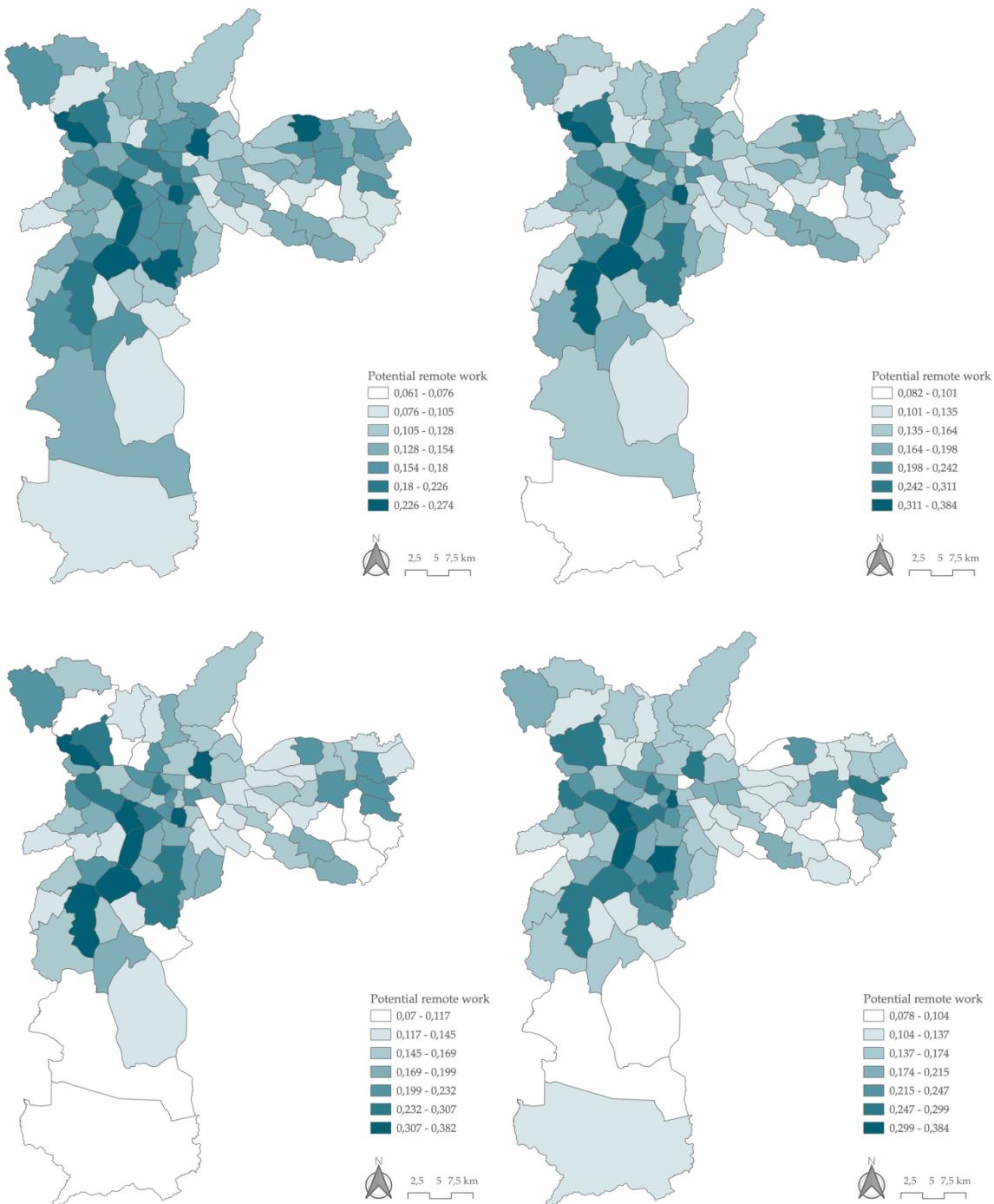


Figure 12: Potential remote work by districts of São Paulo: 2018 (top left), 2019 (top right), 2020 (bottom left), and 2021 (bottom right); Source: (RAIS + CAGED - Ministério do trabalho, 2022) and (IBGE | PNAD Contínua, 2022); Authorship: Own authorship

## 4.4 District Performance

The methodology employed by *Rede Nossa São Paulo* (2023) to evaluate the overall performance of districts was based on each district's ranking across various indicators. Points were assigned according to the district's relative position. The district with the highest score for a given indicator received 96 points, the second-highest received 95 points, and so on, down to the district with the lowest score, which received 1 point. In instances where two or more districts exhibited identical scores, their respective points were averaged. The final measure of overall district performance was calculated by summing all the points and dividing by the number of indicators for which data was available.

In order to apply the methodology across all years, it was necessary to identify indicators that were common to the periods under study. All indicators that were consistently present from 2018 to 2022, as provided by *Rede Nossa São Paulo*, were subjected to analysis. The results of this analysis led to the selection of 16 indicators, which are presented in Table 12.

*Table 12: Social indicators selected to generate the Inequality Meter*

#	Area	2018 - 2023 Indicators Description	Proportionality
1	Culture	Number of cultural centers, houses, and cultural spaces	Proportional
2	Culture	Number of cinemas	Proportional
3	Culture	Number of public cultural facilities	Proportional
4	Human Rights	Incidents of violence against women	Inversely Proportional
5	Education	Enrollment in Basic Education in public schools	Proportional
6	Education	Waiting time for daycare spots	Inversely Proportional
7	Sports	Number of public sports facilities	Proportional
8	Housing	Proportion of households in favelas	Inversely Proportional
9	Health	Teenage pregnancy rate	Inversely Proportional
10	Health	Average age at death	Proportional
11	Health	Infant mortality rate	Inversely Proportional
12	Health	Maternal mortality rate	Inversely Proportional
13	Health	Average waiting time for primary care consultations	Inversely Proportional
14	Road Safety	Traffic fatalities	Inversely Proportional
15	Work and Income	Availability of formal employment	Proportional
16	Work and Income	Average income	Proportional

The compilation of all indicators for each year into an Excel spreadsheet enabled the use of the formula `= RANK.AVG ()` to assign scores corresponding to each indicator. For indicators that exhibited a direct proportionality, the higher the value, the higher the score, with the highest value receiving a score of 96. Conversely, for indicators that exhibited an inverse proportionality, the lower the value, the higher the score. Directly proportional indicators are associated with favorable social conditions, while inversely proportional indicators signify more precarious conditions. The results of these calculations are presented in Table 13.

*Table 13: Final score and ranking of São Paulo districts for the years 2018 to 2021 by Rede Nossa São Paulo's inequality methodology; Source: (Rede Nossa São Paulo, 2013 - 2023); Author: Own authorship*

District	Year	Score	Rank
Água Rasa	2018	54,69	26
Alto de Pinheiros	2018	61,00	17
Anhangüera	2018	47,16	50
Aricanduva	2018	49,69	40
Artur Alvim	2018	41,53	68
Barra Funda	2018	66,97	9
Bela Vista	2018	67,75	8
Belém	2018	59,06	20
Bom Retiro	2018	48,97	42

# Chapter 5

## Regression and Discussion

Once all the data has been collected and processed, it will be possible to present the obtained results and conduct a detailed critical analysis in this chapter. The study in question will employ a multicollinear regression to numerically quantify the impact of potential remote work on real estate prices in the city of São Paulo.

The multicollinear regression methodology will be employed to identify the correlation between independent variables and real estate prices, both for sale and rent. This will facilitate a more precise comprehension of the impact of remote work on the real estate market. Due to the extensive data collection, Table 14 presents the selected variables for applying the technique. These variables include price as the dependent variable and 12 independent variables.

---

Table 14: List of variables used in the regression analysis

#	Variables	Type	Source	Extraction and treatment methodology	Frequency
1	Price	Real	Vivareal.com	Web Scraping (JavaScript) + Excel	Weekly
2	Area	Real	Vivareal.com	Web Scraping (JavaScript) + Excel	Weekly
3	Condominium	Real	Vivareal.com	Web Scraping (JavaScript) + Excel	Weekly
4	Number of bedrooms	Integer	Vivareal.com	Web Scraping (JavaScript) + Excel	Weekly
5	Number of bathrooms	Integer	Vivareal.com	Web Scraping (JavaScript) + Excel	Weekly
6	Parking spaces	Integer	Vivareal.com	Web Scraping (JavaScript) + Excel	Weekly
7	Gym	Binary	Vivareal.com	Web Scraping (JavaScript) + Excel	Weekly
8	Field	Binary	Vivareal.com	Web Scraping (JavaScript) + Excel	Weekly
9	Elevator	Binary	Vivareal.com	Web Scraping (JavaScript) + Excel	Weekly
10	Furnish	Binary	Vivareal.com	Web Scraping (JavaScript) + Excel	Weekly
11	Swimming pool	Binary	Vivareal.com	Web Scraping (JavaScript) + Excel	Weekly
12	Distance from CBD	Numeric	Google API	Google Apps Script + Excel	Weekly
13	Remote work meter	Numeric	PNAD Contínua + RAIS	R and SQLite	Quarter
14	Inequality meter	Numeric	Rede Nossa SP	Excel	Yearly

## 5.1 Model Diagnostics

To assess the goodness-of-fit and quality of the hedonic price models, it is essential to perform various tests and compute indicators that demonstrate the accuracy and reliability of the estimates. A primary indicator in regression models is the R-squared<sup>34</sup> ( $R^2$ ) value.  $R^2$  is a statistical measure that indicates how closely the data fit the regression line. The value of  $R^2$  ranges from 0 to 1, with 0 indicating that the model does not explain any of the variability of the response data around its mean, and 1 indicating that the model explains all the variability, indicating a perfect fit. However, since  $R^2$  is a non-decreasing function of the number of regressors (independent variables), it is also important to compute the Adjusted R-squared<sup>35</sup>. The Adjusted  $R^2$  is a modified version of  $R^2$  that considers the number of regressors in the model. It penalizes the addition of irrelevant variables by adjusting for the degrees of freedom.

---

<sup>34</sup> The  $R^2$  can be calculated by  $R^2 = 1 - \frac{RSS}{TSS}$  where RSS (Residual Sum of Squares) is the sum of squared differences between observed and predicted values  $RSS = \sum_{i=1}^n (y_i - \hat{y}_i)^2$  and TSS (Total Sum of Squares) is the total variance in the observed data around the mean  $TSS = \sum_{i=1}^n (y_i - \bar{y})^2$ .

<sup>35</sup> The Adjusted  $R^2$  can be calculated by  $R^2 = \left( \frac{n-1}{n-k} \right) \cdot (1 - R^2)$  where  $n$  is the number of degrees of freedom and  $k$  is the number of variables (independent + dependent).

Consequently, the addition of a new regressor will only increase the Adjusted R<sup>2</sup> if its contribution to explaining the variability outweighs the loss of degrees of freedom.

It is essential to recognize that both R<sup>2</sup> and Adjusted R<sup>2</sup> assess the model's fit, but they do not imply a causal relationship between the dependent and independent variables. These measures indicate how well the model aligns with the data, rather than the causal relationship between the variables.

Another useful indicator is the p-value, which evaluates the degree to which the sample data support the null hypothesis. The p-value indicates the probability of obtaining a result at least as extreme as the one observed, assuming the null hypothesis is true. In hypothesis testing, a low p-value suggests that the null hypothesis can be rejected. For example, at a 5% significance level, a p-value less than 0.05 indicates that the null hypothesis can be rejected. Each independent variable is associated with a p-value, where the null hypothesis is that the variable is not significant in explaining the price. A lower p-value indicates a higher probability that the variable is significant. For this analysis, the significance level is set at  $\alpha = 1\%$ .

P-values will also be used to evaluate the null hypothesis in other statistical tests performed in the regression models in this dissertation. These include:

- **F-test:** Compares a model with no predictors (intercept-only) to the specified model. The null hypothesis is that both models fit equally well; the alternative is that the specified model fits significantly better.
- **Shapiro-Wilk and Anderson-Darling tests:** Assesses if residuals are normally distributed. If the p-value is greater than 0.01, the null hypothesis (normal distribution) cannot be rejected.
- **Breusch-Pagan test:** Examines heteroskedasticity (variance of errors). The null hypothesis is constant variance (homoscedasticity). A p-value less than 0.01 indicates heteroskedasticity.

- **Durbin-Watson test:** Detects autocorrelation in residuals. Values near 0 indicate positive autocorrelation, near 2 indicate no autocorrelation, and near 4 indicate negative autocorrelation.

A residual vs. predicted values chart will be created to visualize residual distribution and identify any undesirable patterns or outliers as shown in Figure 13.

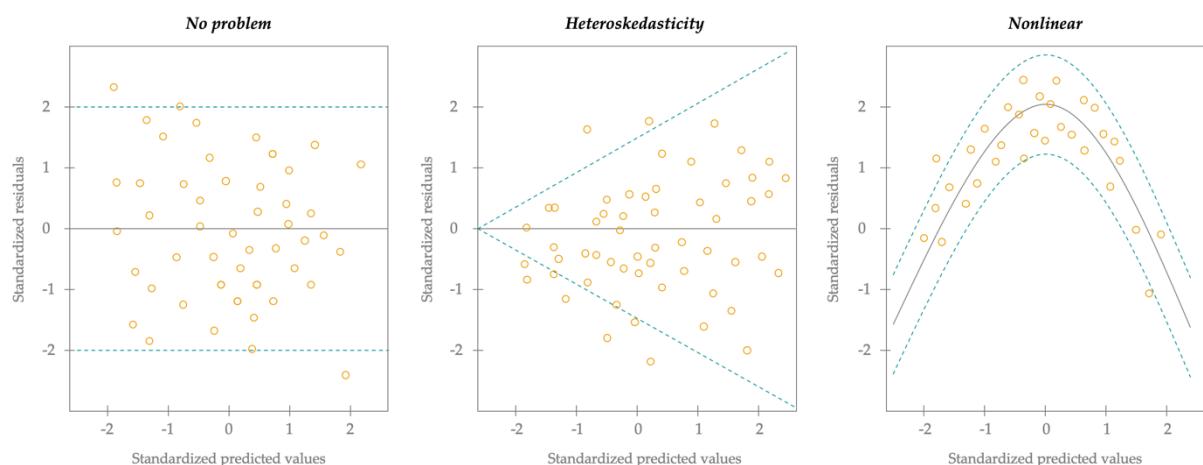


Figure 13: Residuals vs fitted plot examples

## 5.2 Finding the Best Model

To improve the linear regression model by maximizing the  $R^2$  value and ensuring success in statistical tests as normal distribution on residuals, heteroscedasticity, and autocorrelation, non-linear transformations will be utilized in accordance with Equation 4.13. The most effective transformations were identified following the NBR14653-2<sup>36</sup> standard for property valuation and manuals of market software, including AVALIA, INFER, TS-Sisreg, SisDEA, and AVALURB. Based on these guidelines, Code 7 was developed to identify the optimal model, maximizing the  $R^2$  value.

<sup>36</sup> An NBR (Brazilian Standard) is a set of technical guidelines established by the Brazilian Association of Technical Standards (ABNT) with the objective of standardizing procedures and ensuring quality across various sectors in Brazil. The NBR14653-2 standard for urban property appraisal recommends the use of non-linear transformations in regressions as a means of improving the accuracy of value estimates and other instructions.

Code 7: Function that identifies the best linear regression model; Author: Own authorship in R

```

calculate_best_model <- function(data, dependent_var, independent_vars, transformations) {
  best_r2 <- -Inf # Initialize the best R-squared value to negative infinity
  best_model <- NULL # Initialize the best model variable
  best_combination <- NULL # Initialize the best combination of transformations
  list_r2 <- NULL # Initialize a list to store R-squared values for each model

  # Generate all combinations of transformations for each independent variable
  trans_combinations <- expand.grid(rep(list(transformations)), length(independent_vars)))
  colnames(trans_combinations) <- independent_vars # Set column names to independent variables

  # Loop through each row of transformation combinations
  for (trans_row in seq_len(nrow(trans_combinations))) {
    transformed_data <- data # Create a copy of the original data
    formula_parts <- c(dependent_var, "~") # Initialize parts of the formula with the dependent variable

    # Apply transformations to each independent variable
    for (var in independent_vars) {
      trans <- trans_combinations[trans_row, var] # Get the transformation for the current variable
      transformed_var <- switch(as.character(trans),
        "X" = data[[var]], # No transformation (x)
        "1_X" = 1 / data[[var]], # Reciprocal (1/x)
        "LnX" = log(data[[var]]), # Natural logarithm (LN(x))
        "X_2" = data[[var]]^2, # Square (x2)
        "X_1_2" = sqrt(data[[var]]), # Square root (sqrt(x))
        "1_X_2" = 1 / (data[[var]]^2), # Reciprocal square (1/x2)
        "1_X_1_2" = 1 / sqrt(data[[var]])) # Reciprocal square root (1/sqrt(x))
      trans_name <- paste(var, trans, sep = "_") # Create a new name for the transformed variable
      transformed_data[[trans_name]] <- transformed_var
      formula_parts <- c(formula_parts, trans_name)
    }

    # Create the formula string for the linear model
    formula_string <- paste(paste(formula_parts, collapse = " + "), " + garage + gym + field_quadra +
      elevator + furnished + swimming_pool")
    formula_string <- gsub(" \+ ~ \+ ", " ~ ", formula_string) # Correct the formatting of the formula
    formula <- as.formula(formula_string) # Convert the formula string to a formula object
    model <- lm(formula, data = transformed_data) # Fit the linear model

    r2 <- summary(model)$r.squared # Get the R-squared value of the model
    list_r2 <- append(list_r2, r2) # Append the R-squared value to the list

    # Verify diagnostic tests
    ad_test <- ad.test(residuals(model)) # Perform Anderson-Darling test
    bp_test <- bptest(model) # Perform Breush-Pagan test
    dw_test <- dwtest(model) # Perform Durbin-Watson test

    # Update the best model if the current model has a higher R-squared value
    if (r2 > best_r2 && ad_test$p.value > 0.05 && bp_test$p.value > 0.05 && dw_test$p.value > 1.5
      && ad_test$p.value < 2.5) {
      best_r2 <- r2 # Update the best R-squared value
      best_model <- model # Update the best model
      best_combination <- list(variables = independent_vars, transformations =
        as.list(trans_combinations[trans_row,])) # Update the best combination of transformations
    }
  }

  # Return a list containing the best model, the best combination of transformations, the best R-squared value, and the list of all R-squared values
  return(list(best_model = best_model, best_combination = best_combination, best_r2 = best_r2,
    list_r2 = list_r2))
}

# Log-transform the dependent variable
data_rent$price_real_month <- log(data_rent$price_real_month)

# Define the dependent variable
dependent_var <- "price_real_month"

# Define the independent variables
independent_vars <- c("area_m2", "bedrooms", "metro_dist_km", "delta_cbd_faria_lima",
  "inequality_meter", "teleworkable")

# Define the possible transformations for the independent variables
transformations <- c("X", "1_X", "LnX", "X_2", "X_1_2", "1_X_2", "1_X_1_2")

# Call the function to identify the best linear regression model and store the results
results <- calculate_best_model(data_rent, dependent_var, independent_vars, transformations)

```

The 'calculate\_best\_model' function optimizes a linear regression model by applying various nonlinear transformations to independent variables, with the objective of maximizing the R-squared value and success and statistical tests. The function accepts a dataset, a dependent variable, independent variables, and possible transformations as inputs<sup>37</sup>. It generates all possible combinations of transformations, applies each combination to the data, and fits a linear model for each. The model with the highest R-squared value is selected as the optimal model.

Conceptually, this approach employs an exhaustive search of transformation combinations to identify the optimal explanatory model for the dependent variable, maximizing the explained variance. According to the book "*Curso de Engenharia de Avaliação Imobiliária – Fundamentos e Aplicação da Estatística Inferencial*" (Neto, 2003) and the NBR 14653-2 standards, there are three methodologies for transformations:

- **General Method:** Calculates a significant number of equations for models with more than eight variables.
- **Simplified Method:** Applies user-chosen transformations to all variables, calculating only combinations that relate the dependent variable to each independent variable.
- **Directed Method:** Defines a specific transformation for each variable from the available forms.

Neto (2003) also highlights two groups of transformations that best explain the market and the possible combinations of independent variables to describe the dependent variable. The simpler options,  $x$ ,  $1/x$ , and  $\ln(x)$  should be used initially as they typically better describe market behavior. The more complex transformations,  $x^2$ ,  $\sqrt{x}$ ,  $1/x^2$  and  $1/\sqrt{x}$ , should be used when a consistent model cannot be identified with the simpler transformations.

---

<sup>37</sup> For dummy variables, a linear transformation was assumed.

For the formulation of this study and the development of Code 7, the simplified method was used. It was assumed that the best transformation for the dependent variable is the natural logarithm, comparing each independent variable with  $\ln(\text{price})$ . This method ensures a comprehensive evaluation of potential nonlinear relationships, thereby enhancing the accuracy and robustness of the model in accordance with academic standards for rigorous data analysis.

### 5.3 Results

The rental and sales data were collected from 2018 to 2023. However, due to the homogeneous behavior observed during the pandemic, as evidenced in Graph 15, and due to time constraints, it was decided to perform the regressions exclusively with rental data. Additionally, there was an issue with the RAIS + CAGED (2022) data. These data, which cover the period up to 2022 and were published on May 18, 2024, as illustrated in Table 4, presented a failure in the district identifier column.

In light of these considerations, it was decided to conduct the regression study using data from the period of 2018 to 2021, which imposes limitations on the results due to the proximity to the pandemic period.

#### Rent Analysis

To implement the hedonic pricing method and quantify the monetary impact of potential remote work, it is imperative to conduct a thorough correlation<sup>38</sup> analysis between the independent variables prior to any regression analysis. This step is crucial to identify and mitigate multicollinearity, where variables exhibit interdependencies.

---

<sup>38</sup> The correlation between variables is the covariance between them normalized by their standard errors:  

$$\text{Corr}_N(X, Y) = \frac{\text{Cov}_N(X, Y)}{\sqrt{\text{Var}_N(X)\text{Var}_N(Y)}}$$

The presence of multicollinearity can severely distort regression outcomes, rendering the coefficients unstable and challenging to interpret. Therefore, ensuring the independence of variables is vital to achieving precise and reliable results in the regression model.

This approach allowed us to construct Table 15, which compares the correlation between all pairs of variables. Notably, the correlation between the number of bathrooms and the number of bedrooms was high, at 0,89. Given the relevance of this variable in the market and the existing literature, we decided to use only the bathroom data in the regression.

*Table 15: Analysis of the correlation between the variables studied; Author: Own authorship*

	Price	Area	Bedrooms	Suite	Bathrooms	Garage	Condo	Metro Distance	Distance CBD	Inequality Meter	Telework Ability
Price	1,00										
Area	0,72	1,00									
Bedrooms	0,52	0,71	1,00								
Suite	0,45	0,55	0,46	1,00							
Bathrooms	0,59	0,72	0,89	0,51	1,00						
Garage	0,58	0,69	0,60	0,56	0,64	1,00					
Condo	0,32	0,37	0,22	0,54	0,27	0,36	1,00				
Metro Distance	-0,04	0,03	0,11	0,00	0,05	0,05	-0,10	1,00			
Distance CBD	-0,26	0,00	0,12	-0,10	0,00	-0,02	-0,25	0,34	1,00		
Inequality Meter	0,15	0,00	-0,15	0,07	-0,06	-0,03	0,30	-0,43	-0,54	1,00	
Telework Ability	0,09	-0,11	-0,09	-0,12	-0,05	-0,08	-0,05	0,04	-0,36	0,04	1,00

Despite the existing literature that highlights the challenges of using both variables or just one in the regression, we opted to use only bedrooms to optimize the transformation function outlined in Code 7, which has not undergone performance refinement. The introduction of an additional variable would result in an  $O(n^2)$ <sup>39</sup>

<sup>39</sup> Describes algorithms whose execution time grows proportionally to the square of the input size.

operation, effectively increasing the execution time of the code quadratically with the inclusion of one more variable.

Another variable that was excluded from the analysis was the residential condominium fee. Despite its relevance for real estate evaluation, the available data was derived from advertisements that were filled out manually by individuals, which resulted in a high incidence of errors. For other variables, it was possible to identify patterns that allowed for data cleaning. However, for condominium fees, these patterns were not evident, which compromised the data's reliability and justified its exclusion from the study.

The regression analysis yielded the following results: the optimal model (highest R<sup>2</sup>) achieved a coefficient of determination R<sup>2</sup> of 0,6286, indicating that approximately 62,86% of the variability in the dependent variable is explained by the independent variables included in the model. This value is deemed acceptable and suggests that the model possesses a robust explanatory power. The adjusted R<sup>2</sup> was 0,6280, a value that is slightly lower than the R<sup>2</sup>, indicating that the inclusion of the independent variables in the model is justified and significantly contributes to the explanation of the variability in the dependent variable without introducing unnecessary complexity.

These results can be observed in Table 16.

*Table 16: Statistics results from regression performed on the rental data from 2018 to 2021*

<b>Regression Statistics</b>		<b>Analysis of Variance (ANOVA)</b>				
		<i>Degrees of Freedom</i>	<i>Sum of Squares</i>	<i>Mean Square</i>	<i>F-Value</i>	<i>Significance F</i>
Multiple R	0,7928					
R Square	0,6286					
Adjusted R	0,6280	Regression	12	1397,6927	116,4744	1056,998 <2,00E-16
Standard Error	0,3320	Residual	7494	825,7910	0,1102	
Observations	7507	Total	7506	2223,4837		

The F-test, with a value of 1056,998, assesses the null hypothesis that all the coefficients of the independent variables are equal to zero. The significance F value, which is less than  $2,0 \cdot 10^{-16}$ , is extremely low, indicating that the null hypothesis is rejected with a very high level of confidence. This indicates that the model is statistically significant,

and that the independent variables collectively have a significant effect on the dependent variable.

The analysis of the p-values associated with the coefficients of the independent variables provides further insights into the statistical significance of each individual variable. The p-values indicate that the majority of the independent variables are statistically significant, as demonstrated in Table 17. For instance, the intercept, area ( $m^2$ ), number of bedrooms, distance to the metro, distance from the CBD, inequality index, telework capability, garage, gym, elevator, and furniture have p-values less than 0,05, indicating that they are statistically significant. In contrast, variables such as sports field and swimming pool are not statistically significant, with p-values of 0,5117 and 0,12885, respectively. This indicates that they do not have a significant effect on the dependent variable.

*Table 17: Coefficients and optimal transform that yield the highest  $R^2$*

#	Transformation	Estimate Coefficients	Standard Error	T Value	P Value (>  t )
	Intercept		6,444166	0,066819	< 2,00E-16 ***
1	Area ( $m^2$ )	$Ln(x)$	0,659591	0,013171	< 2,00E-16 ***
2	Bedrooms (Integer)	$x$	-0,096087	0,008198	-11,7213 < 2,00E-16 ***
3	Metro Distance (km)	$\sqrt{x}$	-0,110151	0,009177	-12,0029 < 2,00E-16 ***
4	Distance from CBD (km)	$\sqrt{x}$	-0,209648	0,007079	-29,6158 < 2,00E-16 ***
5	Inequality Meter (Real)	$1/\sqrt{x}$	-4,525500	0,418609	-10,8108 < 2,00E-16 ***
6	Telework Ability (Real)	$1/\sqrt{x}$	-0,092740	0,009385	-9,8821 < 2,00E-16 ***
7	Garage (Binary)	$x$	0,207380	0,007881	26,3135 < 2,00E-16 ***
8	Gym (Binary)	$x$	0,115074	0,024040	4,7867 1,73E-06 ***
9	Field (Binary)	$x$	0,013252	0,020193	0,6563 0,5117
10	Elevator (Binary)	$x$	-0,048081	0,016392	-2,9332 0,00337 **
11	Furnish (Binary)	$x$	0,109986	0,017108	6,4288 1,36E-10 ***
12	Swimming Pool (Binary)	$x$	-0,037074	0,024410	-1,5188 0,12885

Signif. codes: 0 '\*\*\*' 0,001 '\*\*' 0,01 '\*' 0,05 '.' 0,1 '' 1

These results indicate that the regression model has a good fit, and that the majority of the independent variables are relevant for explaining the variability of the dependent variable. The presence of some non-significant variables, such as sports field and swimming pool, suggests that they could be reconsidered or removed in future analyses to simplify the model without losing explanatory power.

In conclusion, the presented regression model is intriguing and provides valuable insights into the factors that influence rental or sale prices. It quantifies the monetary impact of remote work and other factors on rental property prices, as demonstrated by Equation 5.1. For a complete validation of the regression, it will be necessary to conduct statistical tests to assess the distribution of residuals, heteroscedasticity, and autocorrelation.

$$\text{price} = e^{\left( 6,44 + 0,660 \cdot \ln \text{Area} - 0,096 \cdot \text{Bedrooms} - 0,110 \cdot \sqrt{\Delta \text{Metro}} - 0,210 \cdot \sqrt{\Delta \text{CBD}} - 4,530 \cdot \frac{1}{\sqrt{\text{Inequality Meter}}} - 0,093 \cdot \frac{1}{\sqrt{\text{Telework Ability}}} + 0,207 \cdot \text{Garage} + 0,115 \cdot \text{Gym} + 0,013 \cdot \text{Field} - 0,048 \cdot \text{Elevator} + 0,101 \cdot \text{Furnish} - 0,037 \cdot \text{Swimming Pool} \right)} \quad (5.1)$$

In order to assess the suitability of the model, a series of statistical tests were conducted, including the Shapiro-Wilk or Anderson-Darling, Breusch-Pagan, and Durbin-Watson tests. These tests help ensure that the fundamental assumptions of linear regression are met, or, at the very least, identify violations that may require additional adjustments. It should be noted that in Code 7, which was previously shown, the optimal model already ensures the verification of these tests. However, it only occurred to me later that this verification was necessary within the loop<sup>40</sup>. Upon executing the final version of the code in its entirety, the result obtained was null, indicating that none of the proposed transformations passed all three tests with the data used. This is illustrated in Figure 14.

```
summary(results$best_model)
Executed at 2024.06.09 22:58:54 in 4ms

  Length Class    Mode
     0   NULL   NULL
```

Figure 14: The summary indicates that `results\$best\_model` is empty, as no transformations passed all statistical tests.

<sup>40</sup> I chose to present the results shown in Table 16 and Table 17, because without the inclusion of the tests in the computational logic, the code execution took around 25 minutes, whereas with the addition of the tests, the average execution time was approximately 45 minutes. Due to the high cost, I decided to perform the tests after the execution of Code 7, focusing it solely on the optimization of R<sup>2</sup>.

The data presented in Table 16 and Table 17 pertain to the model with the highest coefficient of determination  $R^2$ . The model was subsequently subjected to statistical tests, which yielded the following results.

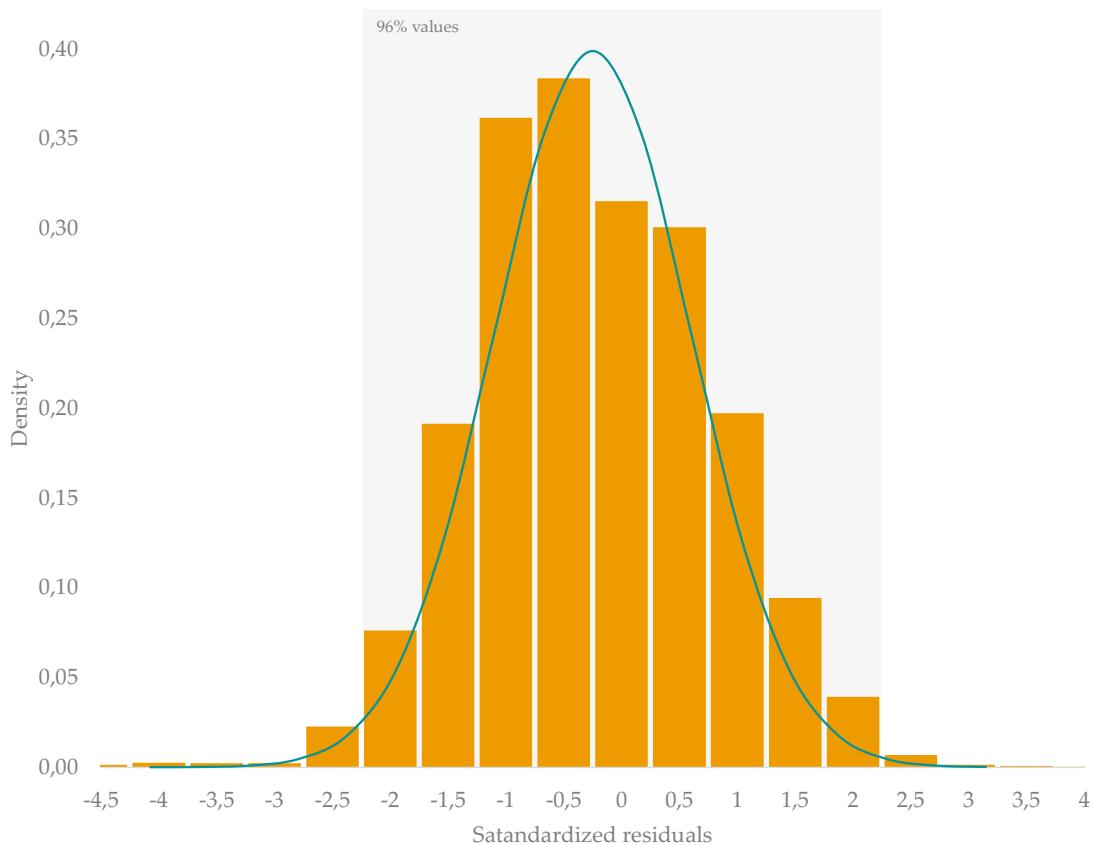
Firstly, due to the sample size exceeding the range suitable for the Shapiro-Wilk test, the Anderson-Darling test was employed to evaluate the normality of the residuals. The Anderson-Darling test statistic was 10,951, with a p-value less than  $2,2 \cdot 10^{-16}$ . These results indicate a rejection of the null hypothesis ( $H_0$ ), which states that the residuals follow a normal distribution. The results indicate the presence of non-normality in the residuals. Furthermore, the graphical representation, as seen in Graph 17, corroborates this conclusion.

Subsequently, the Breusch-Pagan test was employed to identify heteroscedasticity, which refers to the presence of non-constant variance in the residuals. The BP test statistic was 211,82 with 12 degrees of freedom, and the p-value was less than  $2,2 \cdot 10^{-16}$ . These results indicate that the null hypothesis of homoscedasticity is rejected, thereby demonstrating the presence of heteroscedasticity in the residuals, as seen in Graph 18.

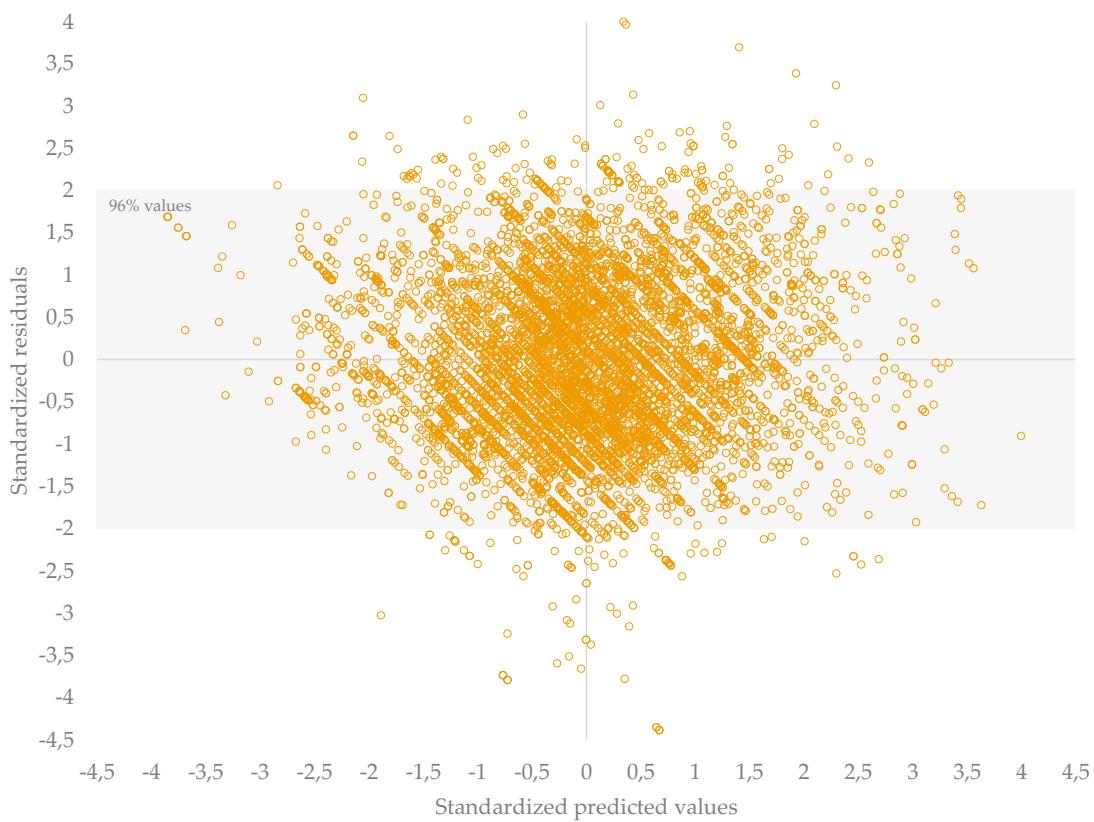
Finally, the Durbin-Watson test was conducted to assess the presence of autocorrelation in the residuals. The Durbin-Watson test statistic was 0,78993, with a p-value less than  $2,2 \cdot 10^{-16}$ . The alternative hypothesis of this test postulates that the true autocorrelation is greater than zero. The results of the test indicate that the null hypothesis is rejected, thereby confirming the presence of positive autocorrelation.

In conclusion, the tests indicate that the residuals of the regression model are not normally distributed, exhibit heteroscedasticity, and display positive autocorrelation. These findings indicate that the model may require adjustments to enhance its validity and precision.

*Graph 17: Distribution of standardized residuals indicating deviation from normality*



*Graph 18: Scatter plot of standardized residuals versus standardized predicted values indicating heteroscedasticity*



Despite the inconsistencies in the regression data, it was possible to use the data to address other questions related to the market. In addition to the hedonic pricing method, this dissertation seeks to investigate information beyond the variation in rental prices in São Paulo due to remote work. Another hypothesis to be tested is the price variation in districts proximate to the financial center and their potential for remote work. The possibility of working remotely reduces transportation costs, thereby allowing for the option of living farther from the Central Business District (CBD).

To address this question, the Compound Annual Growth Rate (CAGR) was calculated for 71 different districts, which had data on both the potential for remote work and rental values over multiple years. The annual growth rate was calculated from the perspective of rental prices and remote work potential, thus obtaining the magnitudes of CAGR rent and CAGR teleworkable.

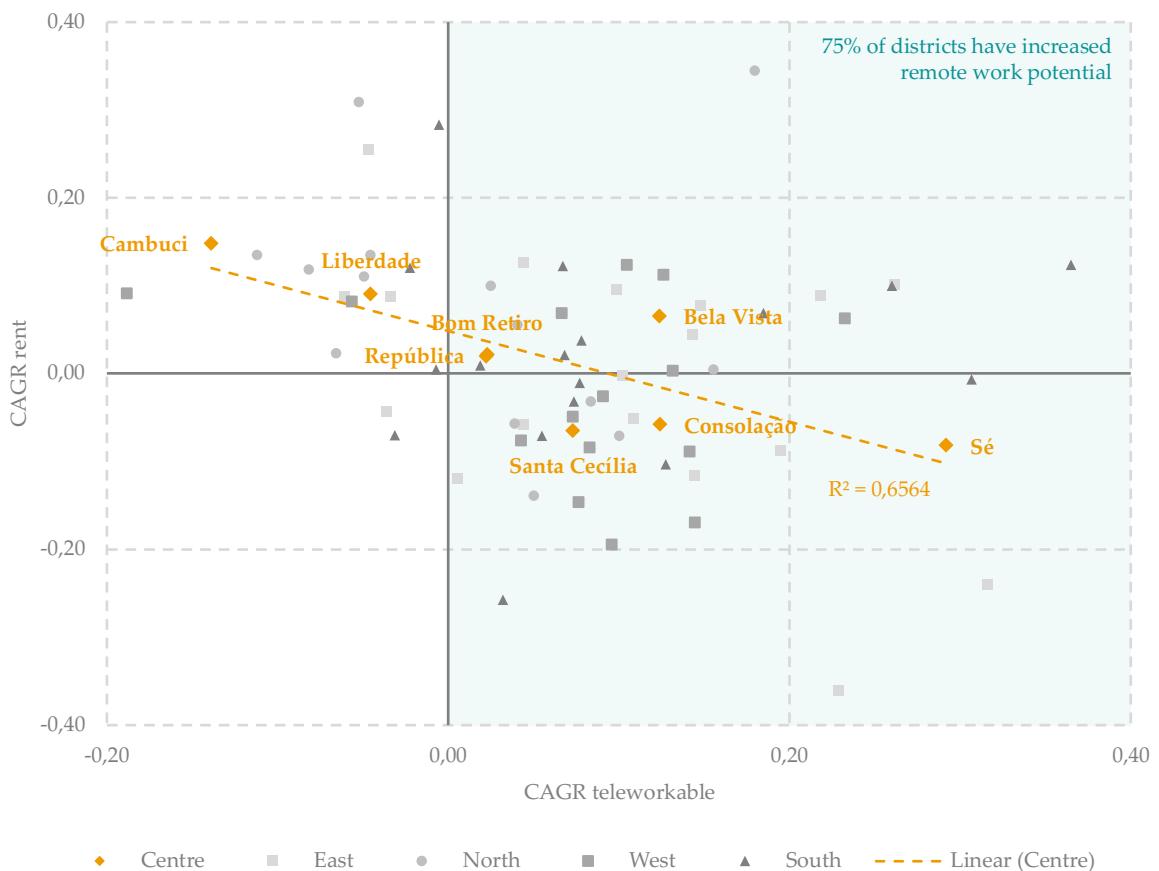
Given the magnitudes in question, a comparison could be performed, resulting in an  $R^2$  of 0,08072. This value indicates that the linear model is inadequate for explaining the variation in the dependent variable. It suggests that the independent variables used are not sufficient to capture this variation effectively. In other words, the rental CAGR is not linearly associated with the remote work potential CAGR.

However, when dividing the analysis by zones, it is possible to notice that only for the central area of São Paulo, there is a decreasing linear behavior between the variables ( $y = -0.517x + 0.0485$ ). In this case, the  $R^2$  is 0,6564, which means that approximately 65.3% of the variability in the CAGR Rent can be explained by the CAGR Teleworkable. This indicates that the model is moderately effective in explaining the relationship between these variables, as shown in Graph 19.

To further substantiate the proportion of variability explained by the model, it is necessary to conduct reliability tests to conclusively determine that a true relationship exists between the studied variables. The F-test is used to determine whether the

regression model is significant. A p-value less than 0,05 in the F-test indicates that the regression is significant. In our case, the p-value of the F-test is 0,015, suggesting a statistically significant relationship between the CAGR Teleworkable and the CAGR Rent.

*Graph 19: CAGR rent (2018-2021) vs CAGR teleworkable (2018-2021) on São Paulo's districts; Author: Own authorship*



We also conducted the Shapiro-Wilk test to check the normality of the data. The results show that the CAGR Teleworkable has a statistic of 0,970 and a p-value of 0,899, while the CAGR Rent has a statistic of 0,935 and a p-value of 0,567. Since both p-values are greater than 0,05, we can conclude that the data do not significantly deviate from a normal distribution.

The Breusch-Pagan test was performed to detect heteroscedasticity in the regression model's residuals. The test value was 0,384 with a p-value of 0,536, indicating no

significant evidence of heteroscedasticity, meaning the variance of the errors is not systematically related to the independent variables.

The Durbin-Watson test was used to check for the presence of autocorrelation in the residuals. The test value was 2,137, close to 2, suggesting no significant autocorrelation in the model's residuals.

In summary, the analysis indicates a statistically significant relationship between the CAGR Teleworkable and the CAGR Rent in the center of São Paulo, with a model explaining a substantial proportion of the variability in the CAGR Rent. The data are normal, do not show significant heteroscedasticity, and there is no autocorrelation in the residuals.

Another insight that can be concluded from Graph 19 and Figure 15 is that, over the studied time interval, approximately 75% of the districts in the city increased their potential for remote work. This can indicate a trend of evolution in this mode of work.

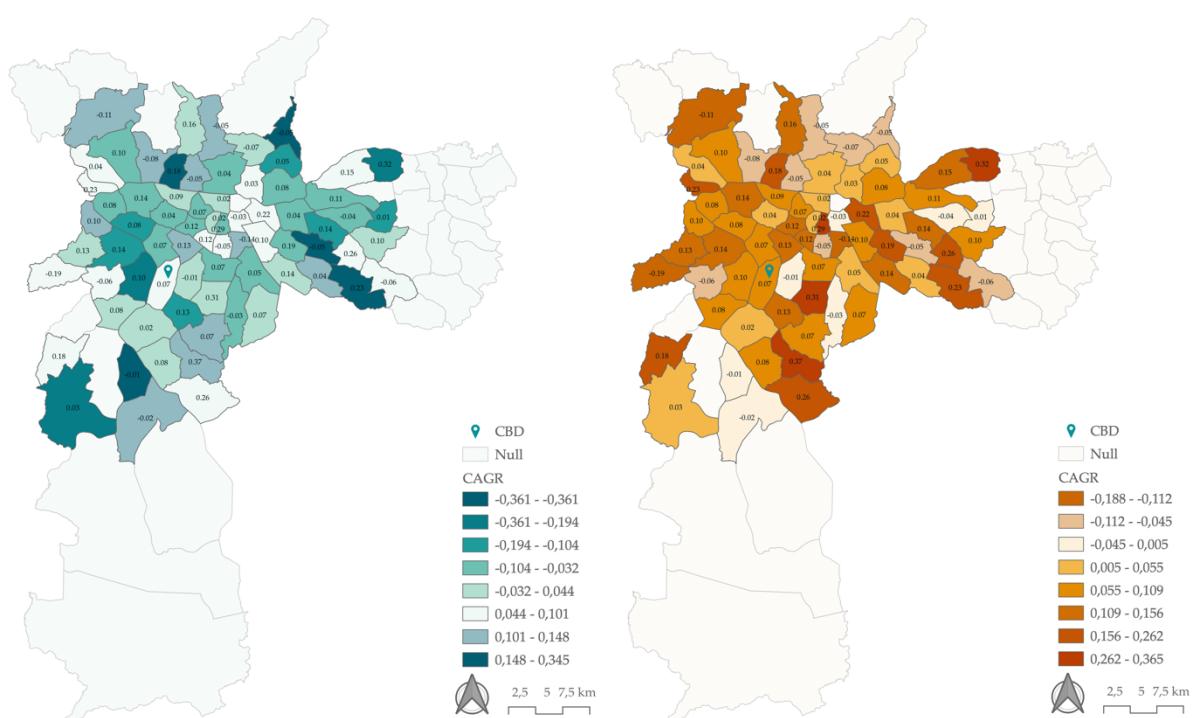


Figure 15: CAGR Rent (left) and CAGR Teleworkable (right) from 2018 to 2021 in São Paulo's districts;  
Author: Own authorship

# Conclusion

The regression analysis conducted with rental data from São Paulo, covering the period from 2018 to 2021, revealed significant insights into the influence of remote work potential on property prices. The optimized regression model achieved a coefficient of determination  $R^2$  of 0,6286, indicating that approximately 62,86% of the variability in the dependent variable (rental prices) is explained by the independent variables included in the model. This value suggests a robust explanatory power, with the adjusted  $R^2$  slightly lower (0,6280), corroborating the validity of the selected variables without adding unnecessary complexity.

Additional statistical tests revealed the presence of heteroscedasticity and positive autocorrelation in the residuals, indicating that the model may require adjustments to

improve its validity and accuracy. However, the statistical significance of the independent variables was confirmed by the p-values, with most variables presenting values less than 0,05, demonstrating their relevance in explaining the variability of rental prices.

A detailed analysis also revealed that, despite the limitations imposed by the pandemic period, there was a significant increase in remote work potential in about 75% of São Paulo's districts during the study period. This finding suggests an evolutionary trend in this mode of work, reflected in the real estate market.

Furthermore, a moderately strong linear relationship was observed between the Compound Annual Growth Rate (CAGR) of rents and the remote work potential in the city center of São Paulo, with an  $R^2$  of 0,6564. This result implies that, in the central area, approximately 65,3% of the variability in the CAGR of rents can be explained by the CAGR of remote work potential, indicating a substantial influence of remote work on rental prices in this region.

The analyzed data were derived from advertised prices, which introduces limitations, uncertainties, and potential distortions into the analysis. One potential avenue for enhancing the efficacy of these outcomes would be to employ transactional data or implement correction factors between the actual and advertised values. Websites such as *FipeZap* and *QuintoAndar* publish these numbers monthly. However, since this study concerns historical data, the historical information was not available.

Another pertinent factor to consider in this analysis is that the study is based on the potential for remote work rather than actual remote work. To achieve greater precision, surveys such as the census or the PNAD Covid, which collect data on remote work, would yield results closer to reality. Although data from the PNAD Covid survey were collected for the purposes of this dissertation, they were not utilized due to the fact that this survey, conducted by the Brazilian federal government, was only conducted for a period of eight months in 2020. It is also important to note that the

remote potential was utilized in the context of neighborhoods that can offer remote jobs. The RAIS provides data on company layoffs that include an address, which was used to assess the remote work potential. However, the reality of residents who work remotely does not necessarily align with districts that have the highest potential to offer remote jobs.

Furthermore, the limited time frame and proximity to the pandemic in the most recent year, 2021, may have introduced distortions into the results. Nevertheless, the findings may serve as a useful indicator of future trends in the São Paulo real estate market. As previously stated, construction companies are already demonstrating alterations in their project portfolios that incorporate coworking spaces in shared areas and home offices in apartments and houses.

For future studies, it would be beneficial to collect data for more recent years, with the aim of conducting a medium- to long-term analysis of remote work. Additionally, it would be advantageous to adjust the data in order to enhance the robustness and variability of the regression model.

## Bibliography

Agarwal, A., 2023. *Labnol*. [Online] Available at: <https://www.labnol.org/google-maps-sheets-200817> [Accessed 02 2024].

Alonso, W., 1964. Location and Land Use: Toward a General Theory of Land Rent. *Harvard University Press*.

Barbosa Filho, F. d. H., Veloso, F. & Peruchetti, P. H., 2022. Trabalho Remoto no Brasil. *RBE | Revista Brasileira de Economia*, 76(4), pp. 349-378.

Bricongne, J.-C., Meunier, B. & Pouget, S., 2022. Web-scraping housing prices in real-time: The Covid-19 crisis in the UK. *Journal of Housing Economics*.

CAGED - Ministério do trabalho, 2020. *O que é CAGED?*. [Online] Available at: <http://pdet.mte.gov.br/o-que-e-caged> [Accessed 02 2024].

Capello, R., 2006. *Regional Economics*. 2<sup>a</sup> Edition ed. Milan: Routledge.

CBO - Ministério do trabalho, 2002. *CBO - Classificação Brasileira de Ocupações*. [Online] Available at: <https://cbo.mte.gov.br/cbosite/pages/home.jsf> [Accessed 02 2024].

Dingel , J. I. & Neiman, B., 2020. How many jobs can be done at home?. *Journal of Public Economics*.

Dingel, J. & Neiman, B., 2020. *GitHub*. [Online] Available at: [https://github.com/jdingel/DingelNeiman-workathome/tree/master/occ\\_onet\\_scores/output](https://github.com/jdingel/DingelNeiman-workathome/tree/master/occ_onet_scores/output) [Accessed 2024].

Dowell, E. K., 2021. *Remote Working, Commuting Time, Life Events All Affect Home Buyers' Decisions.* [Online]

Available at: <https://www.census.gov/library/stories/2021/10/zillow-and-census-bureau-data-show-pandemics-impact-on-housing-market.html>  
[Accessed Apr 2024].

Fipe Zap, 2024. Fipe Zap. [Online]  
Available at: <https://www.fipe.org.br/pt-br/publicacoes/relatorios/#relatorio-fipezap>  
[Accessed 21 05 2024].

Friedman, M., 1953. The Methodology of Positive Economics. In: *Essays In Positive Economics*. Chicago: Univ. of Chicago Press, pp. 3-16; 30-43.

Gabriel Assunção, 2024. *Análise de microdados da PNAD Contínua.* [Online]  
Available at: <https://rpubs.com/gabriel-assuncao-ibge/pnadc>  
[Accessed 2024].

GBO - Ministério do trabalho, 2023. *Guia brasileiro de ocupações.* [Online]  
Available at: <http://pdet.mte.gov.br/guia-brasileiro-de-ocupacoes>  
[Accessed 02 2024].

Globo - G1, 2023. *Cidade de SP tem déficit de 400 mil moradias; até junho deste ano, prefeitura bateu 42% da meta de entregar 49 mil casas.* [Online]  
Available at: <https://g1.globo.com/sp/sao-paulo/noticia/2023/12/11/cidade-de-sp-tem-deficit-de-400-mil-moradias-ate-junho-deste-ano-prefeitura-bateu-42percent-da-meta-de-entregar-49-mil-casas.ghtml>  
[Accessed Mai 2024].

Globo - G1, 2024. *Cidade de São Paulo baterá recorde imobiliário histórico ao entregar mais de 800 condomínios em 2024, diz pesquisa.* [Online]  
Available at: <https://g1.globo.com/sp/sao-paulo/noticia/2024/02/23/cidade-de-sao-paulo-batera-recorde-imobiliaro-historico-ao-entregar-mais-de-800-condominios->

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em-2024-diz-pesquisa.ghtml

[Accessed Mai 2024].

IBGE | COD, 2010. *Principais diferenças entre a COD e a CBO Domiciliar.* [Online] Available at: [https://www.ibge.gov.br/arquivo/projetos/sipd/oitavo\\_forum/COD.pdf](https://www.ibge.gov.br/arquivo/projetos/sipd/oitavo_forum/COD.pdf) [Accessed 2024].

IBGE | PNAD Contínua , 2014. *Pesquisa Nacional por Amostra de Domicílios Contínua Notas Metodológicas.* [Online]

Available at:  
[https://ftp.ibge.gov.br/Trabalho\\_e\\_Rendimento/Pesquisa\\_Nacional\\_por\\_Amostra\\_de\\_Domicilios\\_continua/Notas\\_metodologicas/notas\\_metodologicas.pdf](https://ftp.ibge.gov.br/Trabalho_e_Rendimento/Pesquisa_Nacional_por_Amostra_de_Domicilios_continua/Notas_metodologicas/notas_metodologicas.pdf)  
[Accessed 2024].

IBGE | PNAD Contínua, 2022. *Teletrabalho e trabalho por meio de plataformas digitais 2022.* [Online]

Available at:  
[https://biblioteca.ibge.gov.br/visualizacao/livros/liv102035\\_informativo.pdf](https://biblioteca.ibge.gov.br/visualizacao/livros/liv102035_informativo.pdf)  
[Accessed Apr 2024].

IBGE | PNAD COVID19, 2020. *Pesquisa Nacional por Amostra de Domicílios - PNAD COVID19.* [Online]

Available at: <https://www.ibge.gov.br/estatisticas/sociais/trabalho/27946-divulgacao-semanal-pnadcovid1.html?=&t=o-que-e>  
[Accessed Apr 2024].

IBGE | PNAD COVID, 2020. *Grupamentos ocupacionais e de atividade de divulgação da Pesquisa Nacional por Amostra de Domicílios Contínua.* [Online]

Available at:  
[https://ftp.ibge.gov.br/Trabalho\\_e\\_Rendimento/Pesquisa\\_Nacional\\_por\\_Amostra\\_de\\_Domicilios\\_continua/Trimestral/Microdados/Documentacao/Grupamentos\\_ocupaci](https://ftp.ibge.gov.br/Trabalho_e_Rendimento/Pesquisa_Nacional_por_Amostra_de_Domicilios_continua/Trimestral/Microdados/Documentacao/Grupamentos_ocupaci)

onais atividades PNADC.pdf

[Accessed May 2024].

IBGE | PNADC, 2024. *PNADC - Informações sobre os arquivos de Microdados*. [Online]

Available

at:

[https://ftp.ibge.gov.br/Trabalho e Rendimento/Pesquisa Nacional por Amostra de Domicilios continua/Anual/Microdados/Visita/LEIA-ME.pdf](https://ftp.ibge.gov.br/Trabalho_e_Rendimento/Pesquisa_Nacional_por_Amostra_de_Domicilios_continua/Anual/Microdados/Visita/LEIA-ME.pdf)

[Accessed 2024].

International Labour Organization, 2020. *COVID-19: Guidance for labour statistics data collection: Defining and measuring remote work, telework, work at home and home-based work*.

[Online]

Available at: [https://webapps.ilo.org/wcmsp5/groups/public/-/dgreports/-/stat/documents/publication/wcms\\_747075.pdf](https://webapps.ilo.org/wcmsp5/groups/public/-/dgreports/-/stat/documents/publication/wcms_747075.pdf)

[Accessed Apr 2024].

IPEA, 2022. *O Teletrabalho Potencial no Brasil Revisitado: uma visão espacial*. [Online]

Available

at:

[https://www.ipea.gov.br/portal/images/stories/PDFs/conjuntura/220526\\_nota\\_20\\_teletrabalho\\_no\\_brasil\\_final.pdf](https://www.ipea.gov.br/portal/images/stories/PDFs/conjuntura/220526_nota_20_teletrabalho_no_brasil_final.pdf)

[Accessed Apr 2024].

Mondragon, J. A. & Wieland, J., 2022. Housing Demand and Remote Work. May.

Neto, A. P., 2003. *Curso de Engenharia de Avaliação Imobiliária – Fundamentos e Aplicação da Estatística Inferencial*. Belo Horizonte: s.n.

O\*Net Center, 2021. *O\*NET® Questionnaires*. [Online]

Available at:

<https://www.onetcenter.org/questionnaires.html>

[Accessed 04 2024].

O\*Net, 2024. *O\*Net Resource Center.* [Online]

Available at: <https://www.onetcenter.org/overview.html>

PBI - Ministério do trabalho, 2023. *As ocupações e o mercado de trabalho (assalariado formal).* [Online]

Available at: <https://app.powerbi.com/view?r=eyJrIjoiMzZkMzYzNmYtN2RhZC00OTJILTgwODYtMTY3ODczNmY2NWU4IiwidCI6IjNlYzkyOTY5LTvhNTEtNGYxOC04YWM5LWVmOThmYmFmYTk3OCJ9&pageName=ReportSectionde650100b92052c99c5a>

[Accessed 02 2024].

Prefeitura SP, 2018. *Geo Sampa.* [Online]

Available at: [https://geosampa.prefeitura.sp.gov.br/PaginasPublicas/\\_SBC.aspx](https://geosampa.prefeitura.sp.gov.br/PaginasPublicas/_SBC.aspx)

[Accessed 2024].

RAIS - Ministério do trabalho, 2020. *O que é RAIS?* [Online]

Available at: <http://pdet.mte.gov.br/o-que-e-rais>

[Accessed 02 2024].

RAIS + CAGED - Ministério do trabalho, 2022. *Microdados RAIS e CAGED.* [Online]

Available at: <http://pdet.mte.gov.br/microdados-rais-e-caged>

[Accessed 02 2024].

Rede Nossa São Paulo, 2013 - 2023. *Inequality Map.* [Online]

Available at: <https://www.nossasaopaulo.org.br/campanhas/#13>

[Accessed 2024].

Ricardo, D., 1821. *On The Principles of Political Taxonomy and Taxation.* 3<sup>a</sup> Edition ed. Ontario: Batoche Books.

Rosen, S., 1974. Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition. *Journal of Political Economy*, 82(1), pp. 34-55.

São Paulo, P. d. C. d., 2023. *Governo Cidade de São Paulo*. [Online] Available at:

[https://www.prefeitura.sp.gov.br/cidade/secretarias/fazenda/acesso\\_a\\_informacao/index.php?p=31501](https://www.prefeitura.sp.gov.br/cidade/secretarias/fazenda/acesso_a_informacao/index.php?p=31501)

[Accessed 15 08 2023].

Semrush, 2023. *Most Visited Real Estate Websites in Brazil, November 2023*. [Online]

Available at: <https://www.semrush.com/website/top/brazil/real-estate/>

[Accessed 02 2024].

Statista, 2023. *Revenue in the real estate market in Brazil from 2017 to 2028*. [Online]

Available at: <https://www.statista.com/statistics/1397603/revenue-real-estate-market-brazil/>

[Accessed Mai 2024].

Watkins, C., 1999. Property valuation and the structure of urban housing markets.

*Journal of Property Investment & Finance*, 17(2), pp. 157-175.

Zillow Research, 2020. *Zillow*. [Online]

Available at: <https://www.zillow.com/research/coronavirus-remote-work-suburbs-27046/>

[Accessed Apr. 2024].

# Appendix

## A. O\*Net Dingel & Neiman Method SOC Classification Score Result

Table 18: O\*Net teleworkable result; Source: (Dingel & Neiman, 2020)

O*Net SOC Code	Title	Teleworkable	O*Net SOC Code	Title	Teleworkable
11-1011.00	Chief Executives	1	31-1015.00	Orderlies	0
11-1011.03	Chief Sustainability Officers	1	31-2011.00	Occupational Therapy Assistants	0
11-1021.00	General and Operations Managers	1	31-2012.00	Occupational Therapy Aides	0
11-2011.00	Advertising and Promotions Managers	1	31-2021.00	Physical Therapist Assistants	0
11-2021.00	Marketing Managers	1	31-2022.00	Physical Therapist Aides	0
11-2022.00	Sales Managers	1	31-9011.00	Massage Therapists	0
11-2031.00	Public Relations and Fundraising Managers	1	31-9091.00	Dental Assistants	0
11-3011.00	Administrative Services Managers	1	31-9092.00	Medical Assistants	0
11-3021.00	Computer and Information Systems Managers	1	31-9093.00	Medical Equipment Preparers	0
11-3031.01	Treasurers and Controllers	1	31-9094.00	Medical Transcriptionists	1
11-3031.02	Financial Managers, Branch or Department	1	31-9095.00	Pharmacy Aides	0
11-3051.00	Industrial Production Managers	0	31-9096.00	Veterinary Assistants and Laboratory Animal Caretakers	0
11-3051.01	Quality Control Systems Managers	0	31-9097.00	Phlebotomists	0
11-3051.02	Geothermal Production Managers	0	31-9099.01	Speech-Language Pathology Assistants	1
11-3051.03	Biofuels Production Managers	0	31-9099.02	Endoscopy Technicians	0
11-3051.04	Biomass Power Plant Managers	0	33-1011.00	First-Line Supervisors of Correctional Officers	0
11-3051.06	Hydroelectric Production Managers	0	33-1012.00	First-Line Supervisors of Police and Detectives	0
11-3061.00	Purchasing Managers	1	33-1021.01	Municipal Fire Fighting and Prevention Supervisors	0
11-3071.01	Transportation Managers	1	33-1021.02	Forest Fire Fighting and Prevention Supervisors	0
11-3071.02	Storage and Distribution Managers	0	33-2011.01	Municipal Firefighters	0
11-3071.03	Logistics Managers	1	33-2011.02	Forest Firefighters	0
11-3111.00	Compensation and Benefits Managers	1	33-2021.01	Fire Inspectors	0
11-3121.00	Human Resources Managers	1	33-2021.02	Fire Investigators	0
11-3131.00	Training and Development Managers	1	33-2022.00	Forest Fire Inspectors and Prevention Specialists	0
11-9013.01	Nursery and Greenhouse Managers	0	33-3011.00	Bailiffs	0
11-9013.02	Farm and Ranch Managers	0	33-3012.00	Correctional Officers and Jailers	0
11-9013.03	Aquacultural Managers	0	33-3021.01	Police Detectives	0
11-9021.00	Construction Managers	0	33-3021.02	Police Identification and Records Officers	0
11-9031.00	Education Administrators, Preschool and Childcare Center/Program	0	33-3021.03	Criminal Investigators and Special Agents	0
11-9032.00	Education Administrators, Elementary and Secondary School	1	33-3021.05	Immigration and Customs Inspectors	0
11-9033.00	Education Administrators, Postsecondary	1	33-3021.06	Intelligence Analysts	1
11-9039.01	Distance Learning Coordinators	1	33-3031.00	Fish and Game Wardens	0
11-9039.02	Fitness and Wellness Coordinators	1	33-3041.00	Parking Enforcement Workers	0
11-9041.00	Architectural and Engineering Managers	1	33-3051.01	Police Patrol Officers	0

O*Net SOC Code	Title	Teleworkable	O*Net SOC Code	Title	Teleworkable
11-9041.01	Biofuels/Biodiesel Technology and Product Development Managers	0	33-3051.03	Sheriffs and Deputy Sheriffs	0
11-9051.00	Food Service Managers	0	33-3052.00	Transit and Railroad Police	0
11-9061.00	Funeral Service Managers	0	33-9011.00	Animal Control Workers	0
11-9071.00	Gaming Managers	0	33-9021.00	Private Detectives and Investigators	1
11-9081.00	Lodging Managers	0	33-9031.00	Gaming Surveillance Officers and Gaming Investigators	1
11-9111.00	Medical and Health Services Managers	1	33-9032.00	Security Guards	0
11-9121.00	Natural Sciences Managers	1	33-9091.00	Crossing Guards	0
11-9121.01	Clinical Research Coordinators	1	33-9092.00	Lifeguards, Ski Patrol, and Other Recreational Protective Service Workers	0
11-9121.02	Water Resource Specialists	1	33-9093.00	Transportation Security Screeners	0
11-9131.00	Postmasters and Mail Superintendents	1	33-9099.02	Retail Loss Prevention Specialists	1
11-9141.00	Property, Real Estate, and Community Association Managers	1	35-1011.00	Chefs and Head Cooks	0
11-9151.00	Social and Community Service Managers	1	35-1012.00	First-Line Supervisors of Food Preparation and Serving Workers	0
11-9161.00	Emergency Management Directors	0	35-2011.00	Cooks, Fast Food	0
11-9199.01	Regulatory Affairs Managers	1	35-2012.00	Cooks, Institution and Cafeteria	0
11-9199.02	Compliance Managers	1	35-2013.00	Cooks, Private Household	1
11-9199.03	Investment Fund Managers	1	35-2014.00	Cooks, Restaurant	0
11-9199.04	Supply Chain Managers	1	35-2015.00	Cooks, Short Order	0
11-9199.07	Security Managers	1	35-2021.00	Food Preparation Workers	0
11-9199.08	Loss Prevention Managers	1	35-3011.00	Bartenders	0
11-9199.09	Wind Energy Operations Managers	0	35-3021.00	Combined Food Preparation and Serving Workers, Including Fast Food	0
11-9199.10	Wind Energy Project Managers	1	35-3022.00	Counter Attendants, Cafeteria, Food Concession, and Coffee Shop	0
11-9199.11	Brownfield Redevelopment Specialists and Site Managers	1	35-3022.01	Baristas	0
13-1011.00	Agents and Business Managers of Artists, Performers, and Athletes	1	35-3031.00	Waiters and Waitresses	0
13-1021.00	Buyers and Purchasing Agents, Farm Products	1	35-3041.00	Food Servers, Nonrestaurant	0
13-1022.00	Wholesale and Retail Buyers, Except Farm Products	1	35-9011.00	Dining Room and Cafeteria Attendants and Bartender Helpers	0
13-1023.00	Purchasing Agents, Except Wholesale, Retail, and Farm Products	1	35-9021.00	Dishwashers	0
13-1031.01	Claims Examiners, Property and Casualty Insurance	1	35-9031.00	Hosts and Hostesses, Restaurant, Lounge, and Coffee Shop	0
13-1031.02	Insurance Adjusters, Examiners, and Investigators	1	37-1011.00	First-Line Supervisors of Housekeeping and Janitorial Workers	0
13-1032.00	Insurance Appraisers, Auto Damage	0	37-1012.00	First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers	0
13-1041.01	Environmental Compliance Inspectors	0	37-2011.00	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	0
13-1041.02	Licensing Examiners and Inspectors	0	37-2012.00	Maids and Housekeeping Cleaners	0
13-1041.03	Equal Opportunity Representatives and Officers	1	37-2021.00	Pest Control Workers	0
13-1041.04	Government Property Inspectors and Investigators	1	37-3011.00	Landscaping and Groundskeeping Workers	0
13-1041.06	Coroners	0	37-3012.00	Pesticide Handlers, Sprayers, and Applicators, Vegetation	0
13-1041.07	Regulatory Affairs Specialists	1	37-3013.00	Tree Trimmers and Pruners	0
13-1051.00	Cost Estimators	1	39-1011.00	Gaming Supervisors	0
13-1071.00	Human Resources Specialists	1	39-1012.00	Slot Supervisors	0
13-1074.00	Farm Labor Contractors	1	39-1021.00	First-Line Supervisors of Personal Service Workers	1
13-1075.00	Labor Relations Specialists	1	39-1021.01	Spa Managers	0
13-1081.00	Logisticians	1	39-2011.00	Animal Trainers	0

O*Net SOC Code	Title	Teleworkable	O*Net SOC Code	Title	Teleworkable
13-1081.01	Logistics Engineers		1 39-2021.00	Nonfarm Animal Caretakers	0
13-1081.02	Logistics Analysts		1 39-3011.00	Gaming Dealers	1
13-1111.00	Management Analysts		1 39-3012.00	Gaming and Sports Book Writers and Runners	0
13-1121.00	Meeting, Convention, and Event Planners		0 39-3021.00	Motion Picture Projectionists	0
13-1131.00	Fundraisers		0 39-3031.00	Ushers, Lobby Attendants, and Ticket Takers	1
13-1141.00	Compensation, Benefits, and Job Analysis Specialists		1 39-3091.00	Amusement and Recreation Attendants	0
13-1151.00	Training and Development Specialists		1 39-3092.00	Costume Attendants	0
13-1161.00	Market Research Analysts and Marketing Specialists		1 39-3093.00	Locker Room, Coatroom, and Dressing Room Attendants	0
13-1199.01	Energy Auditors		0 39-4011.00	Embalmers	0
13-1199.02	Security Management Specialists		1 39-4021.00	Funeral Attendants	0
13-1199.03	Customs Brokers		1 39-4031.00	Morticians, Undertakers, and Funeral Directors	0
13-1199.04	Business Continuity Planners		1 39-5011.00	Barbers	0
13-1199.05	Sustainability Specialists		1 39-5012.00	Hairdressers, Hairstylists, and Cosmetologists	0
13-1199.06	Online Merchants		1 39-5091.00	Makeup Artists, Theatrical and Performance	1
13-2011.01	Accountants		1 39-5092.00	Manicurists and Pedicurists	0
13-2011.02	Auditors		1 39-5093.00	Shampooers	0
13-2021.01	Assessors		1 39-5094.00	Skincare Specialists	0
13-2021.02	Appraisers, Real Estate		1 39-6011.00	Baggage Porters and Bellhops	0
13-2031.00	Budget Analysts		1 39-6012.00	Concierges	0
13-2041.00	Credit Analysts		1 39-7011.00	Tour Guides and Escorts	0
13-2051.00	Financial Analysts		1 39-7012.00	Travel Guides	0
13-2052.00	Personal Financial Advisors		1 39-9011.00	Childcare Workers	1
13-2053.00	Insurance Underwriters		1 39-9011.01	Nannies	1
13-2061.00	Financial Examiners		1 39-9021.00	Personal Care Aides	0
13-2071.00	Credit Counselors		1 39-9031.00	Fitness Trainers and Aerobics Instructors	0
13-2071.01	Loan Counselors		1 39-9032.00	Recreation Workers	1
13-2072.00	Loan Officers		0 39-9041.00	Residential Advisors	1
13-2081.00	Tax Examiners and Collectors, and Revenue Agents		0 41-1011.00	First-Line Supervisors of Retail Sales Workers	0
13-2082.00	Tax Preparers		0 41-1012.00	First-Line Supervisors of Non-Retail Sales Workers	1
13-2099.01	Financial Quantitative Analysts		1 41-2011.00	Cashiers	0
13-2099.02	Risk Management Specialists		1 41-2012.00	Gaming Change Persons and Booth Cashiers	0
13-2099.04	Fraud Examiners, Investigators and Analysts		1 41-2021.00	Counter and Rental Clerks	0
15-1111.00	Computer and Information Research Scientists		1 41-2022.00	Parts Salespersons	0
15-1121.00	Computer Systems Analysts		1 41-2031.00	Retail Salespersons	0
15-1121.01	Informatics Nurse Specialists		1 41-3011.00	Advertising Sales Agents	0
15-1122.00	Information Security Analysts		1 41-3021.00	Insurance Sales Agents	1
15-1131.00	Computer Programmers		1 41-3031.01	Sales Agents, Securities and Commodities	1
15-1132.00	Software Developers, Applications		1 41-3031.02	Sales Agents, Financial Services	1
15-1133.00	Software Developers, Systems Software		1 41-3031.03	Securities and Commodities Traders	1
15-1134.00	Web Developers		1 41-3041.00	Travel Agents	0

O*Net SOC Code	Title	Teleworkable	O*Net SOC Code	Title	Teleworkable
15-1141.00	Database Administrators	1	41-3099.01	Energy Brokers	1
15-1142.00	Network and Computer Systems Administrators	1	41-4011.00	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	1
15-1143.00	Computer Network Architects	1	41-4011.07	Solar Sales Representatives and Assessors	1
15-1143.01	Telecommunications Engineering Specialists	1	41-4012.00	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	1
15-1151.00	Computer User Support Specialists	1	41-9011.00	Demonstrators and Product Promoters	0
15-1152.00	Computer Network Support Specialists	1	41-9012.00	Models	1
15-1199.01	Software Quality Assurance Engineers and Testers	1	41-9021.00	Real Estate Brokers	1
15-1199.02	Computer Systems Engineers/Architects	1	41-9022.00	Real Estate Sales Agents	0
15-1199.03	Web Administrators	1	41-9031.00	Sales Engineers	1
15-1199.04	Geospatial Information Scientists and Technologists	1	41-9041.00	Telemarketers	1
15-1199.05	Geographic Information Systems Technicians	1	41-9091.00	Door-To-Door Sales Workers, News and Street Vendors, and Related Workers	0
15-1199.06	Database Architects	1	43-1011.00	First-Line Supervisors of Office and Administrative Support Workers	1
15-1199.07	Data Warehousing Specialists	1	43-2011.00	Switchboard Operators, Including Answering Service	1
15-1199.08	Business Intelligence Analysts	1	43-2021.00	Telephone Operators	0
15-1199.09	Information Technology Project Managers	1	43-3011.00	Bill and Account Collectors	1
15-1199.10	Search Marketing Strategists	1	43-3021.01	Statement Clerks	0
15-1199.11	Video Game Designers	1	43-3021.02	Billing, Cost, and Rate Clerks	1
15-1199.12	Document Management Specialists	1	43-3031.00	Bookkeeping, Accounting, and Auditing Clerks	1
15-2011.00	Actuaries	1	43-3041.00	Gaming Cage Workers	0
15-2021.00	Mathematicians	1	43-3051.00	Payroll and Timekeeping Clerks	1
15-2031.00	Operations Research Analysts	1	43-3061.00	Procurement Clerks	1
15-2041.00	Statisticians	1	43-3071.00	Tellers	0
15-2041.01	Biostatisticians	1	43-4011.00	Brokerage Clerks	1
15-2041.02	Clinical Data Managers	1	43-4021.00	Correspondence Clerks	1
15-2091.00	Mathematical Technicians	1	43-4031.01	Court Clerks	1
17-1011.00	Architects, Except Landscape and Naval	1	43-4031.02	Municipal Clerks	0
17-1012.00	Landscape Architects	1	43-4031.03	License Clerks	0
17-1021.00	Cartographers and Photogrammetrists	1	43-4041.01	Credit Authorizers	1
17-1022.00	Surveyors	0	43-4041.02	Credit Checkers	1
17-1022.01	Geodetic Surveyors	1	43-4051.00	Customer Service Representatives	1
17-2011.00	Aerospace Engineers	1	43-4051.03	Patient Representatives	0
17-2021.00	Agricultural Engineers	0	43-4061.00	Eligibility Interviewers, Government Programs	0
17-2031.00	Biomedical Engineers	1	43-4071.00	File Clerks	1
17-2041.00	Chemical Engineers	0	43-4081.00	Hotel, Motel, and Resort Desk Clerks	0
17-2051.00	Civil Engineers	1	43-4111.00	Interviewers, Except Eligibility and Loan	1
17-2051.01	Transportation Engineers	1	43-4121.00	Library Assistants, Clerical	0
17-2061.00	Computer Hardware Engineers	1	43-4131.00	Loan Interviewers and Clerks	0
17-2071.00	Electrical Engineers	1	43-4141.00	New Accounts Clerks	0
17-2072.00	Electronics Engineers, Except Computer	1	43-4151.00	Order Clerks	1

O*Net SOC Code	Title	Teleworkable	O*Net SOC Code	Title	Teleworkable
17-2072.01	Radio Frequency Identification Device Specialists	1	43-4161.00	Human Resources Assistants, Except Payroll and Timekeeping	1
17-2081.00	Environmental Engineers	1	43-4171.00	Receptionists and Information Clerks	0
17-2081.01	Water/Wastewater Engineers	1	43-4181.00	Reservation and Transportation Ticket Agents and Travel Clerks	0
17-2111.01	Industrial Safety and Health Engineers	0	43-5011.00	Cargo and Freight Agents	1
17-2111.02	Fire-Prevention and Protection Engineers	1	43-5011.01	Freight Forwarders	1
17-2111.03	Product Safety Engineers	0	43-5021.00	Couriers and Messengers	1
17-2112.00	Industrial Engineers	0	43-5031.00	Police, Fire, and Ambulance Dispatchers	0
17-2112.01	Human Factors Engineers and Ergonomists	1	43-5032.00	Dispatchers, Except Police, Fire, and Ambulance	1
17-2121.01	Marine Engineers	0	43-5041.00	Meter Readers, Utilities	0
17-2121.02	Marine Architects	1	43-5051.00	Postal Service Clerks	0
17-2131.00	Materials Engineers	0	43-5052.00	Postal Service Mail Carriers	0
17-2141.00	Mechanical Engineers	0	43-5053.00	Postal Service Mail Sorters, Processors, and Processing Machine Operators	0
17-2141.01	Fuel Cell Engineers	0	43-5061.00	Production, Planning, and Expediting Clerks	0
17-2141.02	Automotive Engineers	1	43-5071.00	Shipping, Receiving, and Traffic Clerks	0
17-2151.00	Mining and Geological Engineers, Including Mining Safety Engineers	0	43-5081.01	Stock Clerks, Sales Floor	0
17-2161.00	Nuclear Engineers	0	43-5081.02	Marking Clerks	1
17-2171.00	Petroleum Engineers	1	43-5081.03	Stock Clerks- Stockroom, Warehouse, or Storage Yard	0
17-2199.01	Biochemical Engineers	0	43-5081.04	Order Fillers, Wholesale and Retail Sales	0
17-2199.02	Validation Engineers	0	43-5111.00	Weighers, Measurers, Checkers, and Samplers, Recordkeeping	0
17-2199.03	Energy Engineers	0	43-6011.00	Executive Secretaries and Executive Administrative Assistants	1
17-2199.04	Manufacturing Engineers	0	43-6012.00	Legal Secretaries	1
17-2199.05	Mechatronics Engineers	1	43-6013.00	Medical Secretaries	1
17-2199.06	Microsystems Engineers	1	43-6014.00	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	1
17-2199.07	Photonics Engineers	1	43-9011.00	Computer Operators	1
17-2199.08	Robotics Engineers	0	43-9021.00	Data Entry Keyers	1
17-2199.09	Nanosystems Engineers	0	43-9022.00	Word Processors and Typists	1
17-2199.10	Wind Energy Engineers	1	43-9031.00	Desktop Publishers	1
17-2199.11	Solar Energy Systems Engineers	1	43-9041.01	Insurance Claims Clerks	1
17-3011.01	Architectural Drafters	1	43-9041.02	Insurance Policy Processing Clerks	1
17-3011.02	Civil Drafters	1	43-9051.00	Mail Clerks and Mail Machine Operators, Except Postal Service	1
17-3012.01	Electronic Drafters	1	43-9061.00	Office Clerks, General	1
17-3012.02	Electrical Drafters	1	43-9071.00	Office Machine Operators, Except Computer	1
17-3013.00	Mechanical Drafters	1	43-9081.00	Proofreaders and Copy Markers	1
17-3021.00	Aerospace Engineering and Operations Technicians	0	43-9111.00	Statistical Assistants	1
17-3022.00	Civil Engineering Technicians	1	43-9111.01	Bioinformatics Technicians	1
17-3023.01	Electronics Engineering Technicians	0	45-1011.05	First-Line Supervisors of Logging Workers	0
17-3023.03	Electrical Engineering Technicians	0	45-1011.06	First-Line Supervisors of Aquacultural Workers	0
17-3024.00	Electro-Mechanical Technicians	0	45-1011.07	First-Line Supervisors of Agricultural Crop and Horticultural Workers	1
17-3024.01	Robotics Technicians	0	45-1011.08	First-Line Supervisors of Animal Husbandry and Animal Care Workers	0
17-3025.00	Environmental Engineering Technicians	0	45-2011.00	Agricultural Inspectors	0

O*Net SOC Code	Title	Teleworkable	O*Net SOC Code	Title	Teleworkable
17-3026.00	Industrial Engineering Technicians	0	45-2021.00	Animal Breeders	0
17-3027.00	Mechanical Engineering Technicians	0	45-2041.00	Graders and Sorters, Agricultural Products	0
17-3027.01	Automotive Engineering Technicians	0	45-2091.00	Agricultural Equipment Operators	0
17-3029.01	Non-Destructive Testing Specialists	0	45-2092.01	Nursery Workers	0
17-3029.02	Electrical Engineering Technologists	0	45-2092.02	Farmworkers and Laborers, Crop	0
17-3029.03	Electromechanical Engineering Technologists	0	45-2093.00	Farmworkers, Farm, Ranch, and Aquacultural Animals	0
17-3029.04	Electronics Engineering Technologists	0	45-3011.00	Fishers and Related Fishing Workers	0
17-3029.05	Industrial Engineering Technologists	0	45-3021.00	Hunters and Trappers	0
17-3029.06	Manufacturing Engineering Technologists	0	45-4011.00	Forest and Conservation Workers	0
17-3029.07	Mechanical Engineering Technologists	0	45-4021.00	Fallers	0
17-3029.08	Photonics Technicians	0	45-4022.00	Logging Equipment Operators	0
17-3029.09	Manufacturing Production Technicians	0	45-4023.00	Log Graders and Scalers	0
17-3029.11	Nanotechnology Engineering Technologists	0	47-1011.00	First-Line Supervisors of Construction Trades and Extraction Workers	0
17-3029.12	Nanotechnology Engineering Technicians	0	47-1011.03	Solar Energy Installation Managers	0
17-3031.01	Surveying Technicians	0	47-2011.00	Boilermakers	0
17-3031.02	Mapping Technicians	1	47-2021.00	Brickmasons and Blockmasons	0
19-1011.00	Animal Scientists	1	47-2022.00	Stonemasons	0
19-1012.00	Food Scientists and Technologists	0	47-2031.01	Construction Carpenters	0
19-1013.00	Soil and Plant Scientists	1	47-2031.02	Rough Carpenters	0
19-1020.01	Biologists	1	47-2041.00	Carpet Installers	0
19-1021.00	Biochemists and Biophysicists	0	47-2042.00	Floor Layers, Except Carpet, Wood, and Hard Tiles	0
19-1022.00	Microbiologists	0	47-2043.00	Floor Sanders and Finishers	0
19-1023.00	Zoologists and Wildlife Biologists	1	47-2044.00	Tile and Marble Setters	0
19-1029.01	Bioinformatics Scientists	1	47-2051.00	Cement Masons and Concrete Finishers	0
19-1029.02	Molecular and Cellular Biologists	0	47-2053.00	Terrazzo Workers and Finishers	0
19-1029.03	Geneticists	1	47-2061.00	Construction Laborers	0
19-1031.01	Soil and Water Conservationists	1	47-2071.00	Paving, Surfacing, and Tamping Equipment Operators	0
19-1031.02	Range Managers	0	47-2072.00	Pile-Driver Operators	0
19-1031.03	Park Naturalists	0	47-2073.00	Operating Engineers and Other Construction Equipment Operators	0
19-1032.00	Foresters	0	47-2081.00	Drywall and Ceiling Tile Installers	0
19-1041.00	Epidemiologists	1	47-2082.00	Tapers	0
19-1042.00	Medical Scientists, Except Epidemiologists	1	47-2111.00	Electricians	0
19-2011.00	Astronomers	1	47-2121.00	Glaziers	0
19-2012.00	Physicists	1	47-2131.00	Insulation Workers, Floor, Ceiling, and Wall	0
19-2021.00	Atmospheric and Space Scientists	1	47-2132.00	Insulation Workers, Mechanical	0
19-2031.00	Chemists	0	47-2141.00	Painters, Construction and Maintenance	0
19-2032.00	Materials Scientists	0	47-2142.00	Paperhanglers	0
19-2041.00	Environmental Scientists and Specialists, Including Health	1	47-2151.00	Pipelayers	0
19-2041.01	Climate Change Analysts	1	47-2152.01	Pipe Fitters and Steamfitters	0
19-2041.02	Environmental Restoration Planners	1	47-2152.02	Plumbers	0

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19-2041.03	Industrial Ecologists	1	47-2161.00	Plasterers and Stucco Masons	0
19-2042.00	Geoscientists, Except Hydrologists and Geographers	1	47-2171.00	Reinforcing Iron and Rebar Workers	0
19-2043.00	Hydrologists	1	47-2181.00	Roofers	0
19-2099.01	Remote Sensing Scientists and Technologists	1	47-2211.00	Sheet Metal Workers	0
19-3011.00	Economists	1	47-2221.00	Structural Iron and Steel Workers	0
19-3011.01	Environmental Economists	1	47-2231.00	Solar Photovoltaic Installers	0
19-3022.00	Survey Researchers	1	47-3011.00	Helpers--Brickmasons, Blockmasons, Stonemasons, and Tile and Marble Setters	0
19-3031.01	School Psychologists	1	47-3012.00	Helpers--Carpenters	0
19-3031.02	Clinical Psychologists	1	47-3013.00	Helpers--Electricians	0
19-3031.03	Counseling Psychologists	1	47-3014.00	Helpers--Painters, Paperhangers, Plasterers, and Stucco Masons	0
19-3032.00	Industrial-Organizational Psychologists	1	47-3015.00	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	0
19-3039.01	Neuropsychologists and Clinical Neuropsychologists	1	47-3016.00	Helpers--Roofers	0
19-3041.00	Sociologists	1	47-4011.00	Construction and Building Inspectors	0
19-3051.00	Urban and Regional Planners	0	47-4021.00	Elevator Installers and Repairers	0
19-3091.01	Anthropologists	1	47-4031.00	Fence Erectors	0
19-3091.02	Archeologists	1	47-4041.00	Hazardous Materials Removal Workers	0
19-3092.00	Geographers	1	47-4051.00	Highway Maintenance Workers	0
19-3093.00	Historians	0	47-4061.00	Rail-Track Laying and Maintenance Equipment Operators	0
19-3094.00	Political Scientists	1	47-4071.00	Septic Tank Servicers and Sewer Pipe Cleaners	0
19-3099.01	Transportation Planners	1	47-4091.00	Segmental Pavers	0
19-4011.01	Agricultural Technicians	0	47-4099.02	Solar Thermal Installers and Technicians	1
19-4011.02	Food Science Technicians	0	47-4099.03	Weatherization Installers and Technicians	0
19-4021.00	Biological Technicians	0	47-5011.00	Derrick Operators, Oil and Gas	0
19-4031.00	Chemical Technicians	0	47-5012.00	Rotary Drill Operators, Oil and Gas	0
19-4041.01	Geophysical Data Technicians	1	47-5013.00	Service Unit Operators, Oil, Gas, and Mining	0
19-4041.02	Geological Sample Test Technicians	0	47-5021.00	Earth Drillers, Except Oil and Gas	0
19-4051.01	Nuclear Equipment Operation Technicians	0	47-5031.00	Explosives Workers, Ordnance Handling Experts, and Blasters	0
19-4051.02	Nuclear Monitoring Technicians	0	47-5041.00	Continuous Mining Machine Operators	0
19-4061.00	Social Science Research Assistants	1	47-5042.00	Mine Cutting and Channeling Machine Operators	0
19-4061.01	City and Regional Planning Aides	0	47-5051.00	Rock Splitters, Quarry	0
19-4091.00	Environmental Science and Protection Technicians, Including Health	0	47-5061.00	Roof Bolters, Mining	0
19-4092.00	Forensic Science Technicians	0	47-5071.00	Roustabouts, Oil and Gas	0
19-4093.00	Forest and Conservation Technicians	0	47-5081.00	Helpers--Extraction Workers	0
19-4099.01	Quality Control Analysts	0	49-1011.00	First-Line Supervisors of Mechanics, Installers, and Repairers	0
19-4099.02	Precision Agriculture Technicians	1	49-2011.00	Computer, Automated Teller, and Office Machine Repairers	0
19-4099.03	Remote Sensing Technicians	1	49-2021.00	Radio, Cellular, and Tower Equipment Installers and Repairers	0
21-1011.00	Substance Abuse and Behavioral Disorder Counselors	1	49-2021.01	Radio Mechanics	0
21-1012.00	Educational, Guidance, School, and Vocational Counselors	1	49-2022.00	Telecommunications Equipment Installers and Repairers, Except Line Installers	0
21-1013.00	Marriage and Family Therapists	1	49-2091.00	Avionics Technicians	0
21-1014.00	Mental Health Counselors	0	49-2092.00	Electric Motor, Power Tool, and Related Repairers	0

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21-1015.00	Rehabilitation Counselors	1	49-2093.00	Electrical and Electronics Installers and Repairers, Transportation Equipment	0
21-1021.00	Child, Family, and School Social Workers	0	49-2094.00	Electrical and Electronics Repairers, Commercial and Industrial Equipment	0
21-1022.00	Healthcare Social Workers	0	49-2095.00	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	0
21-1023.00	Mental Health and Substance Abuse Social Workers	0	49-2096.00	Electronic Equipment Installers and Repairers, Motor Vehicles	0
21-1091.00	Health Educators	0	49-2097.00	Electronic Home Entertainment Equipment Installers and Repairers	0
21-1092.00	Probation Officers and Correctional Treatment Specialists	1	49-2098.00	Security and Fire Alarm Systems Installers	0
21-1093.00	Social and Human Service Assistants	0	49-3011.00	Aircraft Mechanics and Service Technicians	0
21-1094.00	Community Health Workers	0	49-3021.00	Automotive Body and Related Repairers	0
21-2011.00	Clergy	1	49-3022.00	Automotive Glass Installers and Repairers	0
21-2021.00	Directors, Religious Activities and Education	1	49-3023.01	Automotive Master Mechanics	0
23-1011.00	Lawyers	1	49-3023.02	Automotive Specialty Technicians	0
23-1012.00	Judicial Law Clerks	1	49-3031.00	Bus and Truck Mechanics and Diesel Engine Specialists	0
23-1021.00	Administrative Law Judges, Adjudicators, and Hearing Officers	1	49-3041.00	Farm Equipment Mechanics and Service Technicians	0
23-1022.00	Arbitrators, Mediators, and Conciliators	1	49-3042.00	Mobile Heavy Equipment Mechanics, Except Engines	0
23-1023.00	Judges, Magistrate Judges, and Magistrates	0	49-3043.00	Rail Car Repairers	0
23-2011.00	Paralegals and Legal Assistants	1	49-3051.00	Motorboat Mechanics and Service Technicians	0
23-2091.00	Court Reporters	1	49-3052.00	Motorcycle Mechanics	0
23-2093.00	Title Examiners, Abstractors, and Searchers	1	49-3053.00	Outdoor Power Equipment and Other Small Engine Mechanics	0
25-1011.00	Business Teachers, Postsecondary	1	49-3091.00	Bicycle Repairers	0
25-1021.00	Computer Science Teachers, Postsecondary	1	49-3092.00	Recreational Vehicle Service Technicians	0
25-1022.00	Mathematical Science Teachers, Postsecondary	1	49-3093.00	Tire Repairers and Changers	0
25-1031.00	Architecture Teachers, Postsecondary	1	49-9011.00	Mechanical Door Repairers	0
25-1032.00	Engineering Teachers, Postsecondary	1	49-9012.00	Control and Valve Installers and Repairers, Except Mechanical Door	0
25-1041.00	Agricultural Sciences Teachers, Postsecondary	1	49-9021.01	Heating and Air Conditioning Mechanics and Installers	0
25-1042.00	Biological Science Teachers, Postsecondary	1	49-9021.02	Refrigeration Mechanics and Installers	0
25-1043.00	Forestry and Conservation Science Teachers, Postsecondary	1	49-9031.00	Home Appliance Repairers	0
25-1051.00	Atmospheric, Earth, Marine, and Space Sciences Teachers, Postsecondary	1	49-9041.00	Industrial Machinery Mechanics	0
25-1052.00	Chemistry Teachers, Postsecondary	0	49-9043.00	Maintenance Workers, Machinery	0
25-1053.00	Environmental Science Teachers, Postsecondary	1	49-9044.00	Millwrights	0
25-1054.00	Physics Teachers, Postsecondary	1	49-9045.00	Refractory Materials Repairers, Except Brickmasons	0
25-1061.00	Anthropology and Archeology Teachers, Postsecondary	1	49-9051.00	Electrical Power-Line Installers and Repairers	0
25-1062.00	Area, Ethnic, and Cultural Studies Teachers, Postsecondary	1	49-9052.00	Telecommunications Line Installers and Repairers	0
25-1063.00	Economics Teachers, Postsecondary	1	49-9061.00	Camera and Photographic Equipment Repairers	0
25-1064.00	Geography Teachers, Postsecondary	1	49-9062.00	Medical Equipment Repairers	0
25-1065.00	Political Science Teachers, Postsecondary	1	49-9063.00	Musical Instrument Repairers and Tuners	0
25-1066.00	Psychology Teachers, Postsecondary	1	49-9064.00	Watch Repairers	0
25-1067.00	Sociology Teachers, Postsecondary	1	49-9071.00	Maintenance and Repair Workers, General	0
25-1071.00	Health Specialties Teachers, Postsecondary	1	49-9081.00	Wind Turbine Service Technicians	0
25-1072.00	Nursing Instructors and Teachers, Postsecondary	1	49-9091.00	Coin, Vending, and Amusement Machine Servicers and Repairers	1
25-1081.00	Education Teachers, Postsecondary	1	49-9092.00	Commercial Divers	0

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25-1082.00	Library Science Teachers, Postsecondary	1	49-9093.00	Fabric Menders, Except Garment	0
25-1111.00	Criminal Justice and Law Enforcement Teachers, Postsecondary	1	49-9094.00	Locksmiths and Safe Repairers	0
25-1112.00	Law Teachers, Postsecondary	1	49-9095.00	Manufactured Building and Mobile Home Installers	0
25-1113.00	Social Work Teachers, Postsecondary	1	49-9096.00	Riggers	0
25-1121.00	Art, Drama, and Music Teachers, Postsecondary	1	49-9097.00	Signal and Track Switch Repairers	0
25-1122.00	Communications Teachers, Postsecondary	1	49-9098.00	Helpers—Installation, Maintenance, and Repair Workers	0
25-1123.00	English Language and Literature Teachers, Postsecondary	1	49-9099.01	Geothermal Technicians	0
25-1124.00	Foreign Language and Literature Teachers, Postsecondary	1	51-1011.00	First-Line Supervisors of Production and Operating Workers	0
25-1125.00	History Teachers, Postsecondary	1	51-2011.00	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	0
25-1126.00	Philosophy and Religion Teachers, Postsecondary	1	51-2021.00	Coil Winders, Tapers, and Finishers	0
25-1191.00	Graduate Teaching Assistants	1	51-2022.00	Electrical and Electronic Equipment Assemblers	0
25-1192.00	Home Economics Teachers, Postsecondary	1	51-2023.00	Electromechanical Equipment Assemblers	0
25-1193.00	Recreation and Fitness Studies Teachers, Postsecondary	1	51-2031.00	Engine and Other Machine Assemblers	0
25-1194.00	Vocational Education Teachers, Postsecondary	1	51-2041.00	Structural Metal Fabricators and Fitters	0
25-2011.00	Preschool Teachers, Except Special Education	1	51-2091.00	Fiberglass Laminators and Fabricators	0
25-2012.00	Kindergarten Teachers, Except Special Education	1	51-2092.00	Team Assemblers	0
25-2021.00	Elementary School Teachers, Except Special Education	1	51-2093.00	Timing Device Assemblers and Adjusters	0
25-2022.00	Middle School Teachers, Except Special and Career/Technical Education	1	51-3011.00	Bakers	0
25-2023.00	Career/Technical Education Teachers, Middle School	1	51-3021.00	Butchers and Meat Cutters	0
25-2031.00	Secondary School Teachers, Except Special and Career/Technical Education	1	51-3022.00	Meat, Poultry, and Fish Cutters and Trimmers	0
25-2032.00	Career/Technical Education Teachers, Secondary School	1	51-3023.00	Slaughterers and Meat Packers	0
25-2051.00	Special Education Teachers, Preschool	1	51-3091.00	Food and Tobacco Roasting, Baking, and Drying Machine Operators and Tenders	0
25-2052.00	Special Education Teachers, Kindergarten and Elementary School	1	51-3092.00	Food Batchmakers	0
25-2053.00	Special Education Teachers, Middle School	1	51-3093.00	Food Cooking Machine Operators and Tenders	0
25-2054.00	Special Education Teachers, Secondary School	1	51-4011.00	Computer-Controlled Machine Tool Operators, Metal and Plastic	0
25-2059.01	Adapted Physical Education Specialists	0	51-4012.00	Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	0
25-3011.00	Adult Basic and Secondary Education and Literacy Teachers and Instructors	1	51-4021.00	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	0
25-3021.00	Self-Enrichment Education Teachers	1	51-4022.00	Forging Machine Setters, Operators, and Tenders, Metal and Plastic	0
25-3099.02	Tutors	1	51-4023.00	Rolling Machine Setters, Operators, and Tenders, Metal and Plastic	0
25-4011.00	Archivists	1	51-4031.00	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	0
25-4012.00	Curators	1	51-4032.00	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	0
25-4013.00	Museum Technicians and Conservators	0	51-4033.00	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	0
25-4021.00	Librarians	1	51-4034.00	Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic	0
25-4031.00	Library Technicians	1	51-4035.00	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	0
25-9011.00	Audio-Visual and Multimedia Collections Specialists	1	51-4041.00	Machinists	0
25-9021.00	Farm and Home Management Advisors	0	51-4051.00	Metal-Refining Furnace Operators and Tenders	0
25-9031.00	Instructional Coordinators	1	51-4052.00	Pourers and Casters, Metal	0
25-9031.01	Instructional Designers and Technologists	1	51-4061.00	Model Makers, Metal and Plastic	0
25-9041.00	Teacher Assistants	1	51-4062.00	Patternmakers, Metal and Plastic	0

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27-1011.00	Art Directors		1 51-4071.00	Foundry Mold and Coremakers	0
27-1012.00	Craft Artists		0 51-4072.00	Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic	0
27-1013.00	Fine Artists, Including Painters, Sculptors, and Illustrators		1 51-4081.00	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	0
27-1014.00	Multimedia Artists and Animators		1 51-4111.00	Tool and Die Makers	0
27-1021.00	Commercial and Industrial Designers		1 51-4121.06	Welders, Cutters, and Welder Fitters	0
27-1022.00	Fashion Designers		1 51-4121.07	Soldiers and Brazers	0
27-1023.00	Floral Designers		1 51-4122.00	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	0
27-1024.00	Graphic Designers		1 51-4191.00	Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic	0
27-1025.00	Interior Designers		1 51-4192.00	Layout Workers, Metal and Plastic	0
27-1026.00	Merchandise Displayers and Window Trimmers		0 51-4193.00	Plating and Coating Machine Setters, Operators, and Tenders, Metal and Plastic	0
27-1027.00	Set and Exhibit Designers		1 51-4194.00	Tool Grinders, Filers, and Sharpeners	0
27-2011.00	Actors		0 51-5111.00	Prepress Technicians and Workers	1
27-2012.01	Producers		0 51-5112.00	Printing Press Operators	0
27-2012.02	Directors- Stage, Motion Pictures, Television, and Radio		1 51-5113.00	Print Binding and Finishing Workers	0
27-2012.03	Program Directors		0 51-6011.00	Laundry and Dry-Cleaning Workers	0
27-2012.04	Talent Directors		1 51-6021.00	Pressers, Textile, Garment, and Related Materials	0
27-2012.05	Technical Directors/Managers		0 51-6031.00	Sewing Machine Operators	0
27-2021.00	Athletes and Sports Competitors		1 51-6041.00	Shoe and Leather Workers and Repairers	0
27-2022.00	Coaches and Scouts		1 51-6042.00	Shoe Machine Operators and Tenders	0
27-2023.00	Umpires, Referees, and Other Sports Officials		0 51-6051.00	Sewers, Hand	0
27-2031.00	Dancers		0 51-6052.00	Tailors, Dressmakers, and Custom Sewers	0
27-2032.00	Choreographers		0 51-6061.00	Textile Bleaching and Dyeing Machine Operators and Tenders	0
27-2041.01	Music Directors		0 51-6062.00	Textile Cutting Machine Setters, Operators, and Tenders	0
27-2041.04	Music Composers and Arrangers		1 51-6063.00	Textile Knitting and Weaving Machine Setters, Operators, and Tenders	0
27-2042.01	Singers		0 51-6064.00	Textile Winding, Twisting, and Drawing Out Machine Setters, Operators, and Tenders	0
27-2042.02	Musicians, Instrumental		0 51-6091.00	Extruding and Forming Machine Setters, Operators, and Tenders, Synthetic and Glass Fibers	0
27-3011.00	Radio and Television Announcers		0 51-6092.00	Fabric and Apparel Patternmakers	1
27-3012.00	Public Address System and Other Announcers		1 51-6093.00	Upholsterers	0
27-3021.00	Broadcast News Analysts		0 51-7011.00	Cabinetmakers and Bench Carpenters	0
27-3022.00	Reporters and Correspondents		1 51-7021.00	Furniture Finishers	0
27-3031.00	Public Relations Specialists		1 51-7031.00	Model Makers, Wood	0
27-3041.00	Editors		1 51-7032.00	Patternmakers, Wood	0
27-3042.00	Technical Writers		1 51-7041.00	Sawing Machine Setters, Operators, and Tenders, Wood	0
27-3043.04	Copy Writers		1 51-7042.00	Woodworking Machine Setters, Operators, and Tenders, Except Sawing	0
27-3043.05	Poets, Lyricists and Creative Writers		1 51-8011.00	Nuclear Power Reactor Operators	0
27-3091.00	Interpreters and Translators		0 51-8012.00	Power Distributors and Dispatchers	0
27-4011.00	Audio and Video Equipment Technicians		1 51-8013.00	Power Plant Operators	0
27-4012.00	Broadcast Technicians		1 51-8021.00	Stationary Engineers and Boiler Operators	0
27-4013.00	Radio Operators		1 51-8031.00	Water and Wastewater Treatment Plant and System Operators	0

O*Net SOC Code	Title	Teleworkable	O*Net SOC Code	Title	Teleworkable
27-4014.00	Sound Engineering Technicians	1	51-8091.00	Chemical Plant and System Operators	0
27-4021.00	Photographers	1	51-8092.00	Gas Plant Operators	0
27-4031.00	Camera Operators, Television, Video, and Motion Picture	0	51-8093.00	Petroleum Pump System Operators, Refinery Operators, and Gaugers	0
27-4032.00	Film and Video Editors	1	51-8099.01	Biofuels Processing Technicians	0
29-1011.00	Chiropractors	0	51-8099.03	Biomass Plant Technicians	0
29-1021.00	Dentists, General	0	51-8099.04	Hydroelectric Plant Technicians	0
29-1022.00	Oral and Maxillofacial Surgeons	0	51-9011.00	Chemical Equipment Operators and Tenders	0
29-1023.00	Orthodontists	0	51-9012.00	Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders	0
29-1024.00	Prosthodontists	0	51-9021.00	Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders	0
29-1031.00	Dietitians and Nutritionists	0	51-9022.00	Grinding and Polishing Workers, Hand	0
29-1041.00	Optometrists	0	51-9023.00	Mixing and Blending Machine Setters, Operators, and Tenders	0
29-1051.00	Pharmacists	0	51-9031.00	Cutters and Trimmers, Hand	0
29-1061.00	Anesthesiologists	0	51-9032.00	Cutting and Slicing Machine Setters, Operators, and Tenders	0
29-1062.00	Family and General Practitioners	0	51-9041.00	Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders	0
29-1063.00	Internists, General	0	51-9051.00	Furnace, Kiln, Oven, Drier, and Kettle Operators and Tenders	0
29-1064.00	Obstetricians and Gynecologists	0	51-9061.00	Inspectors, Testers, Sorters, Samplers, and Weighers	0
29-1065.00	Pediatricians, General	0	51-9071.01	Jewelers	0
29-1066.00	Psychiatrists	1	51-9071.06	Gem and Diamond Workers	1
29-1067.00	Surgeons	0	51-9071.07	Precious Metal Workers	0
29-1069.01	Allergists and Immunologists	0	51-9081.00	Dental Laboratory Technicians	0
29-1069.02	Dermatologists	0	51-9082.00	Medical Appliance Technicians	0
29-1069.03	Hospitalists	0	51-9083.00	Ophthalmic Laboratory Technicians	1
29-1069.04	Neurologists	0	51-9111.00	Packaging and Filling Machine Operators and Tenders	0
29-1069.05	Nuclear Medicine Physicians	0	51-9121.00	Coating, Painting, and Spraying Machine Setters, Operators, and Tenders	0
29-1069.06	Ophthalmologists	0	51-9122.00	Painters, Transportation Equipment	0
29-1069.07	Pathologists	0	51-9123.00	Painting, Coating, and Decorating Workers	1
29-1069.08	Physical Medicine and Rehabilitation Physicians	0	51-9141.00	Semiconductor Processors	0
29-1069.09	Preventive Medicine Physicians	1	51-9151.00	Photographic Process Workers and Processing Machine Operators	0
29-1069.10	Radiologists	0	51-9191.00	Adhesive Bonding Machine Operators and Tenders	0
29-1069.11	Sports Medicine Physicians	0	51-9192.00	Cleaning, Washing, and Metal Pickling Equipment Operators and Tenders	0
29-1069.12	Urologists	0	51-9193.00	Cooling and Freezing Equipment Operators and Tenders	0
29-1071.00	Physician Assistants	0	51-9194.00	Etchers and Engravers	0
29-1071.01	Anesthesiologist Assistants	0	51-9195.03	Stone Cutters and Carvers, Manufacturing	0
29-1081.00	Podiatrists	0	51-9195.04	Glass Blowers, Molders, Benders, and Finishers	0
29-1122.00	Occupational Therapists	0	51-9195.05	Potters, Manufacturing	0
29-1122.01	Low Vision Therapists, Orientation and Mobility Specialists, and Vision Rehabilitation Therapists	0	51-9195.07	Molding and Casting Workers	0
29-1123.00	Physical Therapists	0	51-9196.00	Paper Goods Machine Setters, Operators, and Tenders	0
29-1124.00	Radiation Therapists	0	51-9197.00	Tire Builders	0
29-1125.00	Recreational Therapists	0	51-9198.00	Helpers--Production Workers	0
29-1125.01	Art Therapists	1	51-9199.01	Recycling and Reclamation Workers	0

O*Net SOC Code	Title	Teleworkable	O*Net SOC Code	Title	Teleworkable
29-1125.02	Music Therapists	1	53-1011.00	Aircraft Cargo Handling Supervisors	0
29-1126.00	Respiratory Therapists	0	53-1021.00	First-Line Supervisors of Helpers, Laborers, and Material Movers, Hand	1
29-1127.00	Speech-Language Pathologists	1	53-1021.01	Recycling Coordinators	0
29-1128.00	Exercise Physiologists	0	53-1031.00	First-Line Supervisors of Transportation and Material-Moving Machine and Vehicle Operators	1
29-1131.00	Veterinarians	0	53-2011.00	Airline Pilots, Copilots, and Flight Engineers	0
29-1141.00	Registered Nurses	0	53-2012.00	Commercial Pilots	0
29-1141.01	Acute Care Nurses	0	53-2021.00	Air Traffic Controllers	1
29-1141.02	Advanced Practice Psychiatric Nurses	0	53-2022.00	Airfield Operations Specialists	0
29-1141.03	Critical Care Nurses	0	53-2031.00	Flight Attendants	0
29-1141.04	Clinical Nurse Specialists	0	53-3011.00	Ambulance Drivers and Attendants, Except Emergency Medical Technicians	0
29-1151.00	Nurse Anesthetists	0	53-3021.00	Bus Drivers, Transit and Intercity	0
29-1161.00	Nurse Midwives	0	53-3022.00	Bus Drivers, School or Special Client	0
29-1171.00	Nurse Practitioners	0	53-3031.00	Driver/Sales Workers	0
29-1181.00	Audiologists	0	53-3032.00	Heavy and Tractor-Trailer Truck Drivers	0
29-1199.01	Acupuncturists	0	53-3033.00	Light Truck or Delivery Services Drivers	0
29-1199.04	Naturopathic Physicians	0	53-3041.00	Taxi Drivers and Chauffeurs	0
29-1199.05	Orthoptists	0	53-4011.00	Locomotive Engineers	0
29-2011.00	Medical and Clinical Laboratory Technologists	0	53-4012.00	Locomotive Firemen	0
29-2011.01	Cytogenetic Technologists	0	53-4013.00	Rail Yard Engineers, Dinkey Operators, and Hostlers	0
29-2011.02	Cytotechnologists	0	53-4021.00	Railroad Brake, Signal, and Switch Operators	0
29-2011.03	Histotechnologists and Histologic Technicians	0	53-4031.00	Railroad Conductors and Yardmasters	0
29-2012.00	Medical and Clinical Laboratory Technicians	0	53-4041.00	Subway and Streetcar Operators	0
29-2021.00	Dental Hygienists	0	53-5011.00	Sailors and Marine Oilers	0
29-2031.00	Cardiovascular Technologists and Technicians	0	53-5021.01	Ship and Boat Captains	0
29-2032.00	Diagnostic Medical Sonographers	0	53-5021.02	Mates- Ship, Boat, and Barge	0
29-2033.00	Nuclear Medicine Technologists	0	53-5021.03	Pilots, Ship	0
29-2034.00	Radiologic Technologists	0	53-5022.00	Motorboat Operators	0
29-2035.00	Magnetic Resonance Imaging Technologists	0	53-5031.00	Ship Engineers	0
29-2041.00	Emergency Medical Technicians and Paramedics	0	53-6011.00	Bridge and Lock Tenders	0
29-2051.00	Dietetic Technicians	0	53-6021.00	Parking Lot Attendants	0
29-2052.00	Pharmacy Technicians	0	53-6031.00	Automotive and Watercraft Service Attendants	0
29-2053.00	Psychiatric Technicians	0	53-6041.00	Traffic Technicians	0
29-2054.00	Respiratory Therapy Technicians	0	53-6051.01	Aviation Inspectors	0
29-2055.00	Surgical Technologists	0	53-6051.07	Transportation Vehicle, Equipment and Systems Inspectors, Except Aviation	0
29-2056.00	Veterinary Technologists and Technicians	0	53-6051.08	Freight and Cargo Inspectors	0
29-2057.00	Ophthalmic Medical Technicians	0	53-6061.00	Transportation Attendants, Except Flight Attendants	0
29-2061.00	Licensed Practical and Licensed Vocational Nurses	0	53-7011.00	Conveyor Operators and Tenders	0
29-2071.00	Medical Records and Health Information Technicians	1	53-7021.00	Crane and Tower Operators	0
29-2081.00	Opticians, Dispensing	0	53-7031.00	Dredge Operators	0
29-2091.00	Orthotists and Prosthetists	0	53-7032.00	Excavating and Loading Machine and Dragline Operators	0

<i>O*Net SOC Code</i>	<i>Title</i>	<i>Teleworkable</i>	<i>O*Net SOC Code</i>	<i>Title</i>	<i>Teleworkable</i>
29-2092.00	Hearing Aid Specialists		0 53-7033.00	Loading Machine Operators, Underground Mining	0
29-2099.01	Neurodiagnostic Technologists		0 53-7041.00	Hoist and Winch Operators	0
29-2099.05	Ophthalmic Medical Technologists		0 53-7051.00	Industrial Truck and Tractor Operators	0
29-2099.06	Radiologic Technicians		0 53-7061.00	Cleaners of Vehicles and Equipment	0
29-2099.07	Surgical Assistants		0 53-7062.00	Laborers and Freight, Stock, and Material Movers, Hand	0
29-9011.00	Occupational Health and Safety Specialists		0 53-7063.00	Machine Feeders and Offbearers	0
29-9012.00	Occupational Health and Safety Technicians		0 53-7064.00	Packers and Packagers, Hand	0
29-9091.00	Athletic Trainers		1 53-7071.00	Gas Compressor and Gas Pumping Station Operators	0
29-9092.00	Genetic Counselors		1 53-7072.00	Pump Operators, Except Wellhead Pumpers	0
29-9099.01	Midwives		0 53-7073.00	Wellhead Pumpers	0
31-1011.00	Home Health Aides		0 53-7081.00	Refuse and Recyclable Material Collectors	0
31-1013.00	Psychiatric Aides		0 53-7111.00	Mine Shuttle Car Operators	0
31-1014.00	Nursing Assistants		0 53-7121.00	Tank Car, Truck, and Ship Loaders	0

## B. O\*Net to COD Conversion Table

Table 19: O\*Net to COD conversion table; Source: (Barbosa Filho, et al., 2022)

<i>O*Net (Code)</i>	<i>O*Net (Title)</i>	<i>SOC (Code)</i>	<i>SOC (Title)</i>	<i>ISCO08 (Code)</i>	<i>ISCO08 (Title)</i>	<i>PNADC (Code)</i>	<i>PNADC (Title)</i>
11-1011.00	Chief Executives	11-1011	Chief Executives	1112	Senior government officials	1112	Dirigentes superiores da administração pública
11-1011.03	Chief Sustainability Officers	11-1011	Chief Executives	1112	Senior government officials	1112	Dirigentes superiores da administração pública
11-1021.00	General and Operations Managers	11-1021	General and Operations Managers	1112	Senior government officials	1112	Dirigentes superiores da administração pública
11-1031.00	Legislators	11-1031	Legislators	1111	Legislators	1111	Legisladores
11-2011.00	Advertising and Promotions Managers	11-2011	Advertising and Promotions Managers	1222	Advertising and public relations managers	1222	Dirigentes de publicidade e relações públicas
11-2011.01	Green Marketers	11-2011	Advertising and Promotions Managers	1222	Advertising and public relations managers	1222	Dirigentes de publicidade e relações públicas
11-2021.00	Marketing Managers	11-2021	Marketing Managers	1221	Sales and marketing managers	1221	Dirigentes de vendas e comercialização
11-2022.00	Sales Managers	11-2022	Sales Managers	1221	Sales and marketing managers	1221	Dirigentes de vendas e comercialização
11-2031.00	Public Relations and Fundraising Managers	11-2031	Public Relations and Fundraising Managers	1114	Senior officials of special-interest organizations	1114	Dirigentes de organizações que apresentam um interesse especial
11-3011.00	Administrative Services Managers	11-3011	Administrative Services Managers	1219	Business services and administration managers not elsewhere classified	1219	Dirigentes de administração e de serviços não classificados anteriormente
11-3021.00	Computer and Information Systems Managers	11-3021	Computer and Information Systems Managers	1330	Information and communications technology service managers	1330	Dirigentes de serviços de tecnologia da informação e comunicações
11-3031.00	Financial Managers	11-3031	Financial Managers	1211	Finance managers	1211	Dirigentes financeiros
11-3031.01	Treasurers and Controllers	11-3031	Financial Managers	1211	Finance managers	1211	Dirigentes financeiros
11-3031.02	Financial Managers, Branch or Department	11-3031	Financial Managers	1211	Finance managers	1211	Dirigentes financeiros
11-3051.00	Industrial Production Managers	11-3051	Industrial Production Managers	1321	Manufacturing managers	1321	Dirigentes de indústria de transformação
11-3051.01	Quality Control Systems Managers	11-3051	Industrial Production Managers	1321	Manufacturing managers	1321	Dirigentes de indústria de transformação
11-3051.02	Geothermal Production Managers	11-3051	Industrial Production Managers	1321	Manufacturing managers	1321	Dirigentes de indústria de transformação
11-3051.03	Biofuels Production Managers	11-3051	Industrial Production Managers	1321	Manufacturing managers	1321	Dirigentes de indústria de transformação
11-3051.04	Biomass Power Plant Managers	11-3051	Industrial Production Managers	1321	Manufacturing managers	1321	Dirigentes de indústria de transformação
11-3051.05	Methane/Landfill Gas Collection System Operators	11-3051	Industrial Production Managers	1321	Manufacturing managers	1321	Dirigentes de indústria de transformação
11-3051.06	Hydroelectric Production Managers	11-3051	Industrial Production Managers	1321	Manufacturing managers	1321	Dirigentes de indústria de transformação
11-3061.00	Purchasing Managers	11-3061	Purchasing Managers	1219	Business services and administration managers not elsewhere classified	1219	Dirigentes de administração e de serviços não classificados anteriormente

<i>O*Net (Code)</i>	<i>O*Net (Title)</i>	<i>SOC (Code)</i>	<i>SOC (Title)</i>	<i>ISCO08 (Code)</i>	<i>ISCO08 (Title)</i>	<i>PNADC (Code)</i>	<i>PNADC (Title)</i>
11-3071.00	Transportation, Storage, and Distribution Managers	11-3071	Transportation, Storage, and Distribution Managers	1324	Supply, distribution and related managers	1324	Dirigentes de empresas de abastecimento, distribuição e afins
11-3071.01	Transportation Managers	11-3071	Transportation, Storage, and Distribution Managers	1324	Supply, distribution and related managers	1324	Dirigentes de empresas de abastecimento, distribuição e afins
11-3071.02	Storage and Distribution Managers	11-3071	Transportation, Storage, and Distribution Managers	1324	Supply, distribution and related managers	1324	Dirigentes de empresas de abastecimento, distribuição e afins
11-3071.03	Logistics Managers	11-3071	Transportation, Storage, and Distribution Managers	1324	Supply, distribution and related managers	1324	Dirigentes de empresas de abastecimento, distribuição e afins
11-3111.00	Compensation and Benefits Managers	11-3111	Compensation and Benefits Managers	1212	Human resource managers	1212	Dirigentes de recursos humanos
11-3121.00	Human Resources Managers	11-3121	Human Resources Managers	1212	Human resource managers	1212	Dirigentes de recursos humanos
11-3131.00	Training and Development Managers	11-3131	Training and Development Managers	1212	Human resource managers	1212	Dirigentes de recursos humanos
11-9013.00	Farmers, Ranchers, and Other Agricultural Managers	11-9013	Farmers, Ranchers, and Other Agricultural Managers	1311	Agricultural and forestry production managers	1311	Dirigentes de produção agropecuária e silvicultura
11-9013.01	Nursery and Greenhouse Managers	11-9013	Farmers, Ranchers, and Other Agricultural Managers	1311	Agricultural and forestry production managers	1311	Dirigentes de produção agropecuária e silvicultura
11-9013.02	Farm and Ranch Managers	11-9013	Farmers, Ranchers, and Other Agricultural Managers	1311	Agricultural and forestry production managers	1311	Dirigentes de produção agropecuária e silvicultura
11-9013.03	Aquacultural Managers	11-9013	Farmers, Ranchers, and Other Agricultural Managers	1311	Agricultural and forestry production managers	1311	Dirigentes de produção agropecuária e silvicultura
11-9021.00	Construction Managers	11-9021	Construction Managers	1323	Construction managers	1323	Dirigentes de empresas de construção
11-9031.00	Education Administrators, Preschool and Childcare Center/Program	11-9031	Education Administrators, Preschool and Childcare Center/Program	1341	Child care services managers	1341	Dirigentes de serviços de cuidados infantis
11-9032.00	Education Administrators, Elementary and Secondary School	11-9032	Education Administrators, Elementary and Secondary School	1345	Education managers	1345	Dirigentes de serviços de educação
11-9033.00	Education Administrators, Postsecondary	11-9033	Education Administrators, Postsecondary	1345	Education managers	1345	Dirigentes de serviços de educação
11-9039.00	Education Administrators, All Other	11-9039	Education Administrators, All Other	1345	Education managers	1345	Dirigentes de serviços de educação
11-9039.01	Distance Learning Coordinators	11-9039	Education Administrators, All Other	1345	Education managers	1345	Dirigentes de serviços de educação
11-9039.02	Fitness and Wellness Coordinators	11-9039	Education Administrators, All Other	1345	Education managers	1345	Dirigentes de serviços de educação
11-9041.00	Architectural and Engineering Managers	11-9041	Architectural and Engineering Managers	1223	Research and development managers	1223	Dirigentes de pesquisa e desenvolvimento
11-9041.01	Biofuels/Biodiesel Technology and Product Development Managers	11-9041	Architectural and Engineering Managers	1223	Research and development managers	1223	Dirigentes de pesquisa e desenvolvimento
11-9051.00	Food Service Managers	11-9051	Food Service Managers	1412	Restaurant managers	1412	Gerentes de restaurantes
11-9061.00	Funeral Service Managers	11-9061	Funeral Service Managers	1219	Business services and administration managers not elsewhere classified	1219	Dirigentes de administração e de serviços não classificados anteriormente
11-9071.00	Gaming Managers	11-9071	Gaming Managers	1431	Sports, recreation and cultural centre managers	1431	Gerentes de centros esportivos, de diversão e culturais
11-9081.00	Lodging Managers	11-9081	Lodging Managers	1411	Hotel managers	1411	Gerentes de hotéis
11-9111.00	Medical and Health Services Managers	11-9111	Medical and Health Services Managers	1342	Health services managers	1342	Dirigentes de serviços de saúde
11-9121.00	Natural Sciences Managers	11-9121	Natural Sciences Managers	1223	Research and development managers	1223	Dirigentes de pesquisa e desenvolvimento
11-9121.01	Clinical Research Coordinators	11-9121	Natural Sciences Managers	1223	Research and development managers	1223	Dirigentes de pesquisa e desenvolvimento
11-9121.02	Water Resource Specialists	11-9121	Natural Sciences Managers	1223	Research and development managers	1223	Dirigentes de pesquisa e desenvolvimento
11-9131.00	Postmasters and Mail Superintendents	11-9131	Postmasters and Mail Superintendents	1219	Business services and administration managers not elsewhere classified	1219	Dirigentes de administração e de serviços não classificados anteriormente
11-9141.00	Property, Real Estate, and Community Association Managers	11-9141	Property, Real Estate, and Community Association Managers	3334	Real estate agents and property managers	3334	Agentes imobiliários
11-9151.00	Social and Community Service Managers	11-9151	Social and Community Service Managers	1344	Social welfare managers	1344	Dirigentes de serviços de bem-estar social
11-9161.00	Emergency Management Directors	11-9161	Emergency Management Directors	1112	Senior government officials	1112	Dirigentes superiores da administração pública
11-9199.00	Managers, All Other	11-9199	Managers, All Other	1114	Senior officials of special-interest organizations	1114	Dirigentes de organizações que apresentam um interesse especial
11-9199.01	Regulatory Affairs Managers	11-9199	Managers, All Other	1114	Senior officials of special-interest organizations	1114	Dirigentes de organizações que apresentam um interesse especial
11-9199.02	Compliance Managers	11-9199	Managers, All Other	1114	Senior officials of special-interest organizations	1114	Dirigentes de organizações que apresentam um interesse especial
11-9199.03	Investment Fund Managers	11-9199	Managers, All Other	1114	Senior officials of special-interest organizations	1114	Dirigentes de organizações que apresentam um interesse especial
11-9199.04	Supply Chain Managers	11-9199	Managers, All Other	1114	Senior officials of special-interest organizations	1114	Dirigentes de organizações que apresentam um interesse especial
11-9199.07	Security Managers	11-9199	Managers, All Other	1114	Senior officials of special-interest organizations	1114	Dirigentes de organizações que apresentam um interesse especial
11-9199.08	Loss Prevention Managers	11-9199	Managers, All Other	1114	Senior officials of special-interest organizations	1114	Dirigentes de organizações que apresentam um interesse especial
11-9199.09	Wind Energy Operations Managers	11-9199	Managers, All Other	1114	Senior officials of special-interest organizations	1114	Dirigentes de organizações que apresentam um interesse especial
11-9199.10	Wind Energy Project Managers	11-9199	Managers, All Other	1114	Senior officials of special-interest organizations	1114	Dirigentes de organizações que apresentam um interesse especial
11-9199.11	Brownfield Redevelopment Specialists and Site Managers	11-9199	Managers, All Other	1114	Senior officials of special-interest organizations	1114	Dirigentes de organizações que apresentam um interesse especial
13-1011.00	Agents and Business Managers of Artists, Performers, and Athletes	13-1011	Agents and Business Managers of Artists, Performers, and Athletes	3339	Business services agents not elsewhere classified	3339	Agentes de serviços comerciais não classificados anteriormente
13-1021.00	Buyers and Purchasing Agents, Farm Products	13-1021	Buyers and Purchasing Agents, Farm Products	3323	Buyers	3323	Agentes de compras

## Appendix

<i>O*Net (Code)</i>	<i>O*Net (Title)</i>	<i>SOC (Code)</i>	<i>SOC (Title)</i>	<i>ISCO08 (Code)</i>	<i>ISCO08 (Title)</i>	<i>PNADC (Code)</i>	<i>PNADC (Title)</i>
13-1022.00	Wholesale and Retail Buyers, Except Farm Products Purchasing Agents, Except Wholesale, Retail, and Farm Products	13-1022	Wholesale and Retail Buyers, Except Farm Products Purchasing Agents, Except Wholesale, Retail, and Farm Products	3323	Buyers	3323	Agentes de compras
13-1023.00	Wholesale, Retail, and Farm Products	13-1023	Wholesale, Retail, and Farm Products	3323	Buyers	3323	Agentes de compras
13-1031.00	Claims Adjusters, Examiners, and Investigators	13-1031	Claims Adjusters, Examiners, and Investigators	3315	Valuers and loss assessors	3315	Avaliadores
13-1031.01	Claims Examiners, Property and Casualty Insurance	13-1031	Claims Adjusters, Examiners, and Investigators	3315	Valuers and loss assessors	3315	Avaliadores
13-1031.02	Insurance Adjusters, Examiners, and Investigators	13-1031	Claims Adjusters, Examiners, and Investigators	3315	Valuers and loss assessors	3315	Avaliadores
13-1032.00	Insurance Appraisers, Auto Damage	13-1032	Insurance Appraisers, Auto Damage	3315	Valuers and loss assessors	3315	Avaliadores
13-1041.00	Compliance Officers	13-1041	Compliance Officers	3351	Customs and border inspectors	3351	Agentes aduaneiros e inspetores de fronteiras
13-1041.01	Environmental Compliance Inspectors	13-1041	Compliance Officers	3351	Customs and border inspectors	3351	Agentes aduaneiros e inspetores de fronteiras
13-1041.02	Licensing Examiners and Inspectors	13-1041	Compliance Officers	3351	Customs and border inspectors	3351	Agentes aduaneiros e inspetores de fronteiras
13-1041.03	Equal Opportunity Representatives and Officers	13-1041	Compliance Officers	3351	Customs and border inspectors	3351	Agentes aduaneiros e inspetores de fronteiras
13-1041.04	Government Property Inspectors and Investigators	13-1041	Compliance Officers	3351	Customs and border inspectors	3351	Agentes aduaneiros e inspetores de fronteiras
13-1041.06	Coroners	13-1041	Compliance Officers	3351	Customs and border inspectors	3351	Agentes aduaneiros e inspetores de fronteiras
13-1041.07	Regulatory Affairs Specialists	13-1041	Compliance Officers	3351	Customs and border inspectors	3351	Agentes aduaneiros e inspetores de fronteiras
13-1051.00	Cost Estimators	13-1051	Cost Estimators	3339	Business services agents not elsewhere classified	3339	Agentes de serviços comerciais não classificados anteriormente
13-1071.00	Human Resources Specialists	13-1071	Human Resources Specialists	2423	Personnel and careers professionals	2423	Especialistas em políticas e serviços de pessoal e afins
13-1074.00	Farm Labor Contractors	13-1074	Farm Labor Contractors	3333	Employment agents and contractors	3333	Agentes de emprego e agenciadores de mão de obra
13-1075.00	Labor Relations Specialists	13-1075	Labor Relations Specialists	2423	Personnel and careers professionals	2423	Especialistas em políticas e serviços de pessoal e afins
13-1081.00	Logisticians	13-1081	Logisticians	2421	Management and organization analysts	2421	Analistas de gestão e administração
13-1081.01	Logistics Engineers	13-1081	Logisticians	2421	Management and organization analysts	2421	Analistas de gestão e administração
13-1081.02	Logistics Analysts	13-1081	Logisticians	2421	Management and organization analysts	2421	Analistas de gestão e administração
13-1111.00	Management Analysts	13-1111	Management Analysts	2421	Management and organization analysts	2421	Analistas de gestão e administração
13-1121.00	Meeting, Convention, and Event Planners	13-1121	Meeting, Convention, and Event Planners	3332	Conference and event planners	3332	Organizadores de conferências e eventos
13-1131.00	Fundraisers	13-1131	Fundraisers	4214	Debt-collectors and related workers	4214	Cobradores e afins
13-1141.00	Compensation, Benefits, and Job Analysis Specialists	13-1141	Compensation, Benefits, and Job Analysis Specialists	2423	Personnel and careers professionals	2423	Especialistas em políticas e serviços de pessoal e afins
13-1151.00	Training and Development Specialists	13-1151	Training and Development Specialists	2356	Information technology trainers	2356	Instrutores em tecnologias da informação
13-1161.00	Market Research Analysts and Marketing Specialists	13-1161	Market Research Analysts and Marketing Specialists	2431	Advertising and marketing professionals	2431	Profissionais da publicidade e da comercialização
13-1199.00	Business Operations Specialists, All Other	13-1199	Business Operations Specialists, All Other	2422	Policy administration professionals	2422	Especialistas em políticas de administração
13-1199.01	Energy Auditors	13-1199	Business Operations Specialists, All Other	2422	Policy administration professionals	2422	Especialistas em políticas de administração
13-1199.02	Security Management Specialists	13-1199	Business Operations Specialists, All Other	2422	Policy administration professionals	2422	Especialistas em políticas de administração
13-1199.03	Customs Brokers	13-1199	Business Operations Specialists, All Other	2422	Policy administration professionals	2422	Especialistas em políticas de administração
13-1199.04	Business Continuity Planners	13-1199	Business Operations Specialists, All Other	2422	Policy administration professionals	2422	Especialistas em políticas de administração
13-1199.05	Sustainability Specialists	13-1199	Business Operations Specialists, All Other	2422	Policy administration professionals	2422	Especialistas em políticas de administração
13-1199.06	Online Merchants	13-1199	Business Operations Specialists, All Other	2422	Policy administration professionals	2422	Especialistas em políticas de administração
13-2011.00	Accountants and Auditors	13-2011	Accountants and Auditors	2411	Accountants	2411	Contadores
13-2011.01	Accountants	13-2011	Accountants and Auditors	2411	Accountants	2411	Contadores
13-2011.02	Auditors	13-2011	Accountants and Auditors	2411	Accountants	2411	Contadores
13-2021.00	Appraisers and Assessors of Real Estate	13-2021	Appraisers and Assessors of Real Estate	3315	Valuers and loss assessors	3315	Avaliadores
13-2021.01	Assessors	13-2021	Appraisers and Assessors of Real Estate	3315	Valuers and loss assessors	3315	Avaliadores
13-2021.02	Appraisers, Real Estate	13-2021	Appraisers and Assessors of Real Estate	3315	Valuers and loss assessors	3315	Avaliadores
13-2031.00	Budget Analysts	13-2031	Budget Analysts	2411	Accountants	2411	Contadores
13-2041.00	Credit Analysts	13-2041	Credit Analysts	2413	Financial analysts	2413	Analistas financeiros
13-2051.00	Financial Analysts	13-2051	Financial Analysts	2412	Financial and investment advisers	2412	Assessores financeiros e em investimentos
13-2052.00	Personal Financial Advisors	13-2052	Personal Financial Advisors	2412	Financial and investment advisers	2412	Assessores financeiros e em investimentos
13-2053.00	Insurance Underwriters	13-2053	Insurance Underwriters	3321	Insurance representatives	3321	Agentes de seguros
13-2061.00	Financial Examiners	13-2061	Financial Examiners	2413	Financial analysts	2413	Analistas financeiros

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13-2071.00	Credit Counselors	13-2071	Credit Counselors	3312	Credit and loans officers	3312	Agentes de empréstimos e financiamento
13-2071.01	Loan Counselors	13-2071	Credit Counselors	3312	Credit and loans officers	3312	Agentes de empréstimos e financiamento
13-2072.00	Loan Officers	13-2072	Loan Officers	3312	Credit and loans officers	3312	Agentes de empréstimos e financiamento
13-2081.00	Tax Examiners and Collectors, and Revenue Agents	13-2081	Tax Examiners and Collectors, and Revenue Agents	3352	Government tax and excise officials	3352	Agentes da administração tributária
13-2082.00	Tax Preparers	13-2082	Tax Preparers	2411	Accountants	2411	Contadores
13-2099.00	Financial Specialists, All Other	13-2099	Financial Specialists, All Other	3339	Business services agents not elsewhere classified	3339	Agentes de serviços comerciais não classificados anteriormente
13-2099.01	Financial Quantitative Analysts	13-2099	Financial Specialists, All Other	3339	Business services agents not elsewhere classified	3339	Agentes de serviços comerciais não classificados anteriormente
13-2099.02	Risk Management Specialists	13-2099	Financial Specialists, All Other	3339	Business services agents not elsewhere classified	3339	Agentes de serviços comerciais não classificados anteriormente
13-2099.03	Investment Underwriters	13-2099	Financial Specialists, All Other	3339	Business services agents not elsewhere classified	3339	Agentes de serviços comerciais não classificados anteriormente
13-2099.04	Fraud Examiners, Investigators and Analysts	13-2099	Financial Specialists, All Other	3339	Business services agents not elsewhere classified	3339	Agentes de serviços comerciais não classificados anteriormente
15-1111.00	Computer and Information Research Scientists	15-1111	Computer and Information Research Scientists	2511	Systems analysts	2511	Analistas de sistemas
15-1121.00	Computer Systems Analysts	15-1121	Computer Systems Analysts	2511	Systems analysts	2511	Analistas de sistemas
15-1121.01	Informatics Nurse Specialists	15-1121	Computer Systems Analysts	2511	Systems analysts	2511	Analistas de sistemas
15-1122.00	Information Security Analysts	15-1122	Information Security Analysts	2529	Database and network professionals not elsewhere classified	2529	Especialistas em base de dados e em redes de computadores não classificados anteriormente
15-1131.00	Computer Programmers	15-1131	Computer Programmers	2514	Applications programmers	2514	Programadores de aplicações
15-1132.00	Software Developers, Applications	15-1132	Software Developers, Applications	2512	Software developers	2512	Desenvolvedores de programas e aplicativos (software)
15-1133.00	Software Developers, Systems Software	15-1133	Software Developers, Systems Software	2512	Software developers	2512	Desenvolvedores de programas e aplicativos (software)
15-1134.00	Web Developers	15-1134	Web Developers	2513	Web and multimedia developers	2513	Desenvolvedores de páginas de internet (web) e multimídia
15-1141.00	Database Administrators	15-1141	Database Administrators	2521	Database designers and administrators	2521	Desenhistas e administradores de bases de dados
15-1142.00	Network and Computer Systems Administrators	15-1142	Network and Computer Systems Administrators	2522	Systems administrators	2522	Administradores de sistemas
15-1143.00	Computer Network Architects	15-1143	Computer Network Architects	2523	Computer network professionals	2523	Profissionais em rede de computadores
15-1143.01	Telecommunications Engineering Specialists	15-1143	Computer Network Architects	2523	Computer network professionals	2523	Profissionais em rede de computadores
15-1151.00	Computer User Support Specialists	15-1151	Computer User Support Specialists	3512	Information and communications technology user support technicians	3512	Técnicos em assistência ao usuário de tecnologia da informação e das comunicações
15-1152.00	Computer Network Support Specialists	15-1152	Computer Network Support Specialists	3513	Computer network and systems technicians	3513	Técnicos de redes e sistemas de computadores
15-1199.00	Computer Occupations, All Other	15-1199	Computer Occupations, All Other	2519	Software and applications developers and analysts not elsewhere classified	2519	Desenvolvedores e analistas de programas e aplicativos (software) e multimídia não classificados anteriormente
15-1199.01	Software Quality Assurance Engineers and Testers	15-1199	Computer Occupations, All Other	2519	Software and applications developers and analysts not elsewhere classified	2519	Desenvolvedores e analistas de programas e aplicativos (software) e multimídia não classificados anteriormente
15-1199.02	Computer Systems Engineers/Architects	15-1199	Computer Occupations, All Other	2519	Software and applications developers and analysts not elsewhere classified	2519	Desenvolvedores e analistas de programas e aplicativos (software) e multimídia não classificados anteriormente
15-1199.03	Web Administrators	15-1199	Computer Occupations, All Other	2519	Software and applications developers and analysts not elsewhere classified	2519	Desenvolvedores e analistas de programas e aplicativos (software) e multimídia não classificados anteriormente
15-1199.04	Geospatial Information Scientists and Technologists	15-1199	Computer Occupations, All Other	2519	Software and applications developers and analysts not elsewhere classified	2519	Desenvolvedores e analistas de programas e aplicativos (software) e multimídia não classificados anteriormente
15-1199.05	Geographic Information Systems Technicians	15-1199	Computer Occupations, All Other	2519	Software and applications developers and analysts not elsewhere classified	2519	Desenvolvedores e analistas de programas e aplicativos (software) e multimídia não classificados anteriormente
15-1199.06	Database Architects	15-1199	Computer Occupations, All Other	2519	Software and applications developers and analysts not elsewhere classified	2519	Desenvolvedores e analistas de programas e aplicativos (software) e multimídia não classificados anteriormente
15-1199.07	Data Warehousing Specialists	15-1199	Computer Occupations, All Other	2519	Software and applications developers and analysts not elsewhere classified	2519	Desenvolvedores e analistas de programas e aplicativos (software) e multimídia não classificados anteriormente
15-1199.08	Business Intelligence Analysts	15-1199	Computer Occupations, All Other	2519	Software and applications developers and analysts not elsewhere classified	2519	Desenvolvedores e analistas de programas e aplicativos (software) e multimídia não classificados anteriormente
15-1199.09	Information Technology Project Managers	15-1199	Computer Occupations, All Other	2519	Software and applications developers and analysts not elsewhere classified	2519	Desenvolvedores e analistas de programas e aplicativos (software) e multimídia não classificados anteriormente
15-1199.10	Search Marketing Strategists	15-1199	Computer Occupations, All Other	2519	Software and applications developers and analysts not elsewhere classified	2519	Desenvolvedores e analistas de programas e aplicativos (software) e multimídia não classificados anteriormente

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15-1199.11	Video Game Designers	15-1199	Computer Occupations, All Other	2519	Software and applications developers and analysts not elsewhere classified	2519	Desenvolvedores e analistas de programas e aplicativos (software) e multimídia não classificados anteriormente
15-1199.12	Document Management Specialists	15-1199	Computer Occupations, All Other	2519	Software and applications developers and analysts not elsewhere classified	2519	Desenvolvedores e analistas de programas e aplicativos (software) e multimídia não classificados anteriormente
15-2011.00	Actuaries	15-2011	Actuaries	2120	Mathematicians, actuaries and statisticians	2120	Matemáticos, atuários e estatísticos
15-2021.00	Mathematicians	15-2021	Mathematicians	2120	Mathematicians, actuaries and statisticians	2120	Matemáticos, atuários e estatísticos
15-2031.00	Operations Research Analysts	15-2031	Operations Research Analysts	2120	Mathematicians, actuaries and statisticians	2120	Matemáticos, atuários e estatísticos
15-2041.00	Statisticians	15-2041	Statisticians	2120	Mathematicians, actuaries and statisticians	2120	Matemáticos, atuários e estatísticos
15-2041.01	Biostatisticians	15-2041	Statisticians	2120	Mathematicians, actuaries and statisticians	2120	Matemáticos, atuários e estatísticos
15-2041.02	Clinical Data Managers	15-2041	Statisticians	2120	Mathematicians, actuaries and statisticians	2120	Matemáticos, atuários e estatísticos
15-2091.00	Mathematical Technicians	15-2091	Mathematical Technicians	3314	Statistical, mathematical and related associate professionals	3314	Profissionais de nível médio de serviços estatísticos, matemáticos e afins
15-2099.00	Mathematical Science Occupations, All Other	15-2099	Mathematical Science Occupations, All Other	3314	Statistical, mathematical and related associate professionals	3314	Profissionais de nível médio de serviços estatísticos, matemáticos e afins
17-1011.00	Architects, Except Landscape and Naval	17-1011	Architects, Except Landscape and Naval	2161	Building architects	2161	Arquitetos de edificações
17-1012.00	Landscape Architects	17-1012	Landscape Architects	2162	Landscape architects	2162	Arquitetos paisagistas
17-1021.00	Cartographers and Photogrammetrists	17-1021	Cartographers and Photogrammetrists	2165	Cartographers and surveyors	2165	Cartógrafos e agrimensores
17-1022.00	Surveyors	17-1022	Surveyors	2165	Cartographers and surveyors	2165	Cartógrafos e agrimensores
17-1022.01	Geodetic Surveyors	17-1022	Surveyors	2165	Cartographers and surveyors	2165	Cartógrafos e agrimensores
17-2011.00	Aerospace Engineers	17-2011	Aerospace Engineers	2144	Mechanical engineers	2144	Engenheiros mecânicos
17-2021.00	Agricultural Engineers	17-2021	Agricultural Engineers	2144	Mechanical engineers	2144	Engenheiros mecânicos
17-2031.00	Biomedical Engineers	17-2031	Biomedical Engineers	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-2041.00	Chemical Engineers	17-2041	Chemical Engineers	2145	Chemical engineers	2145	Engenheiros químicos
17-2051.00	Civil Engineers	17-2051	Civil Engineers	2142	Civil engineers	2142	Engenheiros civis
17-2051.01	Transportation Engineers	17-2051	Civil Engineers	2142	Civil engineers	2142	Engenheiros civis
17-2061.00	Computer Hardware Engineers	17-2061	Computer Hardware Engineers	2152	Electronics engineers	2152	Engenheiros eletrônicos
17-2071.00	Electrical Engineers	17-2071	Electrical Engineers	2151	Electrical engineers	2151	Engenheiros eletricistas
17-2072.00	Electronics Engineers, Except Computer	17-2072	Electronics Engineers, Except Computer	2152	Electronics engineers	2152	Engenheiros eletrônicos
17-2072.01	Radio Frequency Identification Device Specialists	17-2072	Electronics Engineers, Except Computer	2152	Electronics engineers	2152	Engenheiros eletrônicos
17-2081.00	Environmental Engineers	17-2081	Environmental Engineers	2143	Environmental engineers	2143	Engenheiros de meio ambiente
17-2081.01	Water/Wastewater Engineers	17-2081	Environmental Engineers	2143	Environmental engineers	2143	Engenheiros de meio ambiente
17-2111.00	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-2111.01	Industrial Safety and Health Engineers	17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-2111.02	Fire-Prevention and Protection Engineers	17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-2111.03	Product Safety Engineers	17-2111	Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-2112.00	Industrial Engineers	17-2112	Industrial Engineers	2141	Industrial and production engineers	2141	Engenheiros industriais e de produção
17-2112.01	Human Factors Engineers and Ergonomists	17-2112	Industrial Engineers	2141	Industrial and production engineers	2141	Engenheiros industriais e de produção
17-2121.00	Marine Engineers and Naval Architects	17-2121	Marine Engineers and Naval Architects	2144	Mechanical engineers	2144	Engenheiros mecânicos
17-2121.01	Marine Engineers	17-2121	Marine Engineers and Naval Architects	2144	Mechanical engineers	2144	Engenheiros mecânicos
17-2121.02	Marine Architects	17-2121	Marine Engineers and Naval Architects	2144	Mechanical engineers	2144	Engenheiros mecânicos
17-2131.00	Materials Engineers	17-2131	Materials Engineers	2146	Mining engineers, metallurgists and related professionals	2146	Engenheiros de minas, metalúrgicos e afins
17-2141.00	Mechanical Engineers	17-2141	Mechanical Engineers	2144	Mechanical engineers	2144	Engenheiros mecânicos
17-2141.01	Fuel Cell Engineers	17-2141	Mechanical Engineers	2144	Mechanical engineers	2144	Engenheiros mecânicos
17-2141.02	Automotive Engineers	17-2141	Mechanical Engineers	2144	Mechanical engineers	2144	Engenheiros mecânicos
17-2151.00	Mining and Geological Engineers, Including Mining Safety Engineers	17-2151	Mining and Geological Engineers, Including Mining Safety Engineers	2146	Mining engineers, metallurgists and related professionals	2146	Engenheiros de minas, metalúrgicos e afins

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17-2161.00	Nuclear Engineers	17-2161	Nuclear Engineers	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-2171.00	Petroleum Engineers	17-2171	Petroleum Engineers	2146	Mining engineers, metallurgists and related professionals	2146	Engenheiros de minas, metalúrgicos e afins
17-2199.00	Engineers, All Other	17-2199	Engineers, All Other	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-2199.01	Biochemical Engineers	17-2199	Engineers, All Other	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-2199.02	Validation Engineers	17-2199	Engineers, All Other	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-2199.03	Energy Engineers	17-2199	Engineers, All Other	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-2199.04	Manufacturing Engineers	17-2199	Engineers, All Other	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-2199.05	Mechatronics Engineers	17-2199	Engineers, All Other	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-2199.06	Microsystems Engineers	17-2199	Engineers, All Other	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-2199.07	Photonics Engineers	17-2199	Engineers, All Other	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-2199.08	Robotics Engineers	17-2199	Engineers, All Other	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-2199.09	Nanosystems Engineers	17-2199	Engineers, All Other	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-2199.10	Wind Energy Engineers	17-2199	Engineers, All Other	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-2199.11	Solar Energy Systems Engineers	17-2199	Engineers, All Other	2149	Engineering professionals not elsewhere classified	2149	Engenheiros não classificados anteriormente
17-3011.00	Architectural and Civil Drafters	17-3011	Architectural and Civil Drafters	3118	Draughtpersons	3118	Desenhistas e projetistas técnicos
17-3011.01	Architectural Drafters	17-3011	Architectural and Civil Drafters	3118	Draughtpersons	3118	Desenhistas e projetistas técnicos
17-3011.02	Civil Drafters	17-3011	Architectural and Civil Drafters	3118	Draughtpersons	3118	Desenhistas e projetistas técnicos
17-3012.00	Electrical and Electronics Drafters	17-3012	Electrical and Electronics Drafters	3118	Draughtpersons	3118	Desenhistas e projetistas técnicos
17-3012.01	Electronic Drafters	17-3012	Electrical and Electronics Drafters	3118	Draughtpersons	3118	Desenhistas e projetistas técnicos
17-3012.02	Electrical Drafters	17-3012	Electrical and Electronics Drafters	3118	Draughtpersons	3118	Desenhistas e projetistas técnicos
17-3013.00	Mechanical Drafters	17-3013	Mechanical Drafters	3118	Draughtpersons	3118	Desenhistas e projetistas técnicos
17-3019.00	Drafters, All Other	17-3019	Drafters, All Other	3118	Draughtpersons	3118	Desenhistas e projetistas técnicos
17-3021.00	Aerospace Engineering and Operations Technicians	17-3021	Aerospace Engineering and Operations Technicians	3115	Mechanical engineering technicians	3115	Técnicos em engenharia mecânica
17-3022.00	Civil Engineering Technicians	17-3022	Civil Engineering Technicians	3112	Civil engineering technicians	3112	Técnicos em engenharia civil
17-3023.00	Electrical and Electronic Engineering Technicians	17-3023	Electrical and Electronic Engineering Technicians	3113	Electrical engineering technicians	3113	Eletrotécnicos
17-3023.01	Electronics Engineering Technicians	17-3023	Electrical and Electronic Engineering Technicians	3113	Electrical engineering technicians	3113	Eletrotécnicos
17-3023.03	Electrical Engineering Technicians	17-3023	Electrical and Electronic Engineering Technicians	3113	Electrical engineering technicians	3113	Eletrotécnicos
17-3024.00	Electro-Mechanical Technicians	17-3024	Electro-Mechanical Technicians	3113	Electrical engineering technicians	3113	Eletrotécnicos
17-3024.01	Robotics Technicians	17-3024	Electro-Mechanical Technicians	3113	Electrical engineering technicians	3113	Eletrotécnicos
17-3025.00	Environmental Engineering Technicians	17-3025	Environmental Engineering Technicians	3119	Physical and engineering science technicians not elsewhere classified	3119	Técnicos em ciências físicas e da engenharia não classificados anteriormente
17-3026.00	Industrial Engineering Technicians	17-3026	Industrial Engineering Technicians	3119	Physical and engineering science technicians not elsewhere classified	3119	Técnicos em ciências físicas e da engenharia não classificados anteriormente
17-3027.00	Mechanical Engineering Technicians	17-3027	Mechanical Engineering Technicians	3115	Mechanical engineering technicians	3115	Técnicos em engenharia mecânica
17-3027.01	Automotive Engineering Technicians	17-3027	Mechanical Engineering Technicians	3115	Mechanical engineering technicians	3115	Técnicos em engenharia mecânica
17-3029.00	Engineering Technicians, Except Drafters, All Other	17-3029	Engineering Technicians, Except Drafters, All Other	3115	Mechanical engineering technicians	3115	Técnicos em engenharia mecânica
17-3029.01	Non-Destructive Testing Specialists	17-3029	Engineering Technicians, Except Drafters, All Other	3115	Mechanical engineering technicians	3115	Técnicos em engenharia mecânica
17-3029.02	Electrical Engineering Technologists	17-3029	Engineering Technicians, Except Drafters, All Other	3115	Mechanical engineering technicians	3115	Técnicos em engenharia mecânica
17-3029.03	Electromechanical Engineering Technologists	17-3029	Engineering Technicians, Except Drafters, All Other	3115	Mechanical engineering technicians	3115	Técnicos em engenharia mecânica
17-3029.04	Electronics Engineering Technologists	17-3029	Engineering Technicians, Except Drafters, All Other	3115	Mechanical engineering technicians	3115	Técnicos em engenharia mecânica
17-3029.05	Industrial Engineering Technologists	17-3029	Engineering Technicians, Except Drafters, All Other	3115	Mechanical engineering technicians	3115	Técnicos em engenharia mecânica
17-3029.06	Manufacturing Engineering Technologists	17-3029	Engineering Technicians, Except Drafters, All Other	3115	Mechanical engineering technicians	3115	Técnicos em engenharia mecânica
17-3029.07	Mechanical Engineering Technologists	17-3029	Engineering Technicians, Except Drafters, All Other	3115	Mechanical engineering technicians	3115	Técnicos em engenharia mecânica
17-3029.08	Photonics Technicians	17-3029	Engineering Technicians, Except Drafters, All Other	3115	Mechanical engineering technicians	3115	Técnicos em engenharia mecânica
17-3029.09	Manufacturing Production Technicians	17-3029	Engineering Technicians, Except Drafters, All Other	3115	Mechanical engineering technicians	3115	Técnicos em engenharia mecânica
17-3029.10	Fuel Cell Technicians	17-3029	Engineering Technicians, Except Drafters, All Other	3115	Mechanical engineering technicians	3115	Técnicos em engenharia mecânica

<i>O*Net (Code)</i>	<i>O*Net (Title)</i>	<i>SOC (Code)</i>	<i>SOC (Title)</i>	<i>ISCO08 (Code)</i>	<i>ISCO08 (Title)</i>	<i>PNADC (Code)</i>	<i>PNADC (Title)</i>
17-3029.11	Nanotechnology Engineering Technologists	17-3029	Engineering Technicians, Except Drafters, All Other	3115	Mechanical engineering technicians	3115	Técnicos em engenharia mecânica
17-3029.12	Nanotechnology Engineering Technicians	17-3029	Engineering Technicians, Except Drafters, All Other	3115	Mechanical engineering technicians	3115	Técnicos em engenharia mecânica
17-3031.00	Surveying and Mapping Technicians	17-3031	Surveying and Mapping Technicians	3112	Civil engineering technicians	3112	Técnicos em engenharia civil
17-3031.01	Surveying Technicians	17-3031	Surveying and Mapping Technicians	3112	Civil engineering technicians	3112	Técnicos em engenharia civil
17-3031.02	Mapping Technicians	17-3031	Surveying and Mapping Technicians	3112	Civil engineering technicians	3112	Técnicos em engenharia civil
19-1011.00	Animal Scientists	19-1011	Animal Scientists	2131	Biologists, botanists, zoologists and related professionals	2131	Biólogos, botânicos, zoólogos e afins
19-1012.00	Food Scientists and Technologists	19-1012	Food Scientists and Technologists	2131	Biologists, botanists, zoologists and related professionals	2131	Biólogos, botânicos, zoólogos e afins
19-1013.00	Soil and Plant Scientists	19-1013	Soil and Plant Scientists	2131	Biologists, botanists, zoologists and related professionals	2131	Biólogos, botânicos, zoólogos e afins
19-1020.01	Biologists	19-1020	Biological Scientists	#N/D	#N/D	#N/D	#N/D
19-1021.00	Biochemists and Biophysicists	19-1021	Biochemists and Biophysicists	2131	Biologists, botanists, zoologists and related professionals	2131	Biólogos, botânicos, zoólogos e afins
19-1022.00	Microbiologists	19-1022	Microbiologists	2131	Biologists, botanists, zoologists and related professionals	2131	Biólogos, botânicos, zoólogos e afins
19-1023.00	Zoologists and Wildlife Biologists	19-1023	Zoologists and Wildlife Biologists	2131	Biologists, botanists, zoologists and related professionals	2131	Biólogos, botânicos, zoólogos e afins
19-1029.00	Biological Scientists, All Other	19-1029	Biological Scientists, All Other	2131	Biologists, botanists, zoologists and related professionals	2131	Biólogos, botânicos, zoólogos e afins
19-1029.01	Bioinformatics Scientists	19-1029	Biological Scientists, All Other	2131	Biologists, botanists, zoologists and related professionals	2131	Biólogos, botânicos, zoólogos e afins
19-1029.02	Molecular and Cellular Biologists	19-1029	Biological Scientists, All Other	2131	Biologists, botanists, zoologists and related professionals	2131	Biólogos, botânicos, zoólogos e afins
19-1029.03	Geneticists	19-1029	Biological Scientists, All Other	2131	Biologists, botanists, zoologists and related professionals	2131	Biólogos, botânicos, zoólogos e afins
19-1031.00	Conservation Scientists	19-1031	Conservation Scientists	2133	Environmental protection professionals	2133	Profissionais da proteção do meio ambiente
19-1031.01	Soil and Water Conservationists	19-1031	Conservation Scientists	2133	Environmental protection professionals	2133	Profissionais da proteção do meio ambiente
19-1031.02	Range Managers	19-1031	Conservation Scientists	2133	Environmental protection professionals	2133	Profissionais da proteção do meio ambiente
19-1031.03	Park Naturalists	19-1031	Conservation Scientists	2133	Environmental protection professionals	2133	Profissionais da proteção do meio ambiente
19-1032.00	Foresters	19-1032	Foresters	2132	Farming, forestry and fisheries advisers	2132	Agrônomos e afins
19-1041.00	Epidemiologists	19-1041	Epidemiologists	2131	Biologists, botanists, zoologists and related professionals	2131	Biólogos, botânicos, zoólogos e afins
19-1042.00	Medical Scientists, Except Epidemiologists	19-1042	Medical Scientists, Except Epidemiologists	2131	Biologists, botanists, zoologists and related professionals	2131	Biólogos, botânicos, zoólogos e afins
19-1099.00	Life Scientists, All Other	19-1099	Life Scientists, All Other	2131	Biologists, botanists, zoologists and related professionals	2131	Biólogos, botânicos, zoólogos e afins
19-2011.00	Astronomers	19-2011	Astronomers	2111	Physicists and astronomers	2111	Físicos e astrônomos
19-2012.00	Physicists	19-2012	Physicists	2111	Physicists and astronomers	2111	Físicos e astrônomos
19-2021.00	Atmospheric and Space Scientists	19-2021	Atmospheric and Space Scientists	2112	Meteorologists	2112	Meteorologistas
19-2031.00	Chemists	19-2031	Chemists	2113	Chemists	2113	Químicos
19-2032.00	Materials Scientists	19-2032	Materials Scientists	2113	Chemists	2113	Químicos
19-2041.00	Environmental Scientists and Specialists, Including Health	19-2041	Environmental Scientists and Specialists, Including Health	2133	Environmental protection professionals	2133	Profissionais da proteção do meio ambiente
19-2041.01	Climate Change Analysts	19-2041	Environmental Scientists and Specialists, Including Health	2133	Environmental protection professionals	2133	Profissionais da proteção do meio ambiente
19-2041.02	Environmental Restoration Planners	19-2041	Environmental Scientists and Specialists, Including Health	2133	Environmental protection professionals	2133	Profissionais da proteção do meio ambiente
19-2041.03	Industrial Ecologists	19-2041	Environmental Scientists and Specialists, Including Health	2133	Environmental protection professionals	2133	Profissionais da proteção do meio ambiente
19-2042.00	Geoscientists, Except Hydrologists and Geographers	19-2042	Geoscientists, Except Hydrologists and Geographers	2114	Geologists and geophysicists	2114	Geólogos e geofísicos
19-2043.00	Hydrologists	19-2043	Hydrologists	2114	Geologists and geophysicists	2114	Geólogos e geofísicos
19-2099.00	Physical Scientists, All Other	19-2099	Physical Scientists, All Other	211	Physical and earth science professionals	#N/D	#N/D
19-2099.01	Remote Sensing Scientists and Technologists	19-2099	Physical Scientists, All Other	211	Physical and earth science professionals	#N/D	#N/D
19-3011.00	Economists	19-3011	Economists	2631	Economists	2631	Economistas
19-3011.01	Environmental Economists	19-3011	Economists	2631	Economists	2631	Economistas
19-3022.00	Survey Researchers	19-3022	Survey Researchers	2120	Mathematicians, actuaries and statisticians	2120	Matemáticos, atuários e estatísticos
19-3031.00	Clinical, Counseling, and School Psychologists	19-3031	Clinical, Counseling, and School Psychologists	2634	Psychologists	2634	Psicólogos
19-3031.01	School Psychologists	19-3031	Clinical, Counseling, and School Psychologists	2634	Psychologists	2634	Psicólogos
19-3031.02	Clinical Psychologists	19-3031	Clinical, Counseling, and School Psychologists	2634	Psychologists	2634	Psicólogos
19-3031.03	Counseling Psychologists	19-3031	Clinical, Counseling, and School Psychologists	2634	Psychologists	2634	Psicólogos
19-3032.00	Industrial-Organizational Psychologists	19-3032	Industrial-Organizational Psychologists	2634	Psychologists	2634	Psicólogos

## Appendix

<i>O*Net (Code)</i>	<i>O*Net (Title)</i>	<i>SOC (Code)</i>	<i>SOC (Title)</i>	<i>ISCO08 (Code)</i>	<i>ISCO08 (Title)</i>	<i>PNADC (Code)</i>	<i>PNADC (Title)</i>
19-3039.00	Psychologists, All Other	19-3039	Psychologists, All Other	2634	Psychologists	2634	Psicólogos
19-3039.01	Neuropsychologists and Clinical Neuropsychologists	19-3039	Psychologists, All Other	2634	Psychologists	2634	Psicólogos
19-3041.00	Sociologists	19-3041	Sociologists	2632	Sociologists, anthropologists and related professionals	2632	Sociólogos, antropólogos e afins
19-3051.00	Urban and Regional Planners	19-3051	Urban and Regional Planners	2164	Town and traffic planners	2164	Urbanistas e engenheiros de trânsito
19-3091.00	Anthropologists and Archeologists	19-3091	Anthropologists and Archeologists	2632	Sociologists, anthropologists and related professionals	2632	Sociólogos, antropólogos e afins
19-3091.01	Anthropologists	19-3091	Anthropologists and Archeologists	2632	Sociologists, anthropologists and related professionals	2632	Sociólogos, antropólogos e afins
19-3091.02	Archeologists	19-3091	Anthropologists and Archeologists	2632	Sociologists, anthropologists and related professionals	2632	Sociólogos, antropólogos e afins
19-3092.00	Geographers	19-3092	Geographers	2632	Sociologists, anthropologists and related professionals	2632	Sociólogos, antropólogos e afins
19-3093.00	Historians	19-3093	Historians	2633	Philosophers, historians and political scientists	2633	Filósofos, historiadores e especialistas em ciência política
19-3094.00	Political Scientists	19-3094	Political Scientists	2633	Philosophers, historians and political scientists	2633	Filósofos, historiadores e especialistas em ciência política
19-3099.00	Social Scientists and Related Workers, All Other	19-3099	Social Scientists and Related Workers, All Other	2633	Philosophers, historians and political scientists	2633	Filósofos, historiadores e especialistas em ciência política
19-3099.01	Transportation Planners	19-3099	Social Scientists and Related Workers, All Other	2633	Philosophers, historians and political scientists	2633	Filósofos, historiadores e especialistas em ciência política
19-4011.00	Agricultural and Food Science Technicians	19-4011	Agricultural and Food Science Technicians	3142	Agricultural technicians	3142	Técnicos agropecuários
19-4011.01	Agricultural Technicians	19-4011	Agricultural and Food Science Technicians	3142	Agricultural technicians	3142	Técnicos agropecuários
19-4011.02	Food Science Technicians	19-4011	Agricultural and Food Science Technicians	3142	Agricultural technicians	3142	Técnicos agropecuários
19-4021.00	Biological Technicians	19-4021	Biological Technicians	3141	Life science technicians (excluding medical)	3141	Técnicos e profissionais de nível médio em ciências biológicas (exclusive da medicina)
19-4031.00	Chemical Technicians	19-4031	Chemical Technicians	3111	Chemical and physical science technicians	3111	Técnicos em ciências físicas e químicas
19-4041.00	Geological and Petroleum Technicians	19-4041	Geological and Petroleum Technicians	3111	Chemical and physical science technicians	3111	Técnicos em ciências físicas e químicas
19-4041.01	Geophysical Data Technicians	19-4041	Geological and Petroleum Technicians	3111	Chemical and physical science technicians	3111	Técnicos em ciências físicas e químicas
19-4041.02	Geological Sample Test Technicians	19-4041	Geological and Petroleum Technicians	3111	Chemical and physical science technicians	3111	Técnicos em ciências físicas e químicas
19-4051.00	Nuclear Technicians	19-4051	Nuclear Technicians	3119	Physical and engineering science technicians not elsewhere classified	3119	Técnicos em ciências físicas e da engenharia não classificados anteriormente
19-4051.01	Nuclear Equipment Operation Technicians	19-4051	Nuclear Technicians	3119	Physical and engineering science technicians not elsewhere classified	3119	Técnicos em ciências físicas e da engenharia não classificados anteriormente
19-4051.02	Nuclear Monitoring Technicians	19-4051	Nuclear Technicians	3119	Physical and engineering science technicians not elsewhere classified	3119	Técnicos em ciências físicas e da engenharia não classificados anteriormente
19-4061.00	Social Science Research Assistants	19-4061	Social Science Research Assistants	3314	Statistical, mathematical and related associate professionals	3314	Profissionais de nível médio de serviços estatísticos, matemáticos e afins
19-4061.01	City and Regional Planning Aides	19-4061	Social Science Research Assistants	3314	Statistical, mathematical and related associate professionals	3314	Profissionais de nível médio de serviços estatísticos, matemáticos e afins
19-4091.00	Environmental Science and Protection Technicians, Including Health	19-4091	Environmental Science and Protection Technicians, Including Health	3141	Life science technicians (excluding medical)	3141	Técnicos e profissionais de nível médio em ciências biológicas (exclusive da medicina)
19-4092.00	Forensic Science Technicians	19-4092	Forensic Science Technicians	3119	Physical and engineering science technicians not elsewhere classified	3119	Técnicos em ciências físicas e da engenharia não classificados anteriormente
19-4093.00	Forest and Conservation Technicians	19-4093	Forest and Conservation Technicians	3143	Forestry technicians	3143	Técnicos florestais
19-4099.00	Life, Physical, and Social Science Technicians, All Other	19-4099	Life, Physical, and Social Science Technicians, All Other	3111	Chemical and physical science technicians	3111	Técnicos em ciências físicas e químicas
19-4099.01	Quality Control Analysts	19-4099	Life, Physical, and Social Science Technicians, All Other	3111	Chemical and physical science technicians	3111	Técnicos em ciências físicas e químicas
19-4099.02	Precision Agriculture Technicians	19-4099	Life, Physical, and Social Science Technicians, All Other	3111	Chemical and physical science technicians	3111	Técnicos em ciências físicas e químicas
19-4099.03	Remote Sensing Technicians	19-4099	Life, Physical, and Social Science Technicians, All Other	3111	Chemical and physical science technicians	3111	Técnicos em ciências físicas e químicas
21-1011.00	Substance Abuse and Behavioral Disorder Counselors	21-1011	Substance Abuse and Behavioral Disorder Counselors	2635	Social work and counselling professionals	2635	Assistentes sociais
21-1012.00	Educational, Guidance, School, and Vocational Counselors	21-1012	Educational, Guidance, School, and Vocational Counselors	2359	Teaching professionals not elsewhere classified	2359	Profissionais de ensino não classificados anteriormente
21-1013.00	Marriage and Family Therapists	21-1013	Marriage and Family Therapists	2635	Social work and counselling professionals	2635	Assistentes sociais
21-1014.00	Mental Health Counselors	21-1014	Mental Health Counselors	2635	Social work and counselling professionals	2635	Assistentes sociais
21-1015.00	Rehabilitation Counselors	21-1015	Rehabilitation Counselors	2635	Social work and counselling professionals	2635	Assistentes sociais
21-1019.00	Counselors, All Other	21-1019	Counselors, All Other	2635	Social work and counselling professionals	2635	Assistentes sociais
21-1021.00	Child, Family, and School Social Workers	21-1021	Child, Family, and School Social Workers	2635	Social work and counselling professionals	2635	Assistentes sociais
21-1022.00	Healthcare Social Workers	21-1022	Healthcare Social Workers	2635	Social work and counselling professionals	2635	Assistentes sociais
21-1023.00	Mental Health and Substance Abuse Social Workers	21-1023	Mental Health and Substance Abuse Social Workers	2635	Social work and counselling professionals	2635	Assistentes sociais
21-1029.00	Social Workers, All Other	21-1029	Social Workers, All Other	2635	Social work and counselling professionals	2635	Assistentes sociais

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21-1091.00	Health Educators	21-1091	Health Educators	2263	Environmental and occupational health and hygiene professionals	2263	Profissionais da saúde e da higiene laboral e ambiental
21-1092.00	Probation Officers and Correctional Treatment Specialists	21-1092	Probation Officers and Correctional Treatment Specialists	2635	Social work and counselling professionals	2635	Assistentes sociais
21-1093.00	Social and Human Service Assistants	21-1093	Social and Human Service Assistants	3412	Social work associate professionals	3412	Trabalhadores e assistentes sociais de nível médio
21-1094.00	Community Health Workers	21-1094	Community Health Workers	3253	Community health workers	3253	Trabalhadores comunitários da saúde
21-1099.00	Community and Social Service Specialists, All Other	21-1099	Community and Social Service Specialists, All Other	2635	Social work and counselling professionals	2635	Assistentes sociais
21-2011.00	Clergy	21-2011	Clergy	2636	Religious professionals	2636	Ministros de cultos religiosos, missionários e afins
21-2021.00	Directors, Religious Activities and Education	21-2021	Directors, Religious Activities and Education	2636	Religious professionals	2636	Ministros de cultos religiosos, missionários e afins
21-2099.00	Religious Workers, All Other	21-2099	Religious Workers, All Other	3413	Religious associate professionals	3413	Auxiliares leigos de religião
23-1011.00	Lawyers	23-1011	Lawyers	2611	Lawyers	2611	Advogados e juristas
23-1012.00	Judicial Law Clerks	23-1012	Judicial Law Clerks	3411	Legal and related associate professionals	3411	Profissionais de nível médio do direito e serviços legais e afins
23-1021.00	Administrative Law Judges, Adjudicators, and Hearing Officers	23-1021	Administrative Law Judges, Adjudicators, and Hearing Officers	2612	Judges	2612	Juízes
23-1022.00	Arbitrators, Mediators, and Conciliators	23-1022	Arbitrators, Mediators, and Conciliators	2619	Legal professionals not elsewhere classified	2619	Profissionais em direito não classificados anteriormente
23-1023.00	Judges, Magistrate Judges, and Magistrates	23-1023	Judges, Magistrate Judges, and Magistrates	2612	Judges	2612	Juízes
23-2011.00	Paralegals and Legal Assistants	23-2011	Paralegals and Legal Assistants	3411	Legal and related associate professionals	3411	Profissionais de nível médio do direito e serviços legais e afins
23-2091.00	Court Reporters	23-2091	Court Reporters	3343	Administrative and executive secretaries	3343	Secretários executivos e administrativos
23-2093.00	Title Examiners, Abstractors, and Searchers	23-2093	Title Examiners, Abstractors, and Searchers	3411	Legal and related associate professionals	3411	Profissionais de nível médio do direito e serviços legais e afins
23-2099.00	Legal Support Workers, All Other	23-2099	Legal Support Workers, All Other	3411	Legal and related associate professionals	3411	Profissionais de nível médio do direito e serviços legais e afins
25-1011.00	Business Teachers, Postsecondary	25-1011	Business Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1021.00	Computer Science Teachers, Postsecondary	25-1021	Computer Science Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1022.00	Mathematical Science Teachers, Postsecondary	25-1022	Mathematical Science Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1031.00	Architecture Teachers, Postsecondary	25-1031	Architecture Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1032.00	Engineering Teachers, Postsecondary	25-1032	Engineering Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1041.00	Agricultural Sciences Teachers, Postsecondary	25-1041	Agricultural Sciences Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1042.00	Biological Science Teachers, Postsecondary	25-1042	Biological Science Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1043.00	Forestry and Conservation Science Teachers, Postsecondary	25-1043	Forestry and Conservation Science Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1051.00	Atmospheric, Earth, Marine, and Space Sciences Teachers, Postsecondary	25-1051	Atmospheric, Earth, Marine, and Space Sciences Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1052.00	Chemistry Teachers, Postsecondary	25-1052	Chemistry Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1053.00	Environmental Science Teachers, Postsecondary	25-1053	Environmental Science Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1054.00	Physics Teachers, Postsecondary	25-1054	Physics Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1061.00	Anthropology and Archeology Teachers, Postsecondary	25-1061	Anthropology and Archeology Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1062.00	Area, Ethnic, and Cultural Studies Teachers, Postsecondary	25-1062	Area, Ethnic, and Cultural Studies Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1063.00	Economics Teachers, Postsecondary	25-1063	Economics Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1064.00	Geography Teachers, Postsecondary	25-1064	Geography Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1065.00	Political Science Teachers, Postsecondary	25-1065	Political Science Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1066.00	Psychology Teachers, Postsecondary	25-1066	Psychology Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1067.00	Sociology Teachers, Postsecondary	25-1067	Sociology Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1069.00	Social Sciences Teachers, Postsecondary, All Other	25-1069	Social Sciences Teachers, Postsecondary, All Other	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1071.00	Health Specialties Teachers, Postsecondary	25-1071	Health Specialties Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1072.00	Nursing Instructors and Teachers, Postsecondary	25-1072	Nursing Instructors and Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1081.00	Education Teachers, Postsecondary	25-1081	Education Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1082.00	Library Science Teachers, Postsecondary	25-1082	Library Science Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1111.00	Criminal Justice and Law Enforcement Teachers, Postsecondary	25-1111	Criminal Justice and Law Enforcement Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1112.00	Law Teachers, Postsecondary	25-1112	Law Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1113.00	Social Work Teachers, Postsecondary	25-1113	Social Work Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior

O*Net (Code)	O*Net (Title)	SOC (Code)	SOC (Title)	ISCO08 (Code)	ISCO08 (Title)	PNADC (Code)	PNADC (Title)
25-1121.00	Art, Drama, and Music Teachers, Postsecondary	25-1121	Art, Drama, and Music Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1122.00	Communications Teachers, Postsecondary	25-1122	Communications Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1123.00	English Language and Literature Teachers, Postsecondary	25-1123	English Language and Literature Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1124.00	Foreign Language and Literature Teachers, Postsecondary	25-1124	Foreign Language and Literature Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1125.00	History Teachers, Postsecondary	25-1125	History Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1126.00	Philosophy and Religion Teachers, Postsecondary	25-1126	Philosophy and Religion Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1191.00	Graduate Teaching Assistants	25-1191	Graduate Teaching Assistants	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1192.00	Home Economics Teachers, Postsecondary	25-1192	Home Economics Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1193.00	Recreation and Fitness Studies Teachers, Postsecondary	25-1193	Recreation and Fitness Studies Teachers, Postsecondary	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-1194.00	Vocational Education Teachers, Postsecondary	25-1194	Vocational Education Teachers, Postsecondary	2320	Vocational education teachers	2320	Professores de formação profissional
25-1199.00	Postsecondary Teachers, All Other	25-1199	Postsecondary Teachers, All Other	2310	University and higher education teachers	2310	Professores de universidades e do ensino superior
25-2011.00	Preschool Teachers, Except Special Education	25-2011	Preschool Teachers, Except Special Education	2342	Early childhood educators	2342	Professores do ensino pré-escolar
25-2012.00	Kindergarten Teachers, Except Special Education	25-2012	Kindergarten Teachers, Except Special Education	2342	Early childhood educators	2342	Professores do ensino pré-escolar
25-2021.00	Elementary School Teachers, Except Special Education	25-2021	Elementary School Teachers, Except Special Education	2341	Primary school teachers	2341	Professores do ensino fundamental
25-2022.00	Middle School Teachers, Except Special and Career/Technical Education	25-2022	Middle School Teachers, Except Special and Career/Technical Education	2341	Primary school teachers	2341	Professores do ensino fundamental
25-2023.00	Career/Technical Education Teachers, Middle School	25-2023	Career/Technical Education Teachers, Middle School	2320	Vocational education teachers	2320	Professores de formação profissional
25-2031.00	Secondary School Teachers, Except Special and Career/Technical Education	25-2031	Secondary School Teachers, Except Special and Career/Technical Education	2330	Secondary education teachers	2330	Professores do ensino médio
25-2032.00	Career/Technical Education Teachers, Secondary School	25-2032	Career/Technical Education Teachers, Secondary School	2320	Vocational education teachers	2320	Professores de formação profissional
25-2051.00	Special Education Teachers, Preschool	25-2051	Special Education Teachers, Preschool	2352	Special needs teachers	2352	Educadores para necessidades especiais
25-2052.00	Special Education Teachers, Kindergarten and Elementary School	25-2052	Special Education Teachers, Kindergarten and Elementary School	2352	Special needs teachers	2352	Educadores para necessidades especiais
25-2053.00	Special Education Teachers, Middle School	25-2053	Special Education Teachers, Middle School	2352	Special needs teachers	2352	Educadores para necessidades especiais
25-2054.00	Special Education Teachers, Secondary School	25-2054	Special Education Teachers, Secondary School	2352	Special needs teachers	2352	Educadores para necessidades especiais
25-2059.00	Special Education Teachers, All Other	25-2059	Special Education Teachers, All Other	2352	Special needs teachers	2352	Educadores para necessidades especiais
25-2059.01	Adapted Physical Education Specialists	25-2059	Special Education Teachers, All Other	2352	Special needs teachers	2352	Educadores para necessidades especiais
25-3011.00	Adult Basic and Secondary Education and Literacy Teachers and Instructors	25-3011	Adult Basic and Secondary Education and Literacy Teachers and Instructors	2353	Other language teachers	2353	Outros professores de idiomas
25-3021.00	Self-Enrichment Education Teachers	25-3021	Self-Enrichment Education Teachers	2353	Other language teachers	2353	Outros professores de idiomas
25-3099.00	Teachers and Instructors, All Other	25-3099	Teachers and Instructors, All Other	2353	Other language teachers	2353	Outros professores de idiomas
25-3099.02	Tutors	25-3099	Teachers and Instructors, All Other	2353	Other language teachers	2353	Outros professores de idiomas
25-4011.00	Archivists	25-4011	Archivists	2621	Archivists and curators	2621	Arquivologistas e curadores de museus
25-4012.00	Curators	25-4012	Curators	2621	Archivists and curators	2621	Arquivologistas e curadores de museus
25-4013.00	Museum Technicians and Conservators	25-4013	Museum Technicians and Conservators	3433	Gallery, museum and library technicians	3433	Técnicos em galerias de arte, museus e bibliotecas
25-4021.00	Librarians	25-4021	Librarians	2622	Librarians and related information professionals	2622	Bibliotecários, documentaristas e afins
25-4031.00	Library Technicians	25-4031	Library Technicians	3433	Gallery, museum and library technicians	3433	Técnicos em galerias de arte, museus e bibliotecas
25-9011.00	Audio-Visual and Multimedia Collections Specialists	25-9011	Audio-Visual and Multimedia Collections Specialists	2622	Librarians and related information professionals	2622	Bibliotecários, documentaristas e afins
25-9021.00	Farm and Home Management Advisors	25-9021	Farm and Home Management Advisors	2132	Farming, forestry and fisheries advisers	2132	Agrônomos e afins
25-9031.00	Instructional Coordinators	25-9031	Instructional Coordinators	2351	Education methods specialists	2351	Especialistas em métodos pedagógicos
25-9031.01	Instructional Designers and Technologists	25-9031	Instructional Coordinators	2351	Education methods specialists	2351	Especialistas em métodos pedagógicos
25-9041.00	Teacher Assistants	25-9041	Teacher Assistants	5312	Teachers' aides	5312	Ajudantes de professores
25-9099.00	Education, Training, and Library Workers, All Other	25-9099	Education, Training, and Library Workers, All Other	2359	Teaching professionals not elsewhere classified	2359	Profissionais de ensino não classificados anteriormente
27-1011.00	Art Directors	27-1011	Art Directors	2654	Film, stage and related directors and producers	2654	Diretores de cinema, de teatro e afins
27-1012.00	Craft Artists	27-1012	Craft Artists	2651	Visual artists	2651	Artistas plásticos
27-1013.00	Fine Artists, Including Painters, Sculptors, and Illustrators	27-1013	Fine Artists, Including Painters, Sculptors, and Illustrators	2651	Visual artists	2651	Artistas plásticos
27-1014.00	Multimedia Artists and Animators	27-1014	Multimedia Artists and Animators	2166	Graphic and multimedia designers	2166	Desenhistas gráficos e de multimídia

## Appendix

<i>O*Net (Code)</i>	<i>O*Net (Title)</i>	<i>SOC (Code)</i>	<i>SOC (Title)</i>	<i>ISCO08 (Code)</i>	<i>ISCO08 (Title)</i>	<i>PNADC (Code)</i>	<i>PNADC (Title)</i>
27-1019.00	Artists and Related Workers, All Other	27-1019	Artists and Related Workers, All Other	3435	Other artistic and cultural associate professionals	3435	Outros profissionais de nível médio em atividades culturais e artísticas
27-1021.00	Commercial and Industrial Designers	27-1021	Commercial and Industrial Designers	2163	Product and garment designers	2163	Desenhistas de produtos e vestuário
27-1022.00	Fashion Designers	27-1022	Fashion Designers	2163	Product and garment designers	2163	Desenhistas de produtos e vestuário
27-1023.00	Floral Designers	27-1023	Floral Designers	7549	Craft and related workers not elsewhere classified	7549	Outros trabalhadores qualificados e operários da indústria e do artesanato não classificados anteriormente
27-1024.00	Graphic Designers	27-1024	Graphic Designers	2166	Graphic and multimedia designers	2166	Desenhistas gráficos e de multimídia
27-1025.00	Interior Designers	27-1025	Interior Designers	3432	Interior designers and decorators	3432	Desenhistas e decoradores de interiores
27-1026.00	Merchandise Displayers and Window Trimmers	27-1026	Merchandise Displayers and Window Trimmers	3432	Interior designers and decorators	3432	Desenhistas e decoradores de interiores
27-1027.00	Set and Exhibit Designers	27-1027	Set and Exhibit Designers	3432	Interior designers and decorators	3432	Desenhistas e decoradores de interiores
27-1029.00	Designers, All Other	27-1029	Designers, All Other	2163	Product and garment designers	2163	Desenhistas de produtos e vestuário
27-2011.00	Actors	27-2011	Actors	2655	Actors	2655	Atores
27-2012.00	Producers and Directors	27-2012	Producers and Directors	2654	Film, stage and related directors and producers	2654	Diretores de cinema, de teatro e afins
27-2012.01	Producers	27-2012	Producers and Directors	2654	Film, stage and related directors and producers	2654	Diretores de cinema, de teatro e afins
27-2012.02	Directors- Stage, Motion Pictures, Television, and Radio	27-2012	Producers and Directors	2654	Film, stage and related directors and producers	2654	Diretores de cinema, de teatro e afins
27-2012.03	Program Directors	27-2012	Producers and Directors	2654	Film, stage and related directors and producers	2654	Diretores de cinema, de teatro e afins
27-2012.04	Talent Directors	27-2012	Producers and Directors	2654	Film, stage and related directors and producers	2654	Diretores de cinema, de teatro e afins
27-2012.05	Technical Directors/Managers	27-2012	Producers and Directors	2654	Film, stage and related directors and producers	2654	Diretores de cinema, de teatro e afins
27-2021.00	Athletes and Sports Competitors	27-2021	Athletes and Sports Competitors	3421	Athletes and sports players	3421	Atletas e esportistas
27-2022.00	Coaches and Scouts	27-2022	Coaches and Scouts	3422	Sports coaches, instructors and officials	3422	Treinadores, instrutores e árbitros de atividades esportivas
27-2023.00	Umpires, Referees, and Other Sports Officials	27-2023	Umpires, Referees, and Other Sports Officials	3422	Sports coaches, instructors and officials	3422	Treinadores, instrutores e árbitros de atividades esportivas
27-2031.00	Dancers	27-2031	Dancers	2653	Dancers and choreographers	2653	Bailarinos e coreógrafos
27-2032.00	Choreographers	27-2032	Choreographers	2653	Dancers and choreographers	2653	Bailarinos e coreógrafos
27-2041.00	Music Directors and Composers	27-2041	Music Directors and Composers	2652	Musicians, singers and composers	2652	Músicos, cantores e compositores
27-2041.01	Music Directors	27-2041	Music Directors and Composers	2652	Musicians, singers and composers	2652	Músicos, cantores e compositores
27-2041.04	Music Composers and Arrangers	27-2041	Music Directors and Composers	2652	Musicians, singers and composers	2652	Músicos, cantores e compositores
27-2042.00	Musicians and Singers	27-2042	Musicians and Singers	2652	Musicians, singers and composers	2652	Músicos, cantores e compositores
27-2042.01	Singers	27-2042	Musicians and Singers	2652	Musicians, singers and composers	2652	Músicos, cantores e compositores
27-2042.02	Musicians, Instrumental	27-2042	Musicians and Singers	2652	Musicians, singers and composers	2652	Músicos, cantores e compositores
27-2099.00	Entertainers and Performers, Sports and Related Workers, All Other	27-2099	Entertainers and Performers, Sports and Related Workers, All Other	2659	Creative and performing artists not elsewhere classified	2659	Artistas criativos e interpretativos não classificados anteriormente
27-3011.00	Radio and Television Announcers	27-3011	Radio and Television Announcers	2656	Announcers on radio, television and other media	2656	Locutores de rádio, televisão e outros meios de comunicação
27-3012.00	Public Address System and Other Announcers	27-3012	Public Address System and Other Announcers	2656	Announcers on radio, television and other media	2656	Locutores de rádio, televisão e outros meios de comunicação
27-3021.00	Broadcast News Analysts	27-3021	Broadcast News Analysts	2656	Announcers on radio, television and other media	2656	Locutores de rádio, televisão e outros meios de comunicação
27-3022.00	Reporters and Correspondents	27-3022	Reporters and Correspondents	2642	Journalists	2642	Jornalistas
27-3031.00	Public Relations Specialists	27-3031	Public Relations Specialists	2432	Public relations professionals	2432	Profissionais de relações públicas
27-3041.00	Editors	27-3041	Editors	2641	Authors and related writers	2641	Escritores
27-3042.00	Technical Writers	27-3042	Technical Writers	2641	Authors and related writers	2641	Escritores
27-3043.00	Writers and Authors	27-3043	Writers and Authors	2431	Advertising and marketing professionals	2431	Profissionais da publicidade e da comercialização
27-3043.04	Copy Writers	27-3043	Writers and Authors	2431	Advertising and marketing professionals	2431	Profissionais da publicidade e da comercialização
27-3043.05	Poets, Lyricists and Creative Writers	27-3043	Writers and Authors	2431	Advertising and marketing professionals	2431	Profissionais da publicidade e da comercialização
27-3091.00	Interpreters and Translators	27-3091	Interpreters and Translators	2643	Translators, interpreters and other linguists	2643	Tradutores, intérpretes e linguistas
27-3099.00	Media and Communication Workers, All Other	27-3099	Media and Communication Workers, All Other	3435	Other artistic and cultural associate professionals	3435	Outros profissionais de nível médio em atividades culturais e artísticas
27-4011.00	Audio and Video Equipment Technicians	27-4011	Audio and Video Equipment Technicians	3521	Broadcasting and audio-visual technicians	3521	Técnicos de radiodifusão e gravação audiovisual
27-4012.00	Broadcast Technicians	27-4012	Broadcast Technicians	3521	Broadcasting and audio-visual technicians	3521	Técnicos de radiodifusão e gravação audiovisual
27-4013.00	Radio Operators	27-4013	Radio Operators	3521	Broadcasting and audio-visual technicians	3521	Técnicos de radiodifusão e gravação audiovisual

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27-4014.00	Sound Engineering Technicians	27-4014	Sound Engineering Technicians	3521	Broadcasting and audio-visual technicians	3521	Técnicos de radiodifusão e gravação audiovisual
27-4021.00	Photographers	27-4021	Photographers	3431	Photographers	3431	Fotógrafos
27-4031.00	Camera Operators, Television, Video, and Motion Picture	27-4031	Camera Operators, Television, Video, and Motion Picture	3521	Broadcasting and audio-visual technicians	3521	Técnicos de radiodifusão e gravação audiovisual
27-4032.00	Film and Video Editors	27-4032	Film and Video Editors	2654	Film, stage and related directors and producers	2654	Diretores de cinema, de teatro e afins
27-4099.00	Media and Communication Equipment Workers, All Other	27-4099	Media and Communication Equipment Workers, All Other	3435	Other artistic and cultural associate professionals	3435	Outros profissionais de nível médio em atividades culturais e artísticas
29-1011.00	Chiropractors	29-1011	Chiropractors	2269	Health professionals not elsewhere classified	2269	Profissionais da saúde não classificados anteriormente
29-1021.00	Dentists, General	29-1021	Dentists, General	2261	Dentists	2261	Dentistas
29-1022.00	Oral and Maxillofacial Surgeons	29-1022	Oral and Maxillofacial Surgeons	2261	Dentists	2261	Dentistas
29-1023.00	Orthodontists	29-1023	Orthodontists	2261	Dentists	2261	Dentistas
29-1024.00	Prosthodontists	29-1024	Prosthodontists	2261	Dentists	2261	Dentistas
29-1029.00	Dentists, All Other Specialists	29-1029	Dentists, All Other Specialists	2261	Dentists	2261	Dentistas
29-1031.00	Dietitians and Nutritionists	29-1031	Dietitians and Nutritionists	2265	Dietitians and nutritionists	2265	Dietistas e nutricionistas
29-1041.00	Optometrists	29-1041	Optometrists	2267	Optometrists and ophthalmic opticians	2267	Optometristas
29-1051.00	Pharmacists	29-1051	Pharmacists	2262	Pharmacists	2262	Farmacêuticos
29-1061.00	Anesthesiologists	29-1061	Anesthesiologists	2212	Specialist medical practitioners	2212	Médicos especialistas
29-1062.00	Family and General Practitioners	29-1062	Family and General Practitioners	2211	Generalist medical practitioners	2211	Médicos gerais
29-1063.00	Internists, General	29-1063	Internists, General	2211	Generalist medical practitioners	2211	Médicos gerais
29-1064.00	Obstetricians and Gynecologists	29-1064	Obstetricians and Gynecologists	2212	Specialist medical practitioners	2212	Médicos especialistas
29-1065.00	Pediatricians, General	29-1065	Pediatricians, General	2211	Generalist medical practitioners	2211	Médicos gerais
29-1066.00	Psychiatrists	29-1066	Psychiatrists	2212	Specialist medical practitioners	2212	Médicos especialistas
29-1067.00	Surgeons	29-1067	Surgeons	2212	Specialist medical practitioners	2212	Médicos especialistas
29-1069.00	Physicians and Surgeons, All Other	29-1069	Physicians and Surgeons, All Other	2211	Generalist medical practitioners	2211	Médicos gerais
29-1069.01	Allergists and Immunologists	29-1069	Physicians and Surgeons, All Other	2211	Generalist medical practitioners	2211	Médicos gerais
29-1069.02	Dermatologists	29-1069	Physicians and Surgeons, All Other	2211	Generalist medical practitioners	2211	Médicos gerais
29-1069.03	Hospitalists	29-1069	Physicians and Surgeons, All Other	2211	Generalist medical practitioners	2211	Médicos gerais
29-1069.04	Neurologists	29-1069	Physicians and Surgeons, All Other	2211	Generalist medical practitioners	2211	Médicos gerais
29-1069.05	Nuclear Medicine Physicians	29-1069	Physicians and Surgeons, All Other	2211	Generalist medical practitioners	2211	Médicos gerais
29-1069.06	Ophthalmologists	29-1069	Physicians and Surgeons, All Other	2211	Generalist medical practitioners	2211	Médicos gerais
29-1069.07	Pathologists	29-1069	Physicians and Surgeons, All Other	2211	Generalist medical practitioners	2211	Médicos gerais
29-1069.08	Physical Medicine and Rehabilitation Physicians	29-1069	Physicians and Surgeons, All Other	2211	Generalist medical practitioners	2211	Médicos gerais
29-1069.09	Preventive Medicine Physicians	29-1069	Physicians and Surgeons, All Other	2211	Generalist medical practitioners	2211	Médicos gerais
29-1069.10	Radiologists	29-1069	Physicians and Surgeons, All Other	2211	Generalist medical practitioners	2211	Médicos gerais
29-1069.11	Sports Medicine Physicians	29-1069	Physicians and Surgeons, All Other	2211	Generalist medical practitioners	2211	Médicos gerais
29-1069.12	Urologists	29-1069	Physicians and Surgeons, All Other	2211	Generalist medical practitioners	2211	Médicos gerais
29-1071.00	Physician Assistants	29-1071	Physician Assistants	2240	Paramedical practitioners	2240	Paramédicos
29-1071.01	Anesthesiologist Assistants	29-1071	Physician Assistants	2240	Paramedical practitioners	2240	Paramédicos
29-1081.00	Podiatrists	29-1081	Podiatrists	2269	Health professionals not elsewhere classified	2269	Profissionais da saúde não classificados anteriormente
29-1122.00	Occupational Therapists	29-1122	Occupational Therapists	2269	Health professionals not elsewhere classified	2269	Profissionais da saúde não classificados anteriormente
29-1122.01	Low Vision Therapists, Orientation and Mobility Specialists, and Vision Rehabilitation Therapists	29-1122	Occupational Therapists	2269	Health professionals not elsewhere classified	2269	Profissionais da saúde não classificados anteriormente
29-1123.00	Physical Therapists	29-1123	Physical Therapists	2264	Physiotherapists	2264	Fisioterapeutas
29-1124.00	Radiation Therapists	29-1124	Radiation Therapists	3211	Medical imaging and therapeutic equipment technicians	3211	Técnicos em aparelhos de diagnóstico e tratamento médico
29-1125.00	Recreational Therapists	29-1125	Recreational Therapists	2269	Health professionals not elsewhere classified	2269	Profissionais da saúde não classificados anteriormente
29-1125.01	Art Therapists	29-1125	Recreational Therapists	2269	Health professionals not elsewhere classified	2269	Profissionais da saúde não classificados anteriormente
29-1125.02	Music Therapists	29-1125	Recreational Therapists	2269	Health professionals not elsewhere classified	2269	Profissionais da saúde não classificados anteriormente

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29-1126.00	Respiratory Therapists	29-1126	Respiratory Therapists	3259	Health associate professionals not elsewhere classified	3259	Profissionais de nível médio da saúde não classificados anteriormente
29-1127.00	Speech-Language Pathologists	29-1127	Speech-Language Pathologists	2266	Audiologists and speech therapists	2266	Fonoaudiólogos e logopedistas
29-1128.00	Exercise Physiologists	29-1128	Exercise Physiologists	2264	Physiotherapists	2264	Fisioterapeutas
29-1129.00	Therapists, All Other	29-1129	Therapists, All Other	2269	Health professionals not elsewhere classified	2269	Profissionais da saúde não classificados anteriormente
29-1131.00	Veterinarians	29-1131	Veterinarians	2250	Veterinarians	2250	Veterinários
29-1141.00	Registered Nurses	29-1141	Registered Nurses	2221	Nursing professionals	2221	Profissionais de enfermagem
29-1141.01	Acute Care Nurses	29-1141	Registered Nurses	2221	Nursing professionals	2221	Profissionais de enfermagem
29-1141.02	Advanced Practice Psychiatric Nurses	29-1141	Registered Nurses	2221	Nursing professionals	2221	Profissionais de enfermagem
29-1141.03	Critical Care Nurses	29-1141	Registered Nurses	2221	Nursing professionals	2221	Profissionais de enfermagem
29-1141.04	Clinical Nurse Specialists	29-1141	Registered Nurses	2221	Nursing professionals	2221	Profissionais de enfermagem
29-1151.00	Nurse Anesthetists	29-1151	Nurse Anesthetists	2221	Nursing professionals	2221	Profissionais de enfermagem
29-1161.00	Nurse Midwives	29-1161	Nurse Midwives	2222	Midwifery professionals	2222	Profissionais de partos
29-1171.00	Nurse Practitioners	29-1171	Nurse Practitioners	2221	Nursing professionals	2221	Profissionais de enfermagem
29-1181.00	Audiologists	29-1181	Audiologists	2266	Audiologists and speech therapists	2266	Fonoaudiólogos e logopedistas
29-1199.00	Health Diagnosing and Treating Practitioners, All Other	29-1199	Health Diagnosing and Treating Practitioners, All Other	2230	Traditional and complementary medicine professionals	2230	Profissionais da medicina tradicional e alternativa
29-1199.01	Acupuncturists	29-1199	Health Diagnosing and Treating Practitioners, All Other	2230	Traditional and complementary medicine professionals	2230	Profissionais da medicina tradicional e alternativa
29-1199.04	Naturopathic Physicians	29-1199	Health Diagnosing and Treating Practitioners, All Other	2230	Traditional and complementary medicine professionals	2230	Profissionais da medicina tradicional e alternativa
29-1199.05	Orthoptists	29-1199	Health Diagnosing and Treating Practitioners, All Other	2230	Traditional and complementary medicine professionals	2230	Profissionais da medicina tradicional e alternativa
29-2011.00	Medical and Clinical Laboratory Technologists	29-2011	Medical and Clinical Laboratory Technologists	3212	Medical and pathology laboratory technicians	3212	Técnicos de laboratórios médicos
29-2011.01	Cytogenetic Technologists	29-2011	Medical and Clinical Laboratory Technologists	3212	Medical and pathology laboratory technicians	3212	Técnicos de laboratórios médicos
29-2011.02	Cytotechnologists	29-2011	Medical and Clinical Laboratory Technologists	3212	Medical and pathology laboratory technicians	3212	Técnicos de laboratórios médicos
29-2011.03	Histotechnologists and Histologic Technicians	29-2011	Medical and Clinical Laboratory Technologists	3212	Medical and pathology laboratory technicians	3212	Técnicos de laboratórios médicos
29-2012.00	Medical and Clinical Laboratory Technicians	29-2012	Medical and Clinical Laboratory Technicians	3212	Medical and pathology laboratory technicians	3212	Técnicos de laboratórios médicos
29-2021.00	Dental Hygienists	29-2021	Dental Hygienists	3251	Dental assistants and therapists	3251	Dentistas auxiliares e ajudantes de odontologia
29-2031.00	Cardiovascular Technologists and Technicians	29-2031	Cardiovascular Technologists and Technicians	3259	Health associate professionals not elsewhere classified	3259	Profissionais de nível médio da saúde não classificados anteriormente
29-2032.00	Diagnostic Medical Sonographers	29-2032	Diagnostic Medical Sonographers	3211	Medical imaging and therapeutic equipment technicians	3211	Técnicos em aparelhos de diagnóstico e tratamento médico
29-2033.00	Nuclear Medicine Technologists	29-2033	Nuclear Medicine Technologists	3211	Medical imaging and therapeutic equipment technicians	3211	Técnicos em aparelhos de diagnóstico e tratamento médico
29-2034.00	Radiologic Technologists	29-2034	Radiologic Technologists	3211	Medical imaging and therapeutic equipment technicians	3211	Técnicos em aparelhos de diagnóstico e tratamento médico
29-2035.00	Magnetic Resonance Imaging Technologists	29-2035	Magnetic Resonance Imaging Technologists	3211	Medical imaging and therapeutic equipment technicians	3211	Técnicos em aparelhos de diagnóstico e tratamento médico
29-2041.00	Emergency Medical Technicians and Paramedics	29-2041	Emergency Medical Technicians and Paramedics	3258	Ambulance workers	3258	Ajudantes de ambulâncias
29-2051.00	Dietetic Technicians	29-2051	Dietetic Technicians	3259	Health associate professionals not elsewhere classified	3259	Profissionais de nível médio da saúde não classificados anteriormente
29-2052.00	Pharmacy Technicians	29-2052	Pharmacy Technicians	3213	Pharmaceutical technicians and assistants	3213	Técnicos e assistentes farmacêuticos
29-2053.00	Psychiatric Technicians	29-2053	Psychiatric Technicians	3259	Health associate professionals not elsewhere classified	3259	Profissionais de nível médio da saúde não classificados anteriormente
29-2054.00	Respiratory Therapy Technicians	29-2054	Respiratory Therapy Technicians	3259	Health associate professionals not elsewhere classified	3259	Profissionais de nível médio da saúde não classificados anteriormente
29-2055.00	Surgical Technologists	29-2055	Surgical Technologists	3259	Health associate professionals not elsewhere classified	3259	Profissionais de nível médio da saúde não classificados anteriormente
29-2056.00	Veterinary Technologists and Technicians	29-2056	Veterinary Technologists and Technicians	3240	Veterinary technicians and assistants	3240	Técnicos e assistentes veterinários
29-2057.00	Ophthalmic Medical Technicians	29-2057	Ophthalmic Medical Technicians	3256	Medical assistants	3256	assistentes de medicina
29-2061.00	Licensed Practical and Licensed Vocational Nurses	29-2061	Licensed Practical and Licensed Vocational Nurses	3221	Nursing associate professionals	3221	Profissionais de nível médio de enfermagem
29-2071.00	Medical Records and Health Information Technicians	29-2071	Medical Records and Health Information Technicians	3252	Medical records and health information technicians	3252	Técnicos em documentação sanitária
29-2081.00	Opticians, Dispensing	29-2081	Opticians, Dispensing	3254	Dispensing opticians	3254	Técnicos em optometria e ópticos
29-2091.00	Orthotists and Prosthetists	29-2091	Orthotists and Prosthetists	3214	Medical and dental prosthetic technicians	3214	Técnicos de próteses médicas e dentárias
29-2092.00	Hearing Aid Specialists	29-2092	Hearing Aid Specialists	3214	Medical and dental prosthetic technicians	3214	Técnicos de próteses médicas e dentárias
29-2099.00	Health Technologists and Technicians, All Other	29-2099	Health Technologists and Technicians, All Other	3259	Health associate professionals not elsewhere classified	3259	Profissionais de nível médio da saúde não classificados anteriormente

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29-2099.01	Neurodiagnostic Technologists	29-2099	Health Technologists and Technicians, All Other	3259	Health associate professionals not elsewhere classified	3259	Profissionais de nível médio da saúde não classificados anteriormente
29-2099.05	Ophthalmic Medical Technologists	29-2099	Health Technologists and Technicians, All Other	3259	Health associate professionals not elsewhere classified	3259	Profissionais de nível médio da saúde não classificados anteriormente
29-2099.06	Radiologic Technicians	29-2099	Health Technologists and Technicians, All Other	3259	Health associate professionals not elsewhere classified	3259	Profissionais de nível médio da saúde não classificados anteriormente
29-2099.07	Surgical Assistants	29-2099	Health Technologists and Technicians, All Other	3259	Health associate professionals not elsewhere classified	3259	Profissionais de nível médio da saúde não classificados anteriormente
29-9011.00	Occupational Health and Safety Specialists	29-9011	Occupational Health and Safety Specialists	2263	Environmental and occupational health and hygiene professionals	2263	Profissionais da saúde e da higiene laboral e ambiental
29-9012.00	Occupational Health and Safety Technicians	29-9012	Occupational Health and Safety Technicians	3257	Environmental and occupational health inspectors and associates	3257	Inspetores de saúde laboral, ambiental e afins
29-9091.00	Athletic Trainers	29-9091	Athletic Trainers	3423	Fitness and recreation instructors and program leaders	3423	Instrutores de educação física e atividades recreativas
29-9092.00	Genetic Counselors	29-9092	Genetic Counselors	2269	Health professionals not elsewhere classified	2269	Profissionais da saúde não classificados anteriormente
29-9099.00	Healthcare Practitioners and Technical Workers, All Other	29-9099	Healthcare Practitioners and Technical Workers, All Other	3222	Midwifery associate professionals	3222	Profissionais de nível médio de partos
29-9099.01	Midwives	29-9099	Healthcare Practitioners and Technical Workers, All Other	3222	Midwifery associate professionals	3222	Profissionais de nível médio de partos
31-1011.00	Home Health Aides	31-1011	Home Health Aides	5322	Home-based personal care workers	5322	Trabalhadores de cuidados pessoais a domicílios
31-1013.00	Psychiatric Aides	31-1013	Psychiatric Aides	5321	Health care assistants	5321	Trabalhadores de cuidados pessoais em instituições
31-1014.00	Nursing Assistants	31-1014	Nursing Assistants	5321	Health care assistants	5321	Trabalhadores de cuidados pessoais em instituições
31-1015.00	Orderlies	31-1015	Orderlies	5329	Personal care workers in health services not elsewhere classified	5329	Trabalhadores de cuidados pessoais nos serviços de saúde não classificados anteriormente
31-2011.00	Occupational Therapy Assistants	31-2011	Occupational Therapy Assistants	3259	Health associate professionals not elsewhere classified	3259	Profissionais de nível médio da saúde não classificados anteriormente
31-2012.00	Occupational Therapy Aides	31-2012	Occupational Therapy Aides	5329	Personal care workers in health services not elsewhere classified	5329	Trabalhadores de cuidados pessoais nos serviços de saúde não classificados anteriormente
31-2021.00	Physical Therapist Assistants	31-2021	Physical Therapist Assistants	3255	Physiotherapy technicians and assistants	3255	Técnicos e assistentes fisioterapeutas
31-2022.00	Physical Therapist Aides	31-2022	Physical Therapist Aides	5329	Personal care workers in health services not elsewhere classified	5329	Trabalhadores de cuidados pessoais nos serviços de saúde não classificados anteriormente
31-9011.00	Massage Therapists	31-9011	Massage Therapists	3255	Physiotherapy technicians and assistants	3255	Técnicos e assistentes fisioterapeutas
31-9091.00	Dental Assistants	31-9091	Dental Assistants	3251	Dental assistants and therapists	3251	Dentistas auxiliares e ajudantes de odontologia
31-9092.00	Medical Assistants	31-9092	Medical Assistants	3256	Medical assistants	3256	assistentes de medicina
31-9093.00	Medical Equipment Preparers	31-9093	Medical Equipment Preparers	5329	Personal care workers in health services not elsewhere classified	5329	Trabalhadores de cuidados pessoais nos serviços de saúde não classificados anteriormente
31-9094.00	Medical Transcriptionists	31-9094	Medical Transcriptionists	3344	Medical secretaries	3344	Secretários de medicina
31-9095.00	Pharmacy Aides	31-9095	Pharmacy Aides	5329	Personal care workers in health services not elsewhere classified	5329	Trabalhadores de cuidados pessoais nos serviços de saúde não classificados anteriormente
31-9096.00	Veterinary Assistants and Laboratory Animal Caretakers	31-9096	Veterinary Assistants and Laboratory Animal Caretakers	3240	Veterinary technicians and assistants	3240	Técnicos e assistentes veterinários
31-9097.00	Phlebotomists	31-9097	Phlebotomists	5329	Personal care workers in health services not elsewhere classified	5329	Trabalhadores de cuidados pessoais nos serviços de saúde não classificados anteriormente
31-9099.00	Healthcare Support Workers, All Other	31-9099	Healthcare Support Workers, All Other	3259	Health associate professionals not elsewhere classified	3259	Profissionais de nível médio da saúde não classificados anteriormente
31-9099.01	Speech-Language Pathology Assistants	31-9099	Healthcare Support Workers, All Other	3259	Health associate professionals not elsewhere classified	3259	Profissionais de nível médio da saúde não classificados anteriormente
31-9099.02	Endoscopy Technicians	31-9099	Healthcare Support Workers, All Other	3259	Health associate professionals not elsewhere classified	3259	Profissionais de nível médio da saúde não classificados anteriormente
33-1011.00	First-Line Supervisors of Correctional Officers	33-1011	First-Line Supervisors of Correctional Officers	5413	Prison guards	5413	Guardiões de presídios
33-1012.00	First-Line Supervisors of Police and Detectives	33-1012	First-Line Supervisors of Police and Detectives	3351	Customs and border inspectors	3351	Agentes aduaneiros e inspetores de fronteiras
33-1021.00	First-Line Supervisors of Fire Fighting and Prevention Workers	33-1021	First-Line Supervisors of Fire Fighting and Prevention Workers	3112	Civil engineering technicians	3112	Técnicos em engenharia civil
33-1021.01	Municipal Fire Fighting and Prevention Supervisors	33-1021	First-Line Supervisors of Fire Fighting and Prevention Workers	3112	Civil engineering technicians	3112	Técnicos em engenharia civil
33-1021.02	Forest Fire Fighting and Prevention Supervisors	33-1021	First-Line Supervisors of Fire Fighting and Prevention Workers	3112	Civil engineering technicians	3112	Técnicos em engenharia civil
33-1099.00	First-Line Supervisors of Protective Service Workers, All Other	33-1099	Protective Service Workers, All Other	5414	Security guards	5414	Guardas de segurança
33-2011.00	Firefighters	33-2011	Firefighters	5411	Fire-fighters	5411	Bombeiros
33-2011.01	Municipal Firefighters	33-2011	Firefighters	5411	Fire-fighters	5411	Bombeiros
33-2011.02	Forest Firefighters	33-2011	Firefighters	5411	Fire-fighters	5411	Bombeiros
33-2021.00	Fire Inspectors and Investigators	33-2021	Fire Inspectors and Investigators	3112	Civil engineering technicians	3112	Técnicos em engenharia civil
33-2021.01	Fire Inspectors	33-2021	Fire Inspectors and Investigators	3112	Civil engineering technicians	3112	Técnicos em engenharia civil

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33-2021.02	Fire Investigators	33-2021	Fire Inspectors and Investigators	3112	Civil engineering technicians	3112	Técnicos em engenharia civil
33-2022.00	Forest Fire Inspectors and Prevention Specialists	33-2022	Forest Fire Inspectors and Prevention Specialists	3119	Physical and engineering science technicians not elsewhere classified	3119	Técnicos em ciências físicas e da engenharia não classificados anteriormente
33-3011.00	Bailiffs	33-3011	Bailiffs	3411	Legal and related associate professionals	3411	Profissionais de nível médio do direito e serviços legais e afins
33-3012.00	Correctional Officers and Jailers	33-3012	Correctional Officers and Jailers	5413	Prison guards	5413	Guardiões de presídios
33-3021.00	Detectives and Criminal Investigators	33-3021	Detectives and Criminal Investigators	3355	Police inspectors and detectives	3355	Inspetores de polícia e detetives
33-3021.01	Police Detectives	33-3021	Detectives and Criminal Investigators	3355	Police inspectors and detectives	3355	Inspetores de polícia e detetives
33-3021.02	Police Identification and Records Officers	33-3021	Detectives and Criminal Investigators	3355	Police inspectors and detectives	3355	Inspetores de polícia e detetives
33-3021.03	Criminal Investigators and Special Agents	33-3021	Detectives and Criminal Investigators	3355	Police inspectors and detectives	3355	Inspetores de polícia e detetives
33-3021.05	Immigration and Customs Inspectors	33-3021	Detectives and Criminal Investigators	3355	Police inspectors and detectives	3355	Inspetores de polícia e detetives
33-3021.06	Intelligence Analysts	33-3021	Detectives and Criminal Investigators	3355	Police inspectors and detectives	3355	Inspetores de polícia e detetives
33-3031.00	Fish and Game Wardens	33-3031	Fish and Game Wardens	5419	Protective services workers not elsewhere classified	5419	Trabalhadores dos serviços de proteção e segurança não classificados anteriormente
33-3041.00	Parking Enforcement Workers	33-3041	Parking Enforcement Workers	5419	Protective services workers not elsewhere classified	5419	Trabalhadores dos serviços de proteção e segurança não classificados anteriormente
33-3051.00	Police and Sheriff's Patrol Officers	33-3051	Police and Sheriff's Patrol Officers	3351	Customs and border inspectors	3351	Agentes aduaneiros e inspetores de fronteiras
33-3051.01	Police Patrol Officers	33-3051	Police and Sheriff's Patrol Officers	3351	Customs and border inspectors	3351	Agentes aduaneiros e inspetores de fronteiras
33-3051.03	Sheriffs and Deputy Sheriffs	33-3051	Police and Sheriff's Patrol Officers	3351	Customs and border inspectors	3351	Agentes aduaneiros e inspetores de fronteiras
33-3052.00	Transit and Railroad Police	33-3052	Transit and Railroad Police	5412	Police officers	5412	Policiais
33-9011.00	Animal Control Workers	33-9011	Animal Control Workers	5419	Protective services workers not elsewhere classified	5419	Trabalhadores dos serviços de proteção e segurança não classificados anteriormente
33-9021.00	Private Detectives and Investigators	33-9021	Private Detectives and Investigators	3411	Legal and related associate professionals	3411	Profissionais de nível médio do direito e serviços legais e afins
33-9031.00	Gaming Surveillance Officers and Gaming Investigators	33-9031	Gaming Surveillance Officers and Gaming Investigators	3411	Legal and related associate professionals	3411	Profissionais de nível médio do direito e serviços legais e afins
33-9032.00	Security Guards	33-9032	Security Guards	5414	Security guards	5414	Guardas de segurança
33-9091.00	Crossing Guards	33-9091	Crossing Guards	5419	Protective services workers not elsewhere classified	5419	Trabalhadores dos serviços de proteção e segurança não classificados anteriormente
33-9092.00	Lifeguards, Ski Patrol, and Other Recreational Protective Service Workers	33-9092	Lifeguards, Ski Patrol, and Other Recreational Protective Service Workers	5419	Protective services workers not elsewhere classified	5419	Trabalhadores dos serviços de proteção e segurança não classificados anteriormente
33-9093.00	Transportation Security Screeners	33-9093	Transportation Security Screeners	5414	Security guards	5414	Guardas de segurança
33-9099.00	Protective Service Workers, All Other	33-9099	Protective Service Workers, All Other	5419	Protective services workers not elsewhere classified	5419	Trabalhadores dos serviços de proteção e segurança não classificados anteriormente
33-9099.02	Retail Loss Prevention Specialists	33-9099	Protective Service Workers, All Other	5419	Protective services workers not elsewhere classified	5419	Trabalhadores dos serviços de proteção e segurança não classificados anteriormente
35-1011.00	Chefs and Head Cooks	35-1011	Chefs and Head Cooks	3434	Chefs	3434	Chefes de cozinha
35-1012.00	First-Line Supervisors of Food Preparation and Serving Workers	35-1012	First-Line Supervisors of Food Preparation and Serving Workers	3434	Chefs	3434	Chefes de cozinha
35-2011.00	Cooks, Fast Food	35-2011	Cooks, Fast Food	9411	Fast food preparers	9411	Preparadores de comidas rápidas
35-2012.00	Cooks, Institution and Cafeteria	35-2012	Cooks, Institution and Cafeteria	5120	Cooks	5120	Cozinheiros
35-2013.00	Cooks, Private Household	35-2013	Cooks, Private Household	5120	Cooks	5120	Cozinheiros
35-2014.00	Cooks, Restaurant	35-2014	Cooks, Restaurant	5120	Cooks	5120	Cozinheiros
35-2015.00	Cooks, Short Order	35-2015	Cooks, Short Order	5120	Cooks	5120	Cozinheiros
35-2019.00	Cooks, All Other	35-2019	Cooks, All Other	5120	Cooks	5120	Cozinheiros
35-2021.00	Food Preparation Workers	35-2021	Food Preparation Workers	9412	Kitchen helpers	9412	Ajudantes de cozinha
35-3011.00	Bartenders	35-3011	Bartenders	5132	Bartenders	5132	atendentes de bar
35-3021.00	Combined Food Preparation and Serving Workers, Including Fast Food	35-3021	Combined Food Preparation and Serving Workers, Including Fast Food	5246	Food service counter attendants	5246	Balconistas dos serviços de alimentação
35-3022.00	Counter Attendants, Cafeteria, Food Concession, and Coffee Shop	35-3022	Counter Attendants, Cafeteria, Food Concession, and Coffee Shop	5246	Food service counter attendants	5246	Balconistas dos serviços de alimentação
35-3022.01	Baristas	35-3022	Counter Attendants, Cafeteria, Food Concession, and Coffee Shop	5246	Food service counter attendants	5246	Balconistas dos serviços de alimentação
35-3031.00	Waiters and Waitresses	35-3031	Waiters and Waitresses	5131	Waiters	5131	Garçons
35-3041.00	Food Servers, Nonrestaurant	35-3041	Food Servers, Nonrestaurant	5131	Waiters	5131	Garçons
35-9011.00	Dining Room and Cafeteria Attendants and Bartender Helpers	35-9011	Dining Room and Cafeteria Attendants and Bartender Helpers	5246	Food service counter attendants	5246	Balconistas dos serviços de alimentação
35-9021.00	Dishwashers	35-9021	Dishwashers	9412	Kitchen helpers	9412	Ajudantes de cozinha

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35-9031.00	Hosts and Hostesses, Restaurant, Lounge, and Coffee Shop	35-9031	Hosts and Hostesses, Restaurant, Lounge, and Coffee Shop	5169	Personal services workers not elsewhere classified	5169	Trabalhadores de serviços pessoais não classificados anteriormente
35-9099.00	Food Preparation and Serving Related Workers, All Other	35-9099	Food Preparation and Serving Related Workers, All Other	9412	Kitchen helpers	9412	Ajudantes de cozinha
37-1011.00	First-Line Supervisors of Housekeeping and Janitorial Workers	37-1011	First-Line Supervisors of Housekeeping and Janitorial Workers	5151	Cleaning and housekeeping supervisors in offices, hotels and other establishments	5151	Supervisores de manutenção e limpeza de edifícios em escritórios, hotéis e estabelecimentos
37-1012.00	First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers	37-1012	First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers	6113	Gardeners, horticultural and nursery growers	#N/D	#N/D
37-2011.00	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	37-2011	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	5153	Building caretakers	5153	Porteiros e zeladores
37-2012.00	Maids and Housekeeping Cleaners	37-2012	Maids and Housekeeping Cleaners	9111	Domestic cleaners and helpers	9111	Trabalhadores dos serviços domésticos em geral
37-2019.00	Building Cleaning Workers, All Other	37-2019	Building Cleaning Workers, All Other	7133	Building structure cleaners	7133	Limpadores de fachadas
37-2021.00	Pest Control Workers	37-2021	Pest Control Workers	7544	Fumigators and other pest and weed controllers	7544	Fumigadores e outros controladores de pragas e ervas daninhas
37-3011.00	Landscaping and Groundskeeping Workers	37-3011	Landscaping and Groundskeeping Workers	9214	Garden and horticultural labourers	9214	Trabalhadores elementares da jardinagem e horticultura
37-3012.00	Pesticide Handlers, Sprayers, and Applicators, Vegetation	37-3012	Pesticide Handlers, Sprayers, and Applicators, Vegetation	7544	Fumigators and other pest and weed controllers	7544	Fumigadores e outros controladores de pragas e ervas daninhas
37-3013.00	Tree Trimmers and Pruners	37-3013	Tree Trimmers and Pruners	6113	Gardeners, horticultural and nursery growers	#N/D	#N/D
37-3019.00	Grounds Maintenance Workers, All Other	37-3019	Grounds Maintenance Workers, All Other	9214	Garden and horticultural labourers	9214	Trabalhadores elementares da jardinagem e horticultura
39-1011.00	Gaming Supervisors	39-1011	Gaming Supervisors	4212	Bookmakers, croupiers and related gaming workers	4212	Coletores de apostas e de jogos
39-1012.00	Slot Supervisors	39-1012	Slot Supervisors	4212	Bookmakers, croupiers and related gaming workers	4212	Coletores de apostas e de jogos
39-1021.00	First-Line Supervisors of Personal Service Workers	39-1021	First-Line Supervisors of Personal Service Workers	3423	Fitness and recreation instructors and program leaders	3423	Instrutores de educação física e atividades recreativas
39-1021.01	Spa Managers	39-1021	First-Line Supervisors of Personal Service Workers	3423	Fitness and recreation instructors and program leaders	3423	Instrutores de educação física e atividades recreativas
39-2011.00	Animal Trainers	39-2011	Animal Trainers	5164	Pet groomers and animal care workers	5164	Cuidadores de animais
39-2021.00	Nonfarm Animal Caretakers	39-2021	Nonfarm Animal Caretakers	5164	Pet groomers and animal care workers	5164	Cuidadores de animais
39-3011.00	Gaming Dealers	39-3011	Gaming Dealers	4212	Bookmakers, croupiers and related gaming workers	4212	Coletores de apostas e de jogos
39-3012.00	Gaming and Sports Book Writers and Runners	39-3012	Gaming and Sports Book Writers and Runners	4212	Bookmakers, croupiers and related gaming workers	4212	Coletores de apostas e de jogos
39-3019.00	Gaming Service Workers, All Other	39-3019	Gaming Service Workers, All Other	4212	Bookmakers, croupiers and related gaming workers	4212	Coletores de apostas e de jogos
39-3021.00	Motion Picture Projectionists	39-3021	Motion Picture Projectionists	9629	Elementary workers not elsewhere classified	9629	Outras ocupações elementares não classificadas anteriormente
39-3031.00	Ushers, Lobby Attendants, and Ticket Takers	39-3031	Ushers, Lobby Attendants, and Ticket Takers	9629	Elementary workers not elsewhere classified	9629	Outras ocupações elementares não classificadas anteriormente
39-3091.00	Amusement and Recreation Attendants	39-3091	Amusement and Recreation Attendants	8343	Crane, hoist and related plant operators	8343	Operadores de guindastes, guias, aparelhos de elevação e afins
39-3092.00	Costume Attendants	39-3092	Costume Attendants	3435	Other artistic and cultural associate professionals	3435	Outros profissionais de nível médio em atividades culturais e artísticas
39-3093.00	Locker Room, Coatroom, and Dressing Room Attendants	39-3093	Locker Room, Coatroom, and Dressing Room Attendants	9629	Elementary workers not elsewhere classified	9629	Outras ocupações elementares não classificadas anteriormente
39-3099.00	Entertainment Attendants and Related Workers, All Other	39-3099	Entertainment Attendants and Related Workers, All Other	3435	Other artistic and cultural associate professionals	3435	Outros profissionais de nível médio em atividades culturais e artísticas
39-4011.00	Embalmers	39-4011	Embalmers	5163	Undertakers and embalmers	5163	Trabalhadores de funerárias e embalsamadores
39-4021.00	Funeral Attendants	39-4021	Funeral Attendants	5163	Undertakers and embalmers	5163	Trabalhadores de funerárias e embalsamadores
39-4031.00	Morticians, Undertakers, and Funeral Directors	39-4031	Morticians, Undertakers, and Funeral Directors	5163	Undertakers and embalmers	5163	Trabalhadores de funerárias e embalsamadores
39-5011.00	Barbers	39-5011	Barbers	5141	Hairdressers	5141	Cabeleireiros
39-5012.00	Hairdressers, Hairstylists, and Cosmetologists	39-5012	Hairdressers, Hairstylists, and Cosmetologists	5141	Hairdressers	5141	Cabeleireiros
39-5091.00	Makeup Artists, Theatrical and Performance	39-5091	Makeup Artists, Theatrical and Performance	5142	Beauticians and related workers	5142	Especialistas em tratamento de beleza e afins
39-5092.00	Manicurists and Pedicurists	39-5092	Manicurists and Pedicurists	5142	Beauticians and related workers	5142	Especialistas em tratamento de beleza e afins
39-5093.00	Shampooers	39-5093	Shampooers	5142	Beauticians and related workers	5142	Especialistas em tratamento de beleza e afins
39-5094.00	Skincare Specialists	39-5094	Skincare Specialists	5142	Beauticians and related workers	5142	Especialistas em tratamento de beleza e afins
39-6011.00	Baggage Porters and Bellhops	39-6011	Baggage Porters and Bellhops	9621	Messengers, package deliverers and luggage porters	9621	Mensageiros, carregadores de bagagens e entregadores de encomendas
39-6012.00	Concierges	39-6012	Concierges	4224	Hotel receptionists	4224	Recepção de hóspedes
39-7011.00	Tour Guides and Escorts	39-7011	Tour Guides and Escorts	5113	Travel guides	5113	Guias de turismo
39-7012.00	Travel Guides	39-7012	Travel Guides	5113	Travel guides	5113	Guias de turismo
39-9011.00	Childcare Workers	39-9011	Childcare Workers	5311	Child care workers	5311	Cuidadores de crianças
39-9011.01	Nannies	39-9011	Childcare Workers	5311	Child care workers	5311	Cuidadores de crianças
39-9021.00	Personal Care Aides	39-9021	Personal Care Aides	4414	Scribes and related workers	4414	Outros escreventes

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39-9031.00	Fitness Trainers and Aerobics Instructors	39-9031	Fitness Trainers and Aerobics Instructors	3423	Fitness and recreation instructors and program leaders	3423	Instrutores de educação física e atividades recreativas
39-9032.00	Recreation Workers	39-9032	Recreation Workers	5169	Personal services workers not elsewhere classified	5169	Trabalhadores de serviços pessoais não classificados anteriormente
39-9041.00	Residential Advisors	39-9041	Residential Advisors	5169	Personal services workers not elsewhere classified	5169	Trabalhadores de serviços pessoais não classificados anteriormente
39-9099.00	Personal Care and Service Workers, All Other	39-9099	Personal Care and Service Workers, All Other	5152	Domestic housekeepers	5152	Governantas e mordomos domésticos
41-1011.00	First-Line Supervisors of Retail Sales Workers	41-1011	First-Line Supervisors of Retail Sales Workers	5222	Shop supervisors	5222	Supervisores de lojas
41-1012.00	First-Line Supervisors of Non-Retail Sales Workers	41-1012	First-Line Supervisors of Non-Retail Sales Workers	2433	Technical and medical sales professionals (excluding ICT)	2433	Profissionais de vendas técnicas e médicas (exclusive tic)
41-2011.00	Cashiers	41-2011	Cashiers	5230	Cashiers and ticket clerks	5230	Caixas e expedidores de bilhetes
41-2012.00	Gaming Change Persons and Booth Cashiers	41-2012	Gaming Change Persons and Booth Cashiers	5230	Cashiers and ticket clerks	5230	Caixas e expedidores de bilhetes
41-2021.00	Counter and Rental Clerks	41-2021	Counter and Rental Clerks	5249	Sales workers not elsewhere classified	5249	Vendedores não classificados anteriormente
41-2022.00	Parts Salespersons	41-2022	Parts Salespersons	5223	Shop sales assistants	5223	Balconistas e vendedores de lojas
41-2031.00	Retail Salespersons	41-2031	Retail Salespersons	5223	Shop sales assistants	5223	Balconistas e vendedores de lojas
41-3011.00	Advertising Sales Agents	41-3011	Advertising Sales Agents	3339	Business services agents not elsewhere classified	3339	Agentes de serviços comerciais não classificados anteriormente
41-3021.00	Insurance Sales Agents	41-3021	Insurance Sales Agents	3321	Insurance representatives	3321	Agentes de seguros
41-3031.00	Securities, Commodities, and Financial Services Sales Agents	41-3031	Securities, Commodities, and Financial Services Sales Agents	3311	Securities and finance dealers and brokers	3311	Agentes e corretores de bolsa, câmbio e outros serviços financeiros
41-3031.01	Sales Agents, Securities and Commodities	41-3031	Securities, Commodities, and Financial Services Sales Agents	3311	Securities and finance dealers and brokers	3311	Agentes e corretores de bolsa, câmbio e outros serviços financeiros
41-3031.02	Sales Agents, Financial Services	41-3031	Securities, Commodities, and Financial Services Sales Agents	3311	Securities and finance dealers and brokers	3311	Agentes e corretores de bolsa, câmbio e outros serviços financeiros
41-3031.03	Securities and Commodities Traders	41-3031	Securities, Commodities, and Financial Services Sales Agents	3311	Securities and finance dealers and brokers	3311	Agentes e corretores de bolsa, câmbio e outros serviços financeiros
41-3041.00	Travel Agents	41-3041	Travel Agents	3339	Business services agents not elsewhere classified	3339	Agentes de serviços comerciais não classificados anteriormente
41-3099.00	Sales Representatives, Services, All Other	41-3099	Sales Representatives, Services, All Other	3322	Commercial sales representatives	3322	Representantes comerciais
41-3099.01	Energy Brokers	41-3099	Sales Representatives, Services, All Other	3322	Commercial sales representatives	3322	Representantes comerciais
41-4011.00	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	2433	Technical and medical sales professionals (excluding ICT)	2433	Profissionais de vendas técnicas e médicas (exclusive tic)
41-4011.07	Solar Sales Representatives and Assessors	41-4011	Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	2433	Technical and medical sales professionals (excluding ICT)	2433	Profissionais de vendas técnicas e médicas (exclusive tic)
41-4012.00	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	3322	Commercial sales representatives	3322	Representantes comerciais
41-9011.00	Demonstrators and Product Promoters	41-9011	Demonstrators and Product Promoters	5242	Sales demonstrators	5242	Demonstradores de lojas
41-9012.00	Models	41-9012	Models	5241	Fashion and other models	5241	Modelos de moda, arte e publicidade
41-9021.00	Real Estate Brokers	41-9021	Real Estate Brokers	3334	Real estate agents and property managers	3334	Agentes imobiliários
41-9022.00	Real Estate Sales Agents	41-9022	Real Estate Sales Agents	3334	Real estate agents and property managers	3334	Agentes imobiliários
41-9031.00	Sales Engineers	41-9031	Sales Engineers	2434	Information and communications technology sales professionals	2434	Profissionais de vendas de tecnologia da informação e comunicações
41-9041.00	Telemarketers	41-9041	Telemarketers	5244	Contact centre salespersons	5244	Vendedores por telefone
41-9091.00	Door-To-Door Sales Workers, News and Street Vendors, and Related Workers	41-9091	Door-to-Door Sales Workers, News and Street Vendors, and Related Workers	5211	Stall and market salespersons	5211	Vendedores de quiosques e postos de mercados
41-9099.00	Sales and Related Workers, All Other	41-9099	Sales and Related Workers, All Other	3339	Business services agents not elsewhere classified	3339	Agentes de serviços comerciais não classificados anteriormente
43-1011.00	First-Line Supervisors of Office and Administrative Support Workers	43-1011	First-Line Supervisors of Office and Administrative Support Workers	3341	Office supervisors	3341	Supervisores de secretaria
43-2011.00	Switchboard Operators, Including Answering Service	43-2011	Switchboard Operators, Including Answering Service	4223	Telephone switchboard operators	4223	Telefonistas
43-2021.00	Telephone Operators	43-2021	Telephone Operators	4223	Telephone switchboard operators	4223	Telefonistas
43-2099.00	Communications Equipment Operators, All Other	43-2099	Communications Equipment Operators, All Other	4229	Client information workers not elsewhere classified	4229	Trabalhadores de serviços de informação ao cliente não classificados anteriormente
43-3011.00	Bill and Account Collectors	43-3011	Bill and Account Collectors	4214	Debt-collectors and related workers	4214	Cobradores e afins
43-3021.00	Billing and Posting Clerks	43-3021	Billing and Posting Clerks	4311	Accounting and bookkeeping clerks	4311	Trabalhadores de contabilidade e cálculo de custos
43-3021.01	Statement Clerks	43-3021	Billing and Posting Clerks	4311	Accounting and bookkeeping clerks	4311	Trabalhadores de contabilidade e cálculo de custos
43-3021.02	Billing, Cost, and Rate Clerks	43-3021	Billing and Posting Clerks	4311	Accounting and bookkeeping clerks	4311	Trabalhadores de contabilidade e cálculo de custos
43-3031.00	Bookkeeping, Accounting, and Auditing Clerks	43-3031	Bookkeeping, Accounting, and Auditing Clerks	3313	Accounting associate professionals	3313	Contabilistas e guarda livros
43-3041.00	Gaming Cage Workers	43-3041	Gaming Cage Workers	4212	Bookmakers, croupiers and related gaming workers	4212	Coletores de apostas e de jogos

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43-3051.00	Payroll and Timekeeping Clerks	43-3051	Payroll and Timekeeping Clerks	4313	Payroll clerks	4313	Trabalhadores encarregados de folha de pagamento
43-3061.00	Procurement Clerks	43-3061	Procurement Clerks	4110	General office clerks	4110	Escriturários gerais
43-3071.00	Tellers	43-3071	Tellers	4211	Bank tellers and related clerks	4211	Caixas de banco e afins
43-3099.00	Financial Clerks, All Other	43-3099	Financial Clerks, All Other	4213	Pawnbrokers and money-lenders	4213	Trabalhadores em escritórios de empréstimos e penhor
43-4011.00	Brokerage Clerks	43-4011	Brokerage Clerks	4312	Statistical, finance and insurance clerks	4312	Trabalhadores de serviços estatísticos, financeiros e de seguros
43-4021.00	Correspondence Clerks	43-4021	Correspondence Clerks	4225	Enquiry clerks	4225	Trabalhadores dos serviços de informações
43-4031.00	Court, Municipal, and License Clerks	43-4031	Court, Municipal, and License Clerks	3354	Government licensing officials	3354	Agentes de serviços de expedição de licenças e permissões
43-4031.01	Court Clerks	43-4031	Court, Municipal, and License Clerks	3354	Government licensing officials	3354	Agentes de serviços de expedição de licenças e permissões
43-4031.02	Municipal Clerks	43-4031	Court, Municipal, and License Clerks	3354	Government licensing officials	3354	Agentes de serviços de expedição de licenças e permissões
43-4031.03	License Clerks	43-4031	Court, Municipal, and License Clerks	3354	Government licensing officials	3354	Agentes de serviços de expedição de licenças e permissões
43-4041.00	Credit Authorizers, Checkers, and Clerks	43-4041	Credit Authorizers, Checkers, and Clerks	4312	Statistical, finance and insurance clerks	4312	Trabalhadores de serviços estatísticos, financeiros e de seguros
43-4041.01	Credit Authorizers	43-4041	Credit Authorizers, Checkers, and Clerks	4312	Statistical, finance and insurance clerks	4312	Trabalhadores de serviços estatísticos, financeiros e de seguros
43-4041.02	Credit Checkers	43-4041	Credit Authorizers, Checkers, and Clerks	4312	Statistical, finance and insurance clerks	4312	Trabalhadores de serviços estatísticos, financeiros e de seguros
43-4051.00	Customer Service Representatives	43-4051	Customer Service Representatives	4222	Contact centre information clerks	4222	Trabalhadores de centrais de atendimento
43-4051.03	Patient Representatives	43-4051	Customer Service Representatives	4222	Contact centre information clerks	4222	Trabalhadores de centrais de atendimento
43-4061.00	Eligibility Interviewers, Government Programs	43-4061	Eligibility Interviewers, Government Programs	3353	Government social benefits officials	3353	Agentes de serviços de segurança social
43-4071.00	File Clerks	43-4071	File Clerks	4415	Filing and copying clerks	4415	Trabalhadores de arquivos
43-4081.00	Hotel, Motel, and Resort Desk Clerks	43-4081	Hotel, Motel, and Resort Desk Clerks	4224	Hotel receptionists	4224	Recepçãoistas de hotéis
43-4111.00	Interviewers, Except Eligibility and Loan	43-4111	Interviewers, Except Eligibility and Loan	4227	Survey and market research interviewers	4227	Entrevistadores de pesquisas de mercado
43-4121.00	Library Assistants, Clerical	43-4121	Library Assistants, Clerical	4411	Library clerks	4411	Trabalhadores de bibliotecas
43-4131.00	Loan Interviewers and Clerks	43-4131	Loan Interviewers and Clerks	4312	Statistical, finance and insurance clerks	4312	Trabalhadores de serviços estatísticos, financeiros e de seguros
43-4141.00	New Accounts Clerks	43-4141	New Accounts Clerks	4312	Statistical, finance and insurance clerks	4312	Trabalhadores de serviços estatísticos, financeiros e de seguros
43-4151.00	Order Clerks	43-4151	Order Clerks	4419	Clerical support workers not elsewhere classified	4419	Trabalhadores de apoio administrativo não classificados anteriormente
43-4161.00	Human Resources Assistants, Except Payroll and Timekeeping Receptionists and Information Clerks	43-4161	Human Resources Assistants, Except Payroll and Timekeeping Receptionists and Information Clerks	4416	Personnel clerks	4416	Trabalhadores do serviço de pessoal
43-4171.00	Reservation and Transportation Ticket Agents and Travel Clerks	43-4171	Reservation and Transportation Ticket Agents and Travel Clerks	4222	Contact centre information clerks	4222	Trabalhadores de centrais de atendimento
43-4181.00	Information and Record Clerks, All Other	43-4199	Information and Record Clerks, All Other	4229	Travel consultants and clerks	4221	Trabalhadores de agências de viagem
43-4199.00	Information and Record Clerks, All Other	43-4199	Information and Record Clerks, All Other	4229	Client information workers not elsewhere classified	4229	Trabalhadores de serviços de informação ao cliente não classificados anteriormente
43-5011.00	Cargo and Freight Agents	43-5011	Cargo and Freight Agents	3324	Trade brokers	3324	Corretores de comercialização
43-5011.01	Freight Forwarders	43-5011	Cargo and Freight Agents	3324	Trade brokers	3324	Corretores de comercialização
43-5021.00	Couriers and Messengers	43-5021	Couriers and Messengers	4412	Mail carriers and sorting clerks	4412	Trabalhadores de serviços de correios
43-5031.00	Police, Fire, and Ambulance Dispatchers	43-5031	Police, Fire, and Ambulance Dispatchers	5419	Protective services workers not elsewhere classified	5419	Trabalhadores dos serviços de proteção e segurança não classificados anteriormente
43-5032.00	Dispatchers, Except Police, Fire, and Ambulance	43-5032	Dispatchers, Except Police, Fire, and Ambulance	4323	Transport clerks	4323	Trabalhadores de serviços de transporte
43-5041.00	Meter Readers, Utilities	43-5041	Meter Readers, Utilities	9623	Meter readers and vending-machine collectors	9623	Coletores de dinheiro em máquinas automáticas de venda e leitores de medidores
43-5051.00	Postal Service Clerks	43-5051	Postal Service Clerks	4211	Bank tellers and related clerks	4211	Caixas de banco e afins
43-5052.00	Postal Service Mail Carriers	43-5052	Postal Service Mail Carriers	4412	Mail carriers and sorting clerks	4412	Trabalhadores de serviços de correios
43-5053.00	Postal Service Mail Sorters, Processors, and Processing Machine Operators	43-5053	Postal Service Mail Sorters, Processors, and Processing Machine Operators	4412	Mail carriers and sorting clerks	4412	Trabalhadores de serviços de correios
43-5061.00	Production, Planning, and Expediting Clerks	43-5061	Production, Planning, and Expediting Clerks	4322	Production clerks	4322	Trabalhadores de serviços de apoio à produção
43-5071.00	Shipping, Receiving, and Traffic Clerks	43-5071	Shipping, Receiving, and Traffic Clerks	3331	Clearing and forwarding agents	3331	Despachantes aduaneiros
43-5081.00	Stock Clerks and Order Fillers	43-5081	Stock Clerks and Order Fillers	4321	Stock clerks	4321	Trabalhadores de controle de abastecimento e estoques
43-5081.01	Stock Clerks, Sales Floor	43-5081	Stock Clerks and Order Fillers	4321	Stock clerks	4321	Trabalhadores de controle de abastecimento e estoques
43-5081.02	Marking Clerks	43-5081	Stock Clerks and Order Fillers	4321	Stock clerks	4321	Trabalhadores de controle de abastecimento e estoques

## Appendix

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43-5081.03	Stock Clerks- Stockroom, Warehouse, or Storage Yard	43-5081	Stock Clerks and Order Fillers	4321	Stock clerks	4321	Trabalhadores de controle de abastecimento e estoques
43-5081.04	Order Fillers, Wholesale and Retail Sales	43-5081	Stock Clerks and Order Fillers	4321	Stock clerks	4321	Trabalhadores de controle de abastecimento e estoques
43-5111.00	Weighers, Measurers, Checkers, and Samplers, Recordkeeping	43-5111	Weighers, Measurers, Checkers, and Samplers, Recordkeeping	4321	Stock clerks	4321	Trabalhadores de controle de abastecimento e estoques
43-6011.00	Executive Secretaries and Executive Administrative Assistants	43-6011	Executive Secretaries and Executive Administrative Assistants	3343	Administrative and executive secretaries	3343	Secretários executivos e administrativos
43-6012.00	Legal Secretaries	43-6012	Legal Secretaries	3342	Legal secretaries	3342	Secretários jurídicos
43-6013.00	Medical Secretaries	43-6013	Medical Secretaries	3344	Medical secretaries	3344	Secretários de medicina
43-6014.00	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	4120	Secretaries (general)	4120	Secretários (geral)
43-9011.00	Computer Operators	43-9011	Computer Operators	3511	Information and communications technology operations technicians	3511	Técnicos em operações de tecnologia da informação e das comunicações
43-9021.00	Data Entry Keyers	43-9021	Data Entry Keyers	4132	Data entry clerks	4132	Operadores de entrada de dados
43-9022.00	Word Processors and Typists	43-9022	Word Processors and Typists	4131	Typists and word processing operators	4131	Operadores de máquinas de processamento de texto e mecanógrafos
43-9031.00	Desktop Publishers	43-9031	Desktop Publishers	7321	Pre-press technicians	7321	Trabalhadores da pré-imprensa gráfica
43-9041.00	Insurance Claims and Policy Processing Clerks	43-9041	Insurance Claims and Policy Processing Clerks	4312	Statistical, finance and insurance clerks	4312	Trabalhadores de serviços estatísticos, financeiros e de seguros
43-9041.01	Insurance Claims Clerks	43-9041	Insurance Claims and Policy Processing Clerks	4312	Statistical, finance and insurance clerks	4312	Trabalhadores de serviços estatísticos, financeiros e de seguros
43-9041.02	Insurance Policy Processing Clerks	43-9041	Insurance Claims and Policy Processing Clerks	4312	Statistical, finance and insurance clerks	4312	Trabalhadores de serviços estatísticos, financeiros e de seguros
43-9051.00	Mail Clerks and Mail Machine Operators, Except Postal Service	43-9051	Mail Clerks and Mail Machine Operators, Except Postal Service	4412	Mail carriers and sorting clerks	4412	Trabalhadores de serviços de correios
43-9061.00	Office Clerks, General	43-9061	Office Clerks, General	4110	General office clerks	4110	Escriturários gerais
43-9071.00	Office Machine Operators, Except Computer	43-9071	Office Machine Operators, Except Computer	4415	Filing and copying clerks	4415	Trabalhadores de arquivos
43-9081.00	Proofreaders and Copy Markers	43-9081	Proofreaders and Copy Markers	4413	Coding, proof-reading and related clerks	4413	Codificadores de dados, revisores de provas de impressão e afins
43-9111.00	Statistical Assistants	43-9111	Statistical Assistants	3314	Statistical, mathematical and related associate professionals	3314	Profissionais de nível médio de serviços estatísticos, matemáticos e afins
43-9111.01	Bioinformatics Technicians	43-9111	Statistical Assistants	3314	Statistical, mathematical and related associate professionals	3314	Profissionais de nível médio de serviços estatísticos, matemáticos e afins
43-9199.00	Office and Administrative Support Workers, All Other	43-9199	Office and Administrative Support Workers, All Other	4419	Clerical support workers not elsewhere classified	4419	Trabalhadores de apoio administrativo não classificados anteriormente
45-1011.00	First-Line Supervisors of Farming, Fishing, and Forestry Workers	45-1011	First-Line Supervisors of Farming, Fishing, and Forestry Workers	6111	Field crop and vegetable growers	6111	Agricultores e trabalhadores qualificados em atividades da agricultura (exclusive hortas, viveiros e jardins)
45-1011.05	First-Line Supervisors of Logging Workers	45-1011	First-Line Supervisors of Farming, Fishing, and Forestry Workers	6111	Field crop and vegetable growers	6111	Agricultores e trabalhadores qualificados em atividades da agricultura (exclusive hortas, viveiros e jardins)
45-1011.06	First-Line Supervisors of Aquacultural Workers	45-1011	First-Line Supervisors of Farming, Fishing, and Forestry Workers	6111	Field crop and vegetable growers	6111	Agricultores e trabalhadores qualificados em atividades da agricultura (exclusive hortas, viveiros e jardins)
45-1011.07	First-Line Supervisors of Agricultural Crop and Horticultural Workers	45-1011	First-Line Supervisors of Farming, Fishing, and Forestry Workers	6111	Field crop and vegetable growers	6111	Agricultores e trabalhadores qualificados em atividades da agricultura (exclusive hortas, viveiros e jardins)
45-1011.08	First-Line Supervisors of Animal Husbandry and Animal Care Workers	45-1011	First-Line Supervisors of Farming, Fishing, and Forestry Workers	6111	Field crop and vegetable growers	6111	Agricultores e trabalhadores qualificados em atividades da agricultura (exclusive hortas, viveiros e jardins)
45-2011.00	Agricultural Inspectors	45-2011	Agricultural Inspectors	3257	Environmental and occupational health inspectors and associates	3257	Inspectores de saúde laboral, ambiental e afins
45-2021.00	Animal Breeders	45-2021	Animal Breeders	6121	Livestock and dairy producers	6121	Criadores de gado e trabalhadores qualificados da criação de gado
45-2041.00	Graders and Sorters, Agricultural Products	45-2041	Graders and Sorters, Agricultural Products	7515	Food and beverage tasters and graders	7515	Trabalhadores da degustação e classificação de alimentos e bebidas
45-2091.00	Agricultural Equipment Operators	45-2091	Agricultural Equipment Operators	6111	Field crop and vegetable growers	6111	Agricultores e trabalhadores qualificados em atividades da agricultura (exclusive hortas, viveiros e jardins)
45-2092.00	Farmworkers and Laborers, Crop, Nursery, and Greenhouse	45-2092	Farmworkers and Laborers, Crop, Nursery, and Greenhouse	6310	Subsistence crop farmers	#N/D	#N/D
45-2092.01	Nursery Workers	45-2092	Farmworkers and Laborers, Crop, Nursery, and Greenhouse	6310	Subsistence crop farmers	#N/D	#N/D
45-2092.02	Farmworkers and Laborers, Crop	45-2092	Farmworkers and Laborers, Crop, Nursery, and Greenhouse	6310	Subsistence crop farmers	#N/D	#N/D
45-2093.00	Farmworkers, Farm, Ranch, and Aquacultural Animals	45-2093	Farmworkers, Farm, Ranch, and Aquacultural Animals	6320	Subsistence livestock farmers	#N/D	#N/D
45-2099.00	Agricultural Workers, All Other	45-2099	Agricultural Workers, All Other	9211	Crop farm labourers	9211	Trabalhadores elementares da agricultura
45-3011.00	Fishers and Related Fishing Workers	45-3011	Fishers and Related Fishing Workers	6222	Inland and coastal waters fishery workers	#N/D	#N/D
45-3021.00	Hunters and Trappers	45-3021	Hunters and Trappers	6224	Hunters and trappers	6224	Caçadores

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45-4011.00	Forest and Conservation Workers	45-4011	Forest and Conservation Workers	6210	Forestry and related workers	6210	Trabalhadores florestais qualificados e afins
45-4021.00	Fallers	45-4021	Fallers	6210	Forestry and related workers	6210	Trabalhadores florestais qualificados e afins
45-4022.00	Logging Equipment Operators	45-4022	Logging Equipment Operators	6210	Forestry and related workers	6210	Trabalhadores florestais qualificados e afins
45-4023.00	Log Graders and Scalers	45-4023	Log Graders and Scalers	6210	Forestry and related workers	6210	Trabalhadores florestais qualificados e afins
45-4029.00	Logging Workers, All Other	45-4029	Logging Workers, All Other	6210	Forestry and related workers	6210	Trabalhadores florestais qualificados e afins
47-1011.00	First-Line Supervisors of Construction Trades and Extraction Workers	47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	3121	Mining supervisors	3121	Supervisores da mineração
47-1011.03	Solar Energy Installation Managers	47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	3121	Mining supervisors	3121	Supervisores da mineração
47-2011.00	Boilermakers	47-2011	Boilermakers	7213	Sheet-metal workers	7213	Chapistas e caldeireiros
47-2021.00	Brickmasons and Blockmasons	47-2021	Brickmasons and Blockmasons	7112	Bricklayers and related workers	7112	Pedreiros
47-2022.00	Stonemasons	47-2022	Stonemasons	7113	Stonemasons, stone cutters, splitters and carvers	7113	Canteiros, cortadores e gravadores de pedras
47-2031.00	Carpenters	47-2031	Carpenters	7115	Carpenters and joiners	7115	Carpinteiros
47-2031.01	Construction Carpenters	47-2031	Carpenters	7115	Carpenters and joiners	7115	Carpinteiros
47-2031.02	Rough Carpenters	47-2031	Carpenters	7115	Carpenters and joiners	7115	Carpinteiros
47-2041.00	Carpet Installers	47-2041	Carpet Installers	7122	Floor layers and tile setters	7122	Aplicadores de revestimentos cerâmicos, pastilhas, pedras e madeiras
47-2042.00	Floor Layers, Except Carpet, Wood, and Hard Tiles	47-2042	Floor Layers, Except Carpet, Wood, and Hard Tiles	7122	Floor layers and tile setters	7122	Aplicadores de revestimentos cerâmicos, pastilhas, pedras e madeiras
47-2043.00	Floor Sanders and Finishers	47-2043	Floor Sanders and Finishers	7122	Floor layers and tile setters	7122	Aplicadores de revestimentos cerâmicos, pastilhas, pedras e madeiras
47-2044.00	Tile and Marble Setters	47-2044	Tile and Marble Setters	7122	Floor layers and tile setters	7122	Aplicadores de revestimentos cerâmicos, pastilhas, pedras e madeiras
47-2051.00	Cement Masons and Concrete Finishers	47-2051	Cement Masons and Concrete Finishers	7114	Concrete placers, concrete finishers and related workers	7114	Trabalhadores em cimento e concreto armado
47-2053.00	Terrazzo Workers and Finishers	47-2053	Terrazzo Workers and Finishers	7114	Concrete placers, concrete finishers and related workers	7114	Trabalhadores em cimento e concreto armado
47-2061.00	Construction Laborers	47-2061	Construction Laborers	9313	Building construction labourers	9313	Trabalhadores elementares da construção de edifícios
47-2071.00	Paving, Surfacing, and Tamping Equipment Operators	47-2071	Paving, Surfacing, and Tamping Equipment Operators	8342	Earthmoving and related plant operators	8342	Operadores de máquinas de movimentação de terras e afins
47-2072.00	Pile-Driver Operators	47-2072	Pile-Driver Operators	8342	Earthmoving and related plant operators	8342	Operadores de máquinas de movimentação de terras e afins
47-2073.00	Operating Engineers and Other Construction Equipment Operators	47-2073	Operating Engineers and Other Construction Equipment Operators	8342	Earthmoving and related plant operators	8342	Operadores de máquinas de movimentação de terras e afins
47-2081.00	Drywall and Ceiling Tile Installers	47-2081	Drywall and Ceiling Tile Installers	7123	Plasterers	7123	Gesseiros
47-2082.00	Tapers	47-2082	Tapers	7123	Plasterers	7123	Gesseiros
47-2111.00	Electricians	47-2111	Electricians	7411	Building and related electricians	7411	Eletricistas de obras e afins
47-2121.00	Glaziers	47-2121	Glaziers	7125	Glaziers	7125	Vidraceiros
47-2131.00	Insulation Workers, Floor, Ceiling and Wall	47-2131	Insulation Workers, Floor, Ceiling and Wall	7124	Insulation workers	7124	Instaladores de material isolante térmico e acústico
47-2132.00	Insulation Workers, Mechanical	47-2132	Insulation Workers, Mechanical	7124	Insulation workers	7124	Instaladores de material isolante térmico e acústico
47-2141.00	Painters, Construction and Maintenance	47-2141	Painters, Construction and Maintenance	7131	Painters and related workers	7131	Pintores e empapeladores
47-2142.00	Paperhanglers	47-2142	Paperhanglers	7131	Painters and related workers	7131	Pintores e empapeladores
47-2151.00	Pipelayers	47-2151	Pipelayers	7126	Plumbers and pipe fitters	7126	Bombeiros e encanadores
47-2152.00	Plumbers, Pipefitters, and Steamfitters	47-2152	Plumbers, Pipefitters, and Steamfitters	7126	Plumbers and pipe fitters	7126	Bombeiros e encanadores
47-2152.01	Pipe Fitters and Steamfitters	47-2152	Plumbers, Pipefitters, and Steamfitters	7126	Plumbers and pipe fitters	7126	Bombeiros e encanadores
47-2152.02	Plumbers	47-2152	Plumbers, Pipefitters, and Steamfitters	7126	Plumbers and pipe fitters	7126	Bombeiros e encanadores
47-2161.00	Plasterers and Stucco Masons	47-2161	Plasterers and Stucco Masons	7123	Plasterers	7123	Gesseiros
47-2171.00	Reinforcing Iron and Rebar Workers	47-2171	Reinforcing Iron and Rebar Workers	7214	Structural-metal preparers and erectors	7214	Montadores de estruturas metálicas
47-2181.00	Roofers	47-2181	Roofers	7121	Roofers	7121	Telhadores
47-2211.00	Sheet Metal Workers	47-2211	Sheet Metal Workers	7213	Sheet-metal workers	7213	Chapistas e caldeireiros
47-2221.00	Structural Iron and Steel Workers	47-2221	Structural Iron and Steel Workers	7214	Structural-metal preparers and erectors	7214	Montadores de estruturas metálicas
47-2231.00	Solar Photovoltaic Installers	47-2231	Solar Photovoltaic Installers	7119	Building frame and related trades workers not elsewhere classified	7119	Outros trabalhadores qualificados e operários da construção não classificados anteriormente
47-3011.00	Helpers--Brickmasons, Blockmasons, Stonemasons, and Tile and Marble Setters	47-3011	Helpers--Brickmasons, Blockmasons, Stonemasons, and Tile and Marble Setters	9313	Building construction labourers	9313	Trabalhadores elementares da construção de edifícios

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47-3012.00	Helpers--Carpenters	47-3012	Helpers--Carpenters	9313	Building construction labourers	9313	Trabalhadores elementares da construção de edifícios
47-3013.00	Helpers--Electricians	47-3013	Helpers--Electricians	9313	Building construction labourers	9313	Trabalhadores elementares da construção de edifícios
47-3014.00	Helpers--Painters, Paperhangers, Plasterers, and Stucco Masons	47-3014	Helpers--Painters, Paperhangers, Plasterers, and Stucco Masons	9313	Building construction labourers	9313	Trabalhadores elementares da construção de edifícios
47-3015.00	Helpers--Pipefitters, Plumbers, Pipefitters, and Steamfitters	47-3015	Helpers--Pipefitters, Plumbers, Pipefitters, and Steamfitters	9313	Building construction labourers	9313	Trabalhadores elementares da construção de edifícios
47-3016.00	Helpers--Roofers	47-3016	Helpers--Roofers	9313	Building construction labourers	9313	Trabalhadores elementares da construção de edifícios
47-3019.00	Helpers, Construction Trades, All Other	47-3019	Helpers, Construction Trades, All Other	9312	Civil engineering labourers	9312	Trabalhadores elementares de obras públicas e da manutenção de estradas, represas e similares
47-4011.00	Construction and Building Inspectors	47-4011	Construction and Building Inspectors	3112	Civil engineering technicians	3112	Técnicos em engenharia civil
47-4021.00	Elevator Installers and Repairers	47-4021	Elevator Installers and Repairers	7412	Electrical mechanics and fitters	7412	Mecânicos e ajustadores eletricistas
47-4031.00	Fence Erectors	47-4031	Fence Erectors	7119	Building frame and related trades workers not elsewhere classified	7119	Outros trabalhadores qualificados e operários da construção não classificados anteriormente
47-4041.00	Hazardous Materials Removal Workers	47-4041	Hazardous Materials Removal Workers	7119	Building frame and related trades workers not elsewhere classified	7119	Outros trabalhadores qualificados e operários da construção não classificados anteriormente
47-4051.00	Highway Maintenance Workers	47-4051	Highway Maintenance Workers	9312	Civil engineering labourers	9312	Trabalhadores elementares de obras públicas e da manutenção de estradas, represas e similares
47-4061.00	Rail-Track Laying and Maintenance Equipment Operators	47-4061	Rail-Track Laying and Maintenance Equipment Operators	9312	Civil engineering labourers	9312	Trabalhadores elementares de obras públicas e da manutenção de estradas, represas e similares
47-4071.00	Septic Tank Servicers and Sewer Pipe Cleaners	47-4071	Septic Tank Servicers and Sewer Pipe Cleaners	9129	Other cleaning workers	9129	Outros trabalhadores de limpeza
47-4091.00	Segmental Pavers	47-4091	Segmental Pavers	7113	Stonemasons, stone cutters, splitters and carvers	7113	Canteiros, cortadores e gravadores de pedras
47-4099.00	Construction and Related Workers, All Other	47-4099	Construction and Related Workers, All Other	7119	Building frame and related trades workers not elsewhere classified	7119	Outros trabalhadores qualificados e operários da construção não classificados anteriormente
47-4099.02	Solar Thermal Installers and Technicians	47-4099	Construction and Related Workers, All Other	7119	Building frame and related trades workers not elsewhere classified	7119	Outros trabalhadores qualificados e operários da construção não classificados anteriormente
47-4099.03	Weatherization Installers and Technicians	47-4099	Construction and Related Workers, All Other	7119	Building frame and related trades workers not elsewhere classified	7119	Outros trabalhadores qualificados e operários da construção não classificados anteriormente
47-5011.00	Derrick Operators, Oil and Gas	47-5011	Derrick Operators, Oil and Gas	8113	Well drillers and borers and related workers	8113	Perfuradores e sondadores de poços e afins
47-5012.00	Rotary Drill Operators, Oil and Gas	47-5012	Rotary Drill Operators, Oil and Gas	8113	Well drillers and borers and related workers	8113	Perfuradores e sondadores de poços e afins
47-5013.00	Service Unit Operators, Oil, Gas, and Mining	47-5013	Service Unit Operators, Oil, Gas, and Mining	8113	Well drillers and borers and related workers	8113	Perfuradores e sondadores de poços e afins
47-5021.00	Earth Drillers, Except Oil and Gas	47-5021	Earth Drillers, Except Oil and Gas	8111	Miners and quarriers	8111	Mineiros e operadores de máquinas e de instalações em minas e pedreiras
47-5031.00	Explosives Workers, Ordnance Handling Experts, and Blasters	47-5031	Explosives Workers, Ordnance Handling Experts, and Blasters	7542	Shotfirers and blasters	7542	Dinamitadores e detonadores
47-5041.00	Continuous Mining Machine Operators	47-5041	Continuous Mining Machine Operators	8111	Miners and quarriers	8111	Mineiros e operadores de máquinas e de instalações em minas e pedreiras
47-5042.00	Mine Cutting and Channeling Machine Operators	47-5042	Mine Cutting and Channeling Machine Operators	8111	Miners and quarriers	8111	Mineiros e operadores de máquinas e de instalações em minas e pedreiras
47-5049.00	Mining Machine Operators, All Other	47-5049	Mining Machine Operators, All Other	8111	Miners and quarriers	8111	Mineiros e operadores de máquinas e de instalações em minas e pedreiras
47-5051.00	Rock Splitters, Quarry	47-5051	Rock Splitters, Quarry	8111	Miners and quarriers	8111	Mineiros e operadores de máquinas e de instalações em minas e pedreiras
47-5061.00	Roof Bolters, Mining	47-5061	Roof Bolters, Mining	8111	Miners and quarriers	8111	Mineiros e operadores de máquinas e de instalações em minas e pedreiras
47-5071.00	Roustabouts, Oil and Gas	47-5071	Roustabouts, Oil and Gas	8113	Well drillers and borers and related workers	8113	Perfuradores e sondadores de poços e afins
47-5081.00	Helpers--Extraction Workers	47-5081	Helpers--Extraction Workers	9311	Mining and quarrying labourers	9311	Trabalhadores elementares de minas e pedreiras
47-5099.00	Extraction Workers, All Other	47-5099	Extraction Workers, All Other	9311	Mining and quarrying labourers	9311	Trabalhadores elementares de minas e pedreiras
49-1011.00	First-Line Supervisors of Mechanics, Installers, and Repairers	49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	7127	Air conditioning and refrigeration mechanics	7127	Mecânicos-instaladores de sistemas de refrigeração e climatização
49-2011.00	Computer, Automated Teller, and Office Machine Repairers	49-2011	Computer, Automated Teller, and Office Machine Repairers	7421	Electronics mechanics and servicers	7421	Mecânicos e reparadores em eletrônica
49-2021.00	Radio, Cellular, and Tower Equipment Installers and Repairers	49-2021	Radio, Cellular, and Tower Equipment Installers and Repairers	7422	Information and communications technology installers and servicers	7422	Instaladores e reparadores em tecnologias da informação e comunicações
49-2021.01	Radio Mechanics	49-2021	Radio Mechanics	7422	Information and communications technology installers and servicers	7422	Instaladores e reparadores em tecnologias da informação e comunicações
49-2022.00	Telecommunications Equipment Installers and Repairers, Except Line Installers	49-2022	Telecommunications Equipment Installers and Repairers, Except Line Installers	7422	Information and communications technology installers and servicers	7422	Instaladores e reparadores em tecnologias da informação e comunicações
49-2091.00	Avionics Technicians	49-2091	Avionics Technicians	7421	Electronics mechanics and servicers	7421	Mecânicos e reparadores em eletrônica
49-2092.00	Electric Motor, Power Tool, and Related Repairers	49-2092	Electric Motor, Power Tool, and Related Repairers	7412	Electrical mechanics and fitters	7412	Mecânicos e ajustadores eletricistas
49-2093.00	Electrical and Electronics Installers and Repairers, Transportation Equipment	49-2093	Electrical and Electronics Installers and Repairers, Transportation Equipment	7412	Electrical mechanics and fitters	7412	Mecânicos e ajustadores eletricistas

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49-2094.00	Electrical and Electronics Repairers, Commercial and Industrial Equipment	49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	7412	Electrical mechanics and fitters	7412	Mecânicos e ajustadores eletricistas
49-2095.00	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	7412	Electrical mechanics and fitters	7412	Mecânicos e ajustadores eletricistas
49-2096.00	Electronic Equipment Installers and Repairers, Motor Vehicles	49-2096	Electronic Equipment Installers and Repairers, Motor Vehicles	7412	Electrical mechanics and fitters	7412	Mecânicos e ajustadores eletricistas
49-2097.00	Electronic Home Entertainment Equipment Installers and Repairers	49-2097	Electronic Home Entertainment Equipment Installers and Repairers	7422	Information and communications technology installers and servicers	7422	Instaladores e reparadores em tecnologias da informação e comunicações
49-2098.00	Security and Fire Alarm Systems Installers	49-2098	Security and Fire Alarm Systems Installers	7412	Electrical mechanics and fitters	7412	Mecânicos e ajustadores eletricistas
49-3011.00	Aircraft Mechanics and Service Technicians	49-3011	Aircraft Mechanics and Service Technicians	7232	Aircraft engine mechanics and repairers	7232	Mecânicos e reparadores de motores de avião
49-3021.00	Automotive Body and Related Repairers	49-3021	Automotive Body and Related Repairers	7231	Motor vehicle mechanics and repairers	7231	Mecânicos e reparadores de veículos a motor
49-3022.00	Automotive Glass Installers and Repairers	49-3022	Automotive Glass Installers and Repairers	7231	Motor vehicle mechanics and repairers	7231	Mecânicos e reparadores de veículos a motor
49-3023.00	Automotive Service Technicians and Mechanics	49-3023	Automotive Service Technicians and Mechanics	7231	Motor vehicle mechanics and repairers	7231	Mecânicos e reparadores de veículos a motor
49-3023.01	Automotive Master Mechanics	49-3023	Automotive Service Technicians and Mechanics	7231	Motor vehicle mechanics and repairers	7231	Mecânicos e reparadores de veículos a motor
49-3023.02	Automotive Specialty Technicians	49-3023	Automotive Service Technicians and Mechanics	7231	Motor vehicle mechanics and repairers	7231	Mecânicos e reparadores de veículos a motor
49-3031.00	Bus and Truck Mechanics and Diesel Engine Specialists	49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	7231	Motor vehicle mechanics and repairers	7231	Mecânicos e reparadores de veículos a motor
49-3041.00	Farm Equipment Mechanics and Service Technicians	49-3041	Farm Equipment Mechanics and Service Technicians	7233	Agricultural and industrial machinery mechanics and repairers	7233	Mecânicos e reparadores de máquinas agrícolas e industriais
49-3042.00	Mobile Heavy Equipment Mechanics, Except Engines	49-3042	Mobile Heavy Equipment Mechanics, Except Engines	7233	Agricultural and industrial machinery mechanics and repairers	7233	Mecânicos e reparadores de máquinas agrícolas e industriais
49-3043.00	Rail Car Repairers	49-3043	Rail Car Repairers	7233	Agricultural and industrial machinery mechanics and repairers	7233	Mecânicos e reparadores de máquinas agrícolas e industriais
49-3051.00	Motorboat Mechanics and Service Technicians	49-3051	Motorboat Mechanics and Service Technicians	7231	Motor vehicle mechanics and repairers	7231	Mecânicos e reparadores de veículos a motor
49-3052.00	Motorcycle Mechanics	49-3052	Motorcycle Mechanics	7231	Motor vehicle mechanics and repairers	7231	Mecânicos e reparadores de veículos a motor
49-3053.00	Outdoor Power Equipment and Other Small Engine Mechanics	49-3053	Outdoor Power Equipment and Other Small Engine Mechanics	7231	Motor vehicle mechanics and repairers	7231	Mecânicos e reparadores de veículos a motor
49-3091.00	Bicycle Repairers	49-3091	Bicycle Repairers	7234	Bicycle and related repairers	7234	Reparadores de bicicletas e afins
49-3092.00	Recreational Vehicle Service Technicians	49-3092	Recreational Vehicle Service Technicians	7231	Motor vehicle mechanics and repairers	7231	Mecânicos e reparadores de veículos a motor
49-3093.00	Tire Repairers and Changers	49-3093	Tire Repairers and Changers	7231	Motor vehicle mechanics and repairers	7231	Mecânicos e reparadores de veículos a motor
49-9011.00	Mechanical Door Repairers	49-9011	Mechanical Door Repairers	7412	Electrical mechanics and fitters	7412	Mecânicos e ajustadores eletricistas
49-9012.00	Control and Valve Installers and Repairers, Except Mechanical Door Heating, Air Conditioning, and Refrigeration Mechanics and Installers	49-9012	Control and Valve Installers and Repairers, Except Mechanical Door Heating, Air Conditioning, and Refrigeration Mechanics and Installers	7412	Electrical mechanics and fitters	7412	Mecânicos e ajustadores eletricistas
49-9021.00	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	7127	Air conditioning and refrigeration mechanics	7127	Mecânicos-instaladores de sistemas de refrigeração e climatização
49-9021.01	Heating and Air Conditioning Mechanics and Installers	49-9021	Heating and Air Conditioning Mechanics and Installers	7127	Air conditioning and refrigeration mechanics	7127	Mecânicos-instaladores de sistemas de refrigeração e climatização
49-9021.02	Refrigeration Mechanics and Installers	49-9021	Refrigeration Mechanics and Installers	7127	Air conditioning and refrigeration mechanics	7127	Mecânicos-instaladores de sistemas de refrigeração e climatização
49-9031.00	Home Appliance Repairers	49-9031	Home Appliance Repairers	7412	Electrical mechanics and fitters	7412	Mecânicos e ajustadores eletricistas
49-9041.00	Industrial Machinery Mechanics	49-9041	Industrial Machinery Mechanics	7233	Agricultural and industrial machinery mechanics and repairers	7233	Mecânicos e reparadores de máquinas agrícolas e industriais
49-9043.00	Maintenance Workers, Machinery	49-9043	Maintenance Workers, Machinery	7233	Agricultural and industrial machinery mechanics and repairers	7233	Mecânicos e reparadores de máquinas agrícolas e industriais
49-9044.00	Millwrights	49-9044	Millwrights	7233	Agricultural and industrial machinery mechanics and repairers	7233	Mecânicos e reparadores de máquinas agrícolas e industriais
49-9045.00	Refractory Materials Repairers, Except Brickmasons	49-9045	Refractory Materials Repairers, Except Brickmasons	7112	Bricklayers and related workers	7112	Pedreiros
49-9051.00	Electrical Power-Line Installers and Repairers	49-9051	Electrical Power-Line Installers and Repairers	7413	Electrical line installers and repairers	7413	Instaladores e reparadores de linhas elétricas
49-9052.00	Telecommunications Line Installers and Repairers	49-9052	Telecommunications Line Installers and Repairers	7422	Information and communications technology installers and servicers	7422	Instaladores e reparadores em tecnologias da informação e comunicações
49-9061.00	Camera and Photographic Equipment Repairers	49-9061	Camera and Photographic Equipment Repairers	7311	Precision-instrument makers and repairers	7311	Mecânicos e reparadores de instrumentos de precisão
49-9062.00	Medical Equipment Repairers	49-9062	Medical Equipment Repairers	7311	Precision-instrument makers and repairers	7311	Mecânicos e reparadores de instrumentos de precisão
49-9063.00	Musical Instrument Repairers and Tuners	49-9063	Musical Instrument Repairers and Tuners	7312	Musical instrument makers and tuners	7312	Confeccionadores e afinadores de instrumentos musicais
49-9064.00	Watch Repairers	49-9064	Watch Repairers	7311	Precision-instrument makers and repairers	7311	Mecânicos e reparadores de instrumentos de precisão
49-9069.00	Precision Instrument and Equipment Repairers, All Other	49-9069	Precision Instrument and Equipment Repairers, All Other	7311	Precision-instrument makers and repairers	7311	Mecânicos e reparadores de instrumentos de precisão
49-9071.00	Maintenance and Repair Workers, General	49-9071	Maintenance and Repair Workers, General	9622	Odd job persons	9622	Pessoas que realizam várias tarefas
49-9081.00	Wind Turbine Service Technicians	49-9081	Wind Turbine Service Technicians	7233	Agricultural and industrial machinery mechanics and repairers	7233	Mecânicos e reparadores de máquinas agrícolas e industriais

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49-9091.00	Coin, Vending, and Amusement Machine Servicers and Repairers	49-9091	Coin, Vending, and Amusement Machine Servicers and Repairers	9623	Meter readers and vending-machine collectors	9623	Coletores de dinheiro em máquinas automáticas de venda e leitores de medidores
49-9092.00	Commercial Divers	49-9092	Commercial Divers	7541	Underwater divers	7541	Trabalhadores subaquáticos
49-9093.00	Fabric Menders, Except Garment	49-9093	Fabric Menders, Except Garment	7533	Sewing, embroidery and related workers	7533	Costureiros, bordadeiros e afins
49-9094.00	Locksmiths and Safe Repairers	49-9094	Locksmiths and Safe Repairers	7222	Toolmakers and related workers	7222	Ferramenteiros e afins
49-9095.00	Manufactured Building and Mobile Home Installers	49-9095	Manufactured Building and Mobile Home Installers	7119	Building frame and related trades workers not elsewhere classified	7119	Outros trabalhadores qualificados e operários da construção não classificados anteriormente
49-9096.00	Riggers	49-9096	Riggers	7215	Riggers and cable splicers	7215	Aparelhadores e emendadores de cabos
49-9097.00	Signal and Track Switch Repairers	49-9097	Signal and Track Switch Repairers	7412	Electrical mechanics and fitters	7412	Mecânicos e ajustadores eletricistas
49-9098.00	Helpers--Installation, Maintenance, and Repair Workers	49-9098	Helpers--Installation, Maintenance, and Repair Workers	9622	Odd job persons	9622	Pessoas que realizam várias tarefas
49-9099.00	Installation, Maintenance, and Repair Workers, All Other	49-9099	Installation, Maintenance, and Repair Workers, All Other	9622	Odd job persons	9622	Pessoas que realizam várias tarefas
49-9099.01	Geothermal Technicians	49-9099	Installation, Maintenance, and Repair Workers, All Other	9622	Odd job persons	9622	Pessoas que realizam várias tarefas
51-1011.00	First-Line Supervisors of Production and Operating Workers	51-1011	First-Line Supervisors of Production and Operating Workers	3122	Manufacturing supervisors	3122	Supervisores de indústrias de transformação
51-2011.00	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	51-2011	Aircraft Structure, Surfaces, Rigging, and Systems Assemblers	8211	Mechanical machinery assemblers	8211	Mecânicos montadores de maquinaria mecânica
51-2021.00	Coil Winders, Tapers, and Finishers	51-2021	Coil Winders, Tapers, and Finishers	8212	Electrical and electronic equipment assemblers	8212	Montadores de equipamentos elétricos e eletrônicos
51-2022.00	Electrical and Electronic Equipment Assemblers	51-2022	Electrical and Electronic Equipment Assemblers	8212	Electrical and electronic equipment assemblers	8212	Montadores de equipamentos elétricos e eletrônicos
51-2023.00	Electromechanical Equipment Assemblers	51-2023	Electromechanical Equipment Assemblers	8212	Electrical and electronic equipment assemblers	8212	Montadores de equipamentos elétricos e eletrônicos
51-2031.00	Engine and Other Machine Assemblers	51-2031	Engine and Other Machine Assemblers	8211	Mechanical machinery assemblers	8211	Mecânicos montadores de maquinaria mecânica
51-2041.00	Structural Metal Fabricators and Fitters	51-2041	Structural Metal Fabricators and Fitters	7214	Structural-metal preparers and erectors	7214	Montadores de estruturas metálicas
51-2091.00	Fiberglass Laminators and Fabricators	51-2091	Fiberglass Laminators and Fabricators	8142	Plastic products machine operators	8142	Operadores de máquinas para fabricar produtos de material plástico
51-2092.00	Team Assemblers	51-2092	Team Assemblers	8219	Assemblers not elsewhere classified	8219	Montadores não classificados anteriormente
51-2093.00	Timing Device Assemblers and Adjusters	51-2093	Timing Device Assemblers and Adjusters	8212	Electrical and electronic equipment assemblers	8212	Montadores de equipamentos elétricos e eletrônicos
51-2099.00	Assemblers and Fabricators, All Other	51-2099	Assemblers and Fabricators, All Other	8219	Assemblers not elsewhere classified	8219	Montadores não classificados anteriormente
51-3011.00	Bakers	51-3011	Bakers	7512	Bakers, pastry-cooks and confectionery makers	7512	Padeiros, confeiteiros e afins
51-3021.00	Butchers and Meat Cutters	51-3021	Butchers and Meat Cutters	7511	Butchers, fishmongers and related food preparers	7511	Magarefes e afins
51-3022.00	Meat, Poultry, and Fish Cutters and Trimmers	51-3022	Meat, Poultry, and Fish Cutters and Trimmers	7511	Butchers, fishmongers and related food preparers	7511	Magarefes e afins
51-3023.00	Slaughterers and Meat Packers	51-3023	Slaughterers and Meat Packers	7511	Butchers, fishmongers and related food preparers	7511	Magarefes e afins
51-3091.00	Food and Tobacco Roasting, Baking, and Drying Machine Operators and Tenders	51-3091	Food and Tobacco Roasting, Baking, and Drying Machine Operators and Tenders	7511	Butchers, fishmongers and related food preparers	7511	Magarefes e afins
51-3092.00	Food Batchmakers	51-3092	Food Batchmakers	7513	Dairy-products makers	7513	Trabalhadores da pasteurização do leite e fabricação de laticínios e afins
51-3093.00	Food Cooking Machine Operators and Tenders	51-3093	Food Cooking Machine Operators and Tenders	7514	Fruit, vegetable and related preservers	7514	Trabalhadores da conservação de frutas, legumes e similares
51-3099.00	Food Processing Workers, All Other	51-3099	Food Processing Workers, All Other	7514	Fruit, vegetable and related preservers	7514	Trabalhadores da conservação de frutas, legumes e similares
51-4011.00	Computer-Controlled Machine Tool Operators, Metal and Plastic	51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	7223	Metal working machine tool setters and operators	7223	Reguladores e operadores de máquinas-ferramentas
51-4012.00	Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	51-4012	Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	3139	Process control technicians not elsewhere classified	3139	Técnicos em controle de processos não classificados anteriormente
51-4021.00	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	51-4021	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	7223	Metal working machine tool setters and operators	7223	Reguladores e operadores de máquinas-ferramentas
51-4022.00	Forging Machine Setters, Operators, and Tenders, Metal and Plastic	51-4022	Forging Machine Setters, Operators, and Tenders, Metal and Plastic	7221	Blacksmiths, hammersmiths and forging press workers	7221	Ferreiros e forjadores
51-4023.00	Rolling Machine Setters, Operators, and Tenders, Metal and Plastic	51-4023	Rolling Machine Setters, Operators, and Tenders, Metal and Plastic	7223	Metal working machine tool setters and operators	7223	Reguladores e operadores de máquinas-ferramentas
51-4031.00	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	7223	Metal working machine tool setters and operators	7223	Reguladores e operadores de máquinas-ferramentas
51-4032.00	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	51-4032	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	7223	Metal working machine tool setters and operators	7223	Reguladores e operadores de máquinas-ferramentas
51-4033.00	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	7223	Metal working machine tool setters and operators	7223	Reguladores e operadores de máquinas-ferramentas
51-4034.00	Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic	51-4034	Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic	7223	Metal working machine tool setters and operators	7223	Reguladores e operadores de máquinas-ferramentas
51-4035.00	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	51-4035	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	7223	Metal working machine tool setters and operators	7223	Reguladores e operadores de máquinas-ferramentas

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51-4041.00	Machinists	51-4041	Machinists	7223	Metal working machine tool setters and operators	7223	Reguladores e operadores de máquinas-ferramentas
51-4051.00	Metal-Refining Furnace Operators and Tenders	51-4051	Metal-Refining Furnace Operators and Tenders	3135	Metal production process controllers	3135	Controladores de processos de produção de metais
51-4052.00	Pourers and Casters, Metal	51-4052	Pourers and Casters, Metal	8121	Metal processing plant operators	8121	Operadores de instalações de processamento de metais
51-4061.00	Model Makers, Metal and Plastic	51-4061	Model Makers, Metal and Plastic	7222	Toolmakers and related workers	7222	Ferramenteiros e afins
51-4062.00	Patternmakers, Metal and Plastic	51-4062	Patternmakers, Metal and Plastic	7222	Toolmakers and related workers	7222	Ferramenteiros e afins
51-4071.00	Foundry Mold and Coremakers	51-4071	Foundry Mold and Coremakers	7211	Metal moulders and coremakers	7211	Moldadores de metal e macheiros
51-4072.00	Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic	51-4072	Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic	7211	Metal moulders and coremakers	7211	Moldadores de metal e macheiros
51-4081.00	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	7223	Metal working machine tool setters and operators	7223	Reguladores e operadores de máquinas-ferramentas
51-4111.00	Tool and Die Makers	51-4111	Tool and Die Makers	7222	Toolmakers and related workers	7222	Ferramenteiros e afins
51-4121.00	Welders, Cutters, Solderers, and Brazers	51-4121	Welders, Cutters, Solderers, and Brazers	7212	Welders and flamecutters	7212	Soldadores e oxicortadores
51-4121.06	Welders, Cutters, and Welder Fitters	51-4121	Welders, Cutters, Solderers, and Brazers	7212	Welders and flamecutters	7212	Soldadores e oxicortadores
51-4121.07	Solderers and Brazers	51-4121	Welders, Cutters, Solderers, and Brazers	7212	Welders and flamecutters	7212	Soldadores e oxicortadores
51-4122.00	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	7212	Welders and flamecutters	7212	Soldadores e oxicortadores
51-4191.00	Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic	51-4191	Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic	8121	Metal processing plant operators	8121	Operadores de instalações de processamento de metais
51-4192.00	Layout Workers, Metal and Plastic	51-4192	Layout Workers, Metal and Plastic	7213	Sheet-metal workers	7213	Chapistas e caldeireiros
51-4193.00	Plating and Coating Machine Setters, Operators, and Tenders, Metal and Plastic	51-4193	Plating and Coating Machine Setters, Operators, and Tenders, Metal and Plastic	8122	Metal finishing, plating and coating machine operators	8122	Operadores de máquinas polidoras, galvanizadoras e recobridoras de metais
51-4194.00	Tool Grinders, Filers, and Sharpeners	51-4194	Tool Grinders, Filers, and Sharpeners	7224	Metal polishers, wheel grinders and tool sharpeners	7224	Polidores de metais e afiadores de ferramentas
51-4199.00	Metal Workers and Plastic Workers, All Other	51-4199	Metal Workers and Plastic Workers, All Other	7221	Blacksmiths, hammersmiths and forging press workers	7221	Ferreiros e forjadores
51-5111.00	Prepress Technicians and Workers	51-5111	Prepress Technicians and Workers	7321	Pre-press technicians	7321	Trabalhadores da pré-imprensa gráfica
51-5112.00	Printing Press Operators	51-5112	Printing Press Operators	7322	Printers	7322	Impressores
51-5113.00	Print Binding and Finishing Workers	51-5113	Print Binding and Finishing Workers	7323	Print finishing and binding workers	7323	Encadernadores e afins
51-6011.00	Laundry and Dry-Cleaning Workers	51-6011	Laundry and Dry-Cleaning Workers	8157	Laundry machine operators	8157	Operadores de máquinas de lavar, tingir e passar roupas
51-6021.00	Pressers, Textile, Garment, and Related Materials	51-6021	Pressers, Textile, Garment, and Related Materials	9121	Hand launderers and pressers	9121	Lavadeiros de roupas e passadeiros manuais
51-6031.00	Sewing Machine Operators	51-6031	Sewing Machine Operators	8153	Sewing machine operators	8153	Operadores de máquinas de costura
51-6041.00	Shoe and Leather Workers and Repairers	51-6041	Shoe and Leather Workers and Repairers	7318	Handicraft workers in textile, leather and related materials	7318	Artesãos de tecidos, couros e materiais semelhantes
51-6042.00	Shoe Machine Operators and Tenders	51-6042	Shoe Machine Operators and Tenders	8156	Shoemaking and related machine operators	8156	Operadores de máquinas para fabricação de calçados e afins
51-6051.00	Sewers, Hand	51-6051	Sewers, Hand	7533	Sewing, embroidery and related workers	7533	Costureiros, bordadeiros e afins
51-6052.00	Tailors, Dressmakers, and Custom Sewers	51-6052	Tailors, Dressmakers, and Custom Sewers	7531	Tailors, dressmakers, furriers and hatters	7531	Alfaiates, modistas, chapeleiros e peleteiros
51-6061.00	Textile Bleaching and Dyeing Machine Operators and Tenders	51-6061	Textile Bleaching and Dyeing Machine Operators and Tenders	8154	Bleaching, dyeing and fabric cleaning machine operators	8154	Operadores de máquinas de branqueamento, tingimento e limpeza de tecidos
51-6062.00	Textile Cutting Machine Setters, Operators, and Tenders	51-6062	Textile Cutting Machine Setters, Operators, and Tenders	7532	Garment and related pattern-makers and cutters	7532	Trabalhadores qualificados da preparação da confecção de roupas
51-6063.00	Textile Knitting and Weaving Machine Setters, Operators, and Tenders	51-6063	Textile Knitting and Weaving Machine Setters, Operators, and Tenders	8152	Weaving and knitting machine operators	8152	Operadores de teares e outras máquinas de tecelagem
51-6064.00	Textile Winding, Twisting, and Drawing Out Machine Setters, Operators, and Tenders	51-6064	Textile Winding, Twisting, and Drawing Out Machine Setters, Operators, and Tenders	8151	Fibre preparing, spinning and winding machine operators	8151	Operadores de máquinas de preparação de fibras, fiação e bobinamento de fios
51-6091.00	Extruding and Forming Machine Setters, Operators, and Tenders, Synthetic and Glass Fibers	51-6091	Extruding and Forming Machine Setters, Operators, and Tenders, Synthetic and Glass Fibers	8181	Glass and ceramics plant operators	8181	Operadores de instalações de vidraaria e cerâmica
51-6092.00	Fabric and Apparel Patternmakers	51-6092	Fabric and Apparel Patternmakers	7532	Garment and related pattern-makers and cutters	7532	Trabalhadores qualificados da preparação da confecção de roupas
51-6093.00	Upholsterers	51-6093	Upholsterers	7534	Upholsterers and related workers	7534	Tapeceiros, colchoneiros e afins
51-6099.00	Textile, Apparel, and Furnishings Workers, All Other	51-6099	Textile, Apparel, and Furnishings Workers, All Other	7535	Pelt dressers, tanners and fellmongers	7535	Trabalhadores qualificados do tratamento de couros e peles
51-7011.00	Cabinetmakers and Bench Carpenters	51-7011	Cabinetmakers and Bench Carpenters	7522	Cabinet-makers and related workers	7522	Marceneiros e afins
51-7021.00	Furniture Finishers	51-7021	Furniture Finishers	7522	Cabinet-makers and related workers	7522	Marceneiros e afins
51-7031.00	Model Makers, Wood	51-7031	Model Makers, Wood	7522	Cabinet-makers and related workers	7522	Marceneiros e afins
51-7032.00	Patternmakers, Wood	51-7032	Patternmakers, Wood	7522	Cabinet-makers and related workers	7522	Marceneiros e afins
51-7041.00	Sawing Machine Setters, Operators, and Tenders, Wood	51-7041	Sawing Machine Setters, Operators, and Tenders, Wood	8172	Wood processing plant operators	8172	Operadores de instalações para processamento de madeira

## Appendix

<i>O*Net (Code)</i>	<i>O*Net (Title)</i>	<i>SOC (Code)</i>	<i>SOC (Title)</i>	<i>ISCO08 (Code)</i>	<i>ISCO08 (Title)</i>	<i>PNADC (Code)</i>	<i>PNADC (Title)</i>
51-7042.00	Woodworking Machine Setters, Operators, and Tenders, Except Sawing	51-7042	Woodworking Machine Setters, Operators, and Tenders, Except Sawing	7523	Woodworking-machine tool setters and operators	7523	Operadores de máquinas de lavrar madeira
51-7099.00	Woodworkers, All Other	51-7099	Woodworkers, All Other	7317	Handicraft workers in wood, basketry and related materials	7317	Artesãos de pedra, madeira, vime e materiais semelhantes
51-8011.00	Nuclear Power Reactor Operators	51-8011	Nuclear Power Reactor Operators	3131	Power production plant operators	3131	Operadores de instalações de produção de energia
51-8012.00	Power Distributors and Dispatchers	51-8012	Power Distributors and Dispatchers	3131	Power production plant operators	3131	Operadores de instalações de produção de energia
51-8013.00	Power Plant Operators	51-8013	Power Plant Operators	3131	Power production plant operators	3131	Operadores de instalações de produção de energia
51-8021.00	Stationary Engineers and Boiler Operators	51-8021	Stationary Engineers and Boiler Operators	8182	Steam engine and boiler operators	8182	Operadores de máquinas de vapor e caldeiras
51-8031.00	Water and Wastewater Treatment Plant and System Operators	51-8031	Water and Wastewater Treatment Plant and System Operators	3132	Incinerator and water treatment plant operators	3132	Operadores de incineradores, instalações de tratamento de água e afins
51-8091.00	Chemical Plant and System Operators	51-8091	Chemical Plant and System Operators	3133	Chemical processing plant controllers	3133	Controladores de instalações de processamento de produtos químicos
51-8092.00	Gas Plant Operators	51-8092	Gas Plant Operators	3134	Petroleum and natural gas refining plant operators	3134	Operadores de instalações de refino de petróleo e gás natural
51-8093.00	Petroleum Pump System Operators, Refinery Operators, and Gaugers	51-8093	Petroleum Pump System Operators, Refinery Operators, and Gaugers	3134	Petroleum and natural gas refining plant operators	3134	Operadores de instalações de refino de petróleo e gás natural
51-8099.00	Plant and System Operators, All Other	51-8099	Plant and System Operators, All Other	3132	Incinerator and water treatment plant operators	3132	Operadores de incineradores, instalações de tratamento de água e afins
51-8099.01	Biofuels Processing Technicians	51-8099	Plant and System Operators, All Other	3132	Incinerator and water treatment plant operators	3132	Operadores de incineradores, instalações de tratamento de água e afins
51-8099.02	Methane/Landfill Gas Generation System Technicians	51-8099	Plant and System Operators, All Other	3132	Incinerator and water treatment plant operators	3132	Operadores de incineradores, instalações de tratamento de água e afins
51-8099.03	Biomass Plant Technicians	51-8099	Plant and System Operators, All Other	3132	Incinerator and water treatment plant operators	3132	Operadores de incineradores, instalações de tratamento de água e afins
51-8099.04	Hydroelectric Plant Technicians	51-8099	Plant and System Operators, All Other	3132	Incinerator and water treatment plant operators	3132	Operadores de incineradores, instalações de tratamento de água e afins
51-9011.00	Chemical Equipment Operators and Tenders	51-9011	Chemical Equipment Operators and Tenders	8131	Chemical products plant and machine operators	8131	Operadores de instalações e máquinas de produtos químicos
51-9012.00	Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders	51-9012	Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders	7513	Dairy-products makers	7513	Trabalhadores da pasteurização do leite e fabricação de laticínios e afins
51-9021.00	Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders	51-9021	Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders	8112	Mineral and stone processing plant operators	8112	Operadores de instalações de processamento de minerais e rochas
51-9022.00	Grinding and Polishing Workers, Hand	51-9022	Grinding and Polishing Workers, Hand	7224	Metal polishers, wheel grinders and tool sharpeners	7224	Polidores de metais e afiadores de ferramentas
51-9023.00	Mixing and Blending Machine Setters, Operators, and Tenders	51-9023	Mixing and Blending Machine Setters, Operators, and Tenders	8114	Cement, stone and other mineral products machine operators	8114	Operadores de máquinas para fabricar cimento, pedras e outros produtos minerais
51-9031.00	Cutters and Trimmers, Hand	51-9031	Cutters and Trimmers, Hand	7315	Glass makers, cutters, grinders and finishers	7315	Cortadores, polidores, jateadores e gravadores de vidros e afins
51-9032.00	Cutting and Slicing Machine Setters, Operators, and Tenders	51-9032	Cutting and Slicing Machine Setters, Operators, and Tenders	8114	Cement, stone and other mineral products machine operators	8114	Operadores de máquinas para fabricar cimento, pedras e outros produtos minerais
51-9041.00	Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders	51-9041	Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders	7516	Tobacco preparers and tobacco products makers	7516	Trabalhadores qualificados da preparação do fumo e seus produtos
51-9051.00	Furnace, Kiln, Oven, Drier, and Kettle Operators and Tenders	51-9051	Furnace, Kiln, Oven, Drier, and Kettle Operators and Tenders	7521	Wood treaters	7521	Trabalhadores de tratamento e preparação da madeira
51-9061.00	Inspectors, Testers, Sorters, Samplers, and Weighers	51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	7543	Product graders and testers (excluding foods and beverages)	7543	Classificadores e provadores de produtos (exeto de bebidas e alimentos)
51-9071.00	Jewelers and Precious Stone and Metal Workers	51-9071	Jewelers and Precious Stone and Metal Workers	7313	Jewellery and precious-metal workers	7313	Joalheiros e lapidadores de gemas, artesãos de metais preciosos e semipreciosos
51-9071.01	Jewelers	51-9071	Jewelers and Precious Stone and Metal Workers	7313	Jewellery and precious-metal workers	7313	Joalheiros e lapidadores de gemas, artesãos de metais preciosos e semipreciosos
51-9071.06	Gem and Diamond Workers	51-9071	Jewelers and Precious Stone and Metal Workers	7313	Jewellery and precious-metal workers	7313	Joalheiros e lapidadores de gemas, artesãos de metais preciosos e semipreciosos
51-9071.07	Precious Metal Workers	51-9071	Jewelers and Precious Stone and Metal Workers	7313	Jewellery and precious-metal workers	7313	Joalheiros e lapidadores de gemas, artesãos de metais preciosos e semipreciosos
51-9081.00	Dental Laboratory Technicians	51-9081	Dental Laboratory Technicians	3214	Medical and dental prosthetic technicians	3214	Técnicos de próteses médicas e dentárias
51-9082.00	Medical Appliance Technicians	51-9082	Medical Appliance Technicians	3214	Medical and dental prosthetic technicians	3214	Técnicos de próteses médicas e dentárias
51-9083.00	Ophthalmic Laboratory Technicians	51-9083	Ophthalmic Laboratory Technicians	7549	Craft and related workers not elsewhere classified	7549	Outros trabalhadores qualificados e operários da indústria e do artesanato não classificados anteriormente
51-9111.00	Packaging and Filling Machine Operators and Tenders	51-9111	Packaging and Filling Machine Operators and Tenders	8183	Packing, bottling and labelling machine operators	8183	Operadores de máquinas de embalagem, engarrapamento e etiquetagem
51-9121.00	Coating, Painting, and Spraying Machine Setters, Operators, and Tenders	51-9121	Coating, Painting, and Spraying Machine Setters, Operators, and Tenders	7132	Spray painters and varnishers	7132	Lustradores
51-9122.00	Painters, Transportation Equipment	51-9122	Painters, Transportation Equipment	7132	Spray painters and varnishers	7132	Lustradores
51-9123.00	Painting, Coating, and Decorating Workers	51-9123	Painting, Coating, and Decorating Workers	7316	Sign writers, decorative painters, engravers and etchers	7316	Redatores de cartazes, pintores decorativos e gravadores
51-9141.00	Semiconductor Processors	51-9141	Semiconductor Processors	8189	Stationary plant and machine operators not elsewhere classified	8189	Operadores de máquinas e de instalações fixas não classificados anteriormente

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51-9151.00	Photographic Process Workers and Processing Machine Operators	51-9151	Photographic Process Workers and Processing Machine Operators	8132	Photographic products machine operators	8132	Operadores de máquinas para fabricar produtos fotográficos
51-9191.00	Adhesive Bonding Machine Operators and Tenders	51-9191	Adhesive Bonding Machine Operators and Tenders	7521	Wood treaters	7521	Trabalhadores de tratamento e preparação da madeira
51-9192.00	Cleaning, Washing, and Metal Pickling Equipment Operators and Tenders	51-9192	Cleaning, Washing, and Metal Pickling Equipment Operators and Tenders	8112	Mineral and stone processing plant operators	8112	Operadores de instalações de processamento de minerais e rochas
51-9193.00	Cooling and Freezing Equipment Operators and Tenders	51-9193	Cooling and Freezing Equipment Operators and Tenders	8160	Food and related products machine operators	8160	Operadores de máquinas para elaborar alimentos e produtos afins
51-9194.00	Etchers and Engravers	51-9194	Etchers and Engravers	7316	Sign writers, decorative painters, engravers and etchers	7316	Redatores de cartazes, pintores decorativos e gravadores
51-9195.00	Molders, Shapers, and Casters, Except Metal and Plastic	51-9195	Molders, Shapers, and Casters, Except Metal and Plastic	7314	Potters and related workers	7314	Ceramistas e afins (preparação e fabricação)
51-9195.03	Stone Cutters and Carvers, Manufacturing	51-9195	Molders, Shapers, and Casters, Except Metal and Plastic	7314	Potters and related workers	7314	Ceramistas e afins (preparação e fabricação)
51-9195.04	Glass Blowers, Molders, Benders, and Finishers	51-9195	Molders, Shapers, and Casters, Except Metal and Plastic	7314	Potters and related workers	7314	Ceramistas e afins (preparação e fabricação)
51-9195.05	Potters, Manufacturing	51-9195	Molders, Shapers, and Casters, Except Metal and Plastic	7314	Potters and related workers	7314	Ceramistas e afins (preparação e fabricação)
51-9195.07	Molding and Casting Workers	51-9195	Molders, Shapers, and Casters, Except Metal and Plastic	7314	Potters and related workers	7314	Ceramistas e afins (preparação e fabricação)
51-9196.00	Paper Goods Machine Setters, Operators, and Tenders	51-9196	Paper Goods Machine Setters, Operators, and Tenders	8143	Paper products machine operators	8143	Operadores de máquinas para fabricar produtos de papel
51-9197.00	Tire Builders	51-9197	Tire Builders	8141	Rubber products machine operators	8141	Operadores de máquinas para fabricar produtos de borracha
51-9198.00	Helpers--Production Workers	51-9198	Helpers--Production Workers	9329	Manufacturing labourers not elsewhere classified	9329	Trabalhadores elementares da indústria de transformação não classificados anteriormente
51-9199.00	Production Workers, All Other	51-9199	Production Workers, All Other	9329	Manufacturing labourers not elsewhere classified	9329	Trabalhadores elementares da indústria de transformação não classificados anteriormente
51-9199.01	Recycling and Reclamation Workers	51-9199	Production Workers, All Other	9329	Manufacturing labourers not elsewhere classified	9329	Trabalhadores elementares da indústria de transformação não classificados anteriormente
53-1011.00	Aircraft Cargo Handling Supervisors	53-1011	Aircraft Cargo Handling Supervisors	9333	Freight handlers	9333	Carregadores
53-1021.00	First-Line Supervisors of Helpers, Laborers, and Material Movers, Hand	53-1021	First-Line Supervisors of Helpers, Laborers, and Material Movers, Hand	9333	Freight handlers	9333	Carregadores
53-1021.01	Recycling Coordinators	53-1021	First-Line Supervisors of Laborers, and Material Movers, Hand	9333	Freight handlers	9333	Carregadores
53-1031.00	First-Line Supervisors of Transportation and Material-Moving Machine and Vehicle Operators	53-1031	First-Line Supervisors of Transportation and Material-Moving Machine and Vehicle Operators	3151	Ships' engineers	3151	Oficiais maquinistas em navegação
53-2011.00	Airline Pilots, Copilots, and Flight Engineers	53-2011	Airline Pilots, Copilots, and Flight Engineers	3153	Aircraft pilots and related associate professionals	3153	Pilotos de aviação e afins
53-2012.00	Commercial Pilots	53-2012	Commercial Pilots	3153	Aircraft pilots and related associate professionals	3153	Pilotos de aviação e afins
53-2021.00	Air Traffic Controllers	53-2021	Air Traffic Controllers	3154	Air traffic controllers	3154	Controladores de tráfego aéreo
53-2022.00	Airfield Operations Specialists	53-2022	Airfield Operations Specialists	315	Ship and aircraft controllers and technicians	#N/D	#N/D
53-2031.00	Flight Attendants	53-2031	Flight Attendants	5111	Travel attendants and travel stewards	5111	Auxiliares de serviço de bordo
53-3011.00	Ambulance Drivers and Attendants, Except Emergency Medical Technicians	53-3011	Ambulance Drivers and Attendants, Except Emergency Medical Technicians	8322	Car, taxi and van drivers	8322	Condutores de automóveis, taxis e caminhonetes
53-3021.00	Bus Drivers, Transit and Intercity	53-3021	Bus Drivers, Transit and Intercity	8331	Bus and tram drivers	8331	Condutores de ônibus e bondes
53-3022.00	Bus Drivers, School or Special Client	53-3022	Bus Drivers, School or Special Client	8331	Bus and tram drivers	8331	Condutores de ônibus e bondes
53-3031.00	Driver/Sales Workers	53-3031	Driver/Sales Workers	8322	Car, taxi and van drivers	8322	Condutores de automóveis, taxis e caminhonetes
53-3032.00	Heavy and Tractor-Trailer Truck Drivers	53-3032	Heavy and Tractor-Trailer Truck Drivers	8332	Heavy truck and lorry drivers	8332	Condutores de caminhões pesados
53-3033.00	Light Truck or Delivery Services Drivers	53-3033	Light Truck or Delivery Services Drivers	8322	Car, taxi and van drivers	8322	Condutores de automóveis, taxis e caminhonetes
53-3041.00	Taxi Drivers and Chauffeurs	53-3041	Taxi Drivers and Chauffeurs	8322	Car, taxi and van drivers	8322	Condutores de automóveis, taxis e caminhonetes
53-3099.00	Motor Vehicle Operators, All Other	53-3099	Motor Vehicle Operators, All Other	8321	Motorcycle drivers	8321	Condutores de motocicletas
53-4011.00	Locomotive Engineers	53-4011	Locomotive Engineers	8311	Locomotive engine drivers	8311	Maquinistas de locomotivas
53-4012.00	Locomotive Firemen	53-4012	Locomotive Firemen	8311	Locomotive engine drivers	8311	Maquinistas de locomotivas
53-4013.00	Rail Yard Engineers, Dinkey Operators, and Hostlers	53-4013	Rail Yard Engineers, Dinkey Operators, and Hostlers	8311	Locomotive engine drivers	8311	Maquinistas de locomotivas
53-4021.00	Railroad Brake, Signal, and Switch Operators	53-4021	Railroad Brake, Signal, and Switch Operators	8312	Railway brake, signal and switch operators	8312	Guarda-freios e agentes de manobras
53-4031.00	Railroad Conductors and Yardmasters	53-4031	Railroad Conductors and Yardmasters	8312	Railway brake, signal and switch operators	8312	Guarda-freios e agentes de manobras
53-4041.00	Subway and Streetcar Operators	53-4041	Subway and Streetcar Operators	8311	Locomotive engine drivers	8311	Maquinistas de locomotivas
53-4099.00	Rail Transportation Workers, All Other	53-4099	Rail Transportation Workers, All Other	8312	Railway brake, signal and switch operators	8312	Guarda-freios e agentes de manobras
53-5011.00	Sailors and Marine Oilers	53-5011	Sailors and Marine Oilers	8350	Ships' deck crews and related workers	8350	Marinheiros de coberta e afins
53-5021.00	Captains, Mates, and Pilots of Water Vessels	53-5021	Captains, Mates, and Pilots of Water Vessels	3152	Ships' deck officers and pilots	3152	Capitães, oficiais de coberta e práticos
53-5021.01	Ship and Boat Captains	53-5021	Captains, Mates, and Pilots of Water Vessels	3152	Ships' deck officers and pilots	3152	Capitães, oficiais de coberta e práticos

<i>O*Net (Code)</i>	<i>O*Net (Title)</i>	<i>SOC (Code)</i>	<i>SOC (Title)</i>	<i>ISCO08 (Code)</i>	<i>ISCO08 (Title)</i>	<i>PNADC (Code)</i>	<i>PNADC (Title)</i>
53-5021.02	Mates- Ship, Boat, and Barge	53-5021	Captains, Mates, and Pilots of Water Vessels	3152	Ships' deck officers and pilots	3152	Capitães, oficiais de coberta e práticos
53-5021.03	Pilots, Ship	53-5021	Captains, Mates, and Pilots of Water Vessels	3152	Ships' deck officers and pilots	3152	Capitães, oficiais de coberta e práticos
53-5022.00	Motorboat Operators	53-5022	Motorboat Operators	8350	Ships' deck crews and related workers	8350	Marinheiros de coberta e afins
53-5031.00	Ship Engineers	53-5031	Ship Engineers	3151	Ships' engineers	3151	Oficiais maquinistas em navegação
53-6011.00	Bridge and Lock Tenders	53-6011	Bridge and Lock Tenders	8343	Crane, hoist and related plant operators	8343	Operadores de guindastes, guias, aparelhos de elevação e afins
53-6021.00	Parking Lot Attendants	53-6021	Parking Lot Attendants	9629	Elementary workers not elsewhere classified	9629	Outras ocupações elementares não classificadas anteriormente
53-6031.00	Automotive and Watercraft Service Attendants	53-6031	Automotive and Watercraft Service Attendants	5245	Service station attendants	5245	Frentistas de posto de gasolina
53-6041.00	Traffic Technicians	53-6041	Traffic Technicians	3119	Physical and engineering science technicians not elsewhere classified	3119	Técnicos em ciências físicas e da engenharia não classificados anteriormente
53-6051.00	Transportation Inspectors	53-6051	Transportation Inspectors	3257	Environmental and occupational health inspectors and associates	3257	Inspectores de saúde laboral, ambiental e afins
53-6051.01	Aviation Inspectors	53-6051	Transportation Inspectors	3257	Environmental and occupational health inspectors and associates	3257	Inspectores de saúde laboral, ambiental e afins
53-6051.07	Transportation Vehicle, Equipment and Systems Inspectors, Except Aviation	53-6051	Transportation Inspectors	3257	Environmental and occupational health inspectors and associates	3257	Inspectores de saúde laboral, ambiental e afins
53-6051.08	Freight and Cargo Inspectors	53-6051	Transportation Inspectors	3257	Environmental and occupational health inspectors and associates	3257	Inspectores de saúde laboral, ambiental e afins
53-6061.00	Transportation Attendants, Except Flight Attendants	53-6061	Transportation Attendants, Except Flight Attendants	5111	Travel attendants and travel stewards	5111	Auxiliares de serviço de bordo
53-6099.00	Transportation Workers, All Other	53-6099	Transportation Workers, All Other	9331	Hand and pedal vehicle drivers	9331	Condutores de veículos acionados a pedal ou a braços
53-7011.00	Conveyor Operators and Tenders	53-7011	Conveyor Operators and Tenders	8189	Stationary plant and machine operators not elsewhere classified	8189	Operadores de máquinas e de instalações fixas não classificados anteriormente
53-7021.00	Crane and Tower Operators	53-7021	Crane and Tower Operators	8343	Crane, hoist and related plant operators	8343	Operadores de guindastes, guias, aparelhos de elevação e afins
53-7031.00	Dredge Operators	53-7031	Dredge Operators	8342	Earthmoving and related plant operators	8342	Operadores de máquinas de movimentação de terras e afins
53-7032.00	Excavating and Loading Machine and Dragline Operators	53-7032	Excavating and Loading Machine and Dragline Operators	8111	Miners and quarriers	8111	Mineiros e operadores de máquinas e de instalações em minas e pedreiras
53-7033.00	Loading Machine Operators, Underground Mining	53-7033	Loading Machine Operators, Underground Mining	8111	Miners and quarriers	8111	Mineiros e operadores de máquinas e de instalações em minas e pedreiras
53-7041.00	Hoist and Winch Operators	53-7041	Hoist and Winch Operators	8343	Crane, hoist and related plant operators	8343	Operadores de guindastes, guias, aparelhos de elevação e afins
53-7051.00	Industrial Truck and Tractor Operators	53-7051	Industrial Truck and Tractor Operators	8344	Lifting truck operators	8344	Operadores de empiladeiras
53-7061.00	Cleaners of Vehicles and Equipment	53-7061	Cleaners of Vehicles and Equipment	9112	Cleaners and helpers in offices, hotels and other establishments	9112	Trabalhadores de limpeza de interior de edifícios, escritórios, hotéis e outros estabelecimentos
53-7062.00	Laborers and Freight, Stock, and Material Movers, Hand	53-7062	Laborers and Freight, Stock, and Material Movers, Hand	9329	Manufacturing labourers not elsewhere classified	9329	Trabalhadores elementares da indústria de transformação não classificados anteriormente
53-7063.00	Machine Feeders and Offbearers	53-7063	Machine Feeders and Offbearers	9329	Manufacturing labourers not elsewhere classified	9329	Trabalhadores elementares da indústria de transformação não classificados anteriormente
53-7064.00	Packers and Packagers, Hand	53-7064	Packers and Packagers, Hand	9321	Hand packers	9321	Empacadores manuais
53-7071.00	Gas Compressor and Gas Pumping Station Operators	53-7071	Gas Compressor and Gas Pumping Station Operators	3134	Petroleum and natural gas refining plant operators	3134	Operadores de instalações de refino de petróleo e gás natural
53-7072.00	Pump Operators, Except Wellhead Pumpers	53-7072	Pump Operators, Except Wellhead Pumpers	3132	Incinerator and water treatment plant operators	3132	Operadores de incineradoras, instalações de tratamento de água e afins
53-7073.00	Wellhead Pumpers	53-7073	Wellhead Pumpers	8113	Well drillers and borers and related workers	8113	Perfuradores e sondadores de poços e afins
53-7081.00	Refuse and Recyclable Material Collectors	53-7081	Refuse and Recyclable Material Collectors	9611	Garbage and recycling collectors	9611	Coletores de lixo e material reciclável
53-7111.00	Mine Shuttle Car Operators	53-7111	Mine Shuttle Car Operators	8311	Locomotive engine drivers	8311	Maquinistas de locomotivas
53-7121.00	Tank Car, Truck, and Ship Loaders	53-7121	Tank Car, Truck, and Ship Loaders	9333	Freight handlers	9333	Carregadores
53-7199.00	Material Moving Workers, All Other	53-7199	Material Moving Workers, All Other	9331	Hand and pedal vehicle drivers	9331	Condutores de veículos acionados a pedal ou a braços
55-1011.00	Air Crew Officers	55-1011	Air Crew Officers	110	Commissioned armed forces officers	110	Oficiais das forças armadas
55-1012.00	Aircraft Launch and Recovery Officers	55-1012	Aircraft Launch and Recovery Officers	110	Commissioned armed forces officers	110	Oficiais das forças armadas
55-1013.00	Armored Assault Vehicle Officers	55-1013	Armored Assault Vehicle Officers	110	Commissioned armed forces officers	110	Oficiais das forças armadas
55-1014.00	Artillery and Missile Officers	55-1014	Artillery and Missile Officers	110	Commissioned armed forces officers	110	Oficiais das forças armadas
55-1015.00	Command and Control Center Officers	55-1015	Command and Control Center Officers	110	Commissioned armed forces officers	110	Oficiais das forças armadas
55-1016.00	Infantry Officers	55-1016	Infantry Officers	110	Commissioned armed forces officers	110	Oficiais das forças armadas
55-1017.00	Special Forces Officers	55-1017	Special Forces Officers	110	Commissioned armed forces officers	110	Oficiais das forças armadas
55-1019.00	Military Officer Special and Tactical Operations Leaders, All Other	55-1019	Military Officer Special and Tactical Operations Leaders, All Other	110	Commissioned armed forces officers	110	Oficiais das forças armadas
55-2011.00	First-Line Supervisors of Air Crew Members	55-2011	First-Line Supervisors of Air Crew Members	210	Non-commissioned armed forces officers	210	Graduados e praças das forças armadas
55-2012.00	First-Line Supervisors of Weapons Specialists/Crew Members	55-2012	First-Line Supervisors of Weapons Specialists/Crew Members	210	Non-commissioned armed forces officers	210	Graduados e praças das forças armadas

O*Net (Code)	O*Net (Title)	SOC (Code)	SOC (Title)	ISCO08 (Code)	ISCO08 (Title)	PNADC (Code)	PNADC (Title)
55-2013.00	First-Line Supervisors of All Other Tactical Operations Specialists	55-2013	First-Line Supervisors of All Other Tactical Operations Specialists	210	Non-commissioned armed forces officers	210	Graduados e praças das forças armadas
55-3011.00	Air Crew Members	55-3011	Air Crew Members	310	Armed forces occupations, other ranks	#N/D	#N/D
55-3012.00	Aircraft Launch and Recovery Specialists	55-3012	Aircraft Launch and Recovery Specialists	310	Armed forces occupations, other ranks	#N/D	#N/D
55-3013.00	Armored Assault Vehicle Crew Members	55-3013	Armored Assault Vehicle Crew Members	310	Armed forces occupations, other ranks	#N/D	#N/D
55-3014.00	Artillery and Missile Crew Members	55-3014	Artillery and Missile Crew Members	310	Armed forces occupations, other ranks	#N/D	#N/D
55-3015.00	Command and Control Center Specialists	55-3015	Command and Control Center Specialists	310	Armed forces occupations, other ranks	#N/D	#N/D
55-3016.00	Infantry	55-3016	Infantry	310	Armed forces occupations, other ranks	#N/D	#N/D
55-3017.00	Radar and Sonar Technicians	55-3017	Radar and Sonar Technicians	310	Armed forces occupations, other ranks	#N/D	#N/D
55-3018.00	Special Forces	55-3018	Special Forces	310	Armed forces occupations, other ranks	#N/D	#N/D
55-3019.00	Military Enlisted Tactical Operations and Air/Weapons Specialists and Crew Members, All Other	55-3019	Military Enlisted Tactical Operations and Air/Weapons Specialists and Crew Members, All Other	310	Armed forces occupations, other ranks	#N/D	#N/D

## C. Codes

Code 8: Web scraping code in R; Author: Own authorship in R

```

# Web scrapping
library(rvest)
library(dplyr)
library(openxlsx)
library(stringr)

#' Sanitize string
#'
#' @param str - string that will be sanitize
#'
#' @return string that has been trimmed if the input is empty or invalid will return '--'
#' @export
#'
#' @examples sanitize_str(" TEST ")
#' @examples sanitize_str(character())
#' Trim spaces and set a default value on null values
sanitize_str <- function (str) {
  if(is.null(str) || length(str) == 0) {
    str <- "--"
  }
  str_trim(str)
}

# URL from the page we gonna run the web scrapping
days_urls <- read_html("Wayback Machine 2022.html", encoding = "utf-8") %>%
html_nodes("div.calendar-day a") %>% html_attr("href")

# Empty data frame
WayBack_2018_2023 <- data.frame()

# Doing the pagination
for (x in seq_along(days_urls)) {
  # Command to read the link
  link <- days_urls[x]
  inter_link <- link
  inter_count <- 1

  repeat {
    # Reading and saving data from ads
    page <- read_html(inter_link, encoding = "utf-8")
    if (inter_count > 7) {
      break
    }
    description <- sanitize_str(page %>% html_elements(".property-card_title") %>% html_text())
    address <- sanitize_str(page %>% html_elements("span.property-card_address") %>% html_text())
    price <- sanitize_str(page %>% html_elements(".js-property-card_price-small") %>% html_text())
    area <- sanitize_str(page %>% html_elements("span.property-card_detail-area") %>% html_text())
    bedrooms <- sanitize_str(page %>% html_elements(".property-card_detail-room span.property-
card_detail-value") %>% html_text())
  }
}

```

```

toilets <- sanitize_str(page %>% html_elements(".property-card__detail-bathroom span.property-
card__detail-value") %>% html_text())
garage <- sanitize_str(page %>% html_elements(".property-card__detail-garage span.property-
card__detail-value") %>% html_text())

# Entering the ads and extracting info from the ads page
ads_links <- page %>% html_nodes("a.property-card__content-link") %>% html_attr("href") %>%
paste0("https://web.archive.org", .)
  #' Get Internal Info
  #
  #' @param ads_link
  #
  #' @return Information inside a advertisement, in this case "suite", "condo" and "charct."
  #' @export
  #
  #' @examples
get_internal_info <- function(ads_link) {
  ads_page <- read_html(ads_link, encoding="utf-8")

  # Info from the ads
  suite <- ads_page %>% html_nodes("small") %>% html_text2() %>% unlist() %>% sanitize_str()
  condo <- ads_page %>% html_nodes("span.price_list-value.condominium") %>% html_text() %>%
  unlist() %>% sanitize_str()
  characteristics <- ads_page %>% html_nodes("ul.amenities_list") %>% html_text() %>%
  sanitize_str() %>% gsub(" ", "|", .)

  c(suite, condo, characteristics)
}

# Data frame with info inside of ads
# details <- sapply(ads_links, FUN = get_internal_info, USE.NAMES = FALSE)
# table_details <- t(details) %>% as_tibble() %>% setNames(c("suite", "condo",
"characteristics"))

# Making a matrix with the info extracted from the page
WayBack_2018_2023 <- rbind(WayBack_2018_2023, data.frame(inter_link, description, address,
price, area, bedrooms, toilets, garage))

print(paste("Page", x, inter_count))
inter_count <- inter_count + 1
inter_link <- paste0(link, "?pagina=", inter_count)
}

print(paste("Finished Page", x))
}

# Export the data frame as Excel file
write.xlsx(WayBack_2018_2023, "~/Documents/WayBack_2022_venda.xlsx")

```

*Code 9: Fetches a webpage's HTML content, retries up to 3 times on a 429 status, with a 15-second wait between retries; Author: Own authorship in JavaScript*

```

/**
 * This function fetches a webpage and returns its HTML content as a string.
 * If the server responds with a 429 status (Too Many Requests), the function will wait for 15
seconds and then retry the request.
 * The function will retry up to 3 times before throwing an error.
 *
 * @param {string} url - The URL of the webpage to fetch.
 * @param {number} [retry=3] - The number of times to retry the request if a 429 status is received.
 * @returns {Promise<string | undefined>} - A promise that resolves to the HTML content of the
webpage as a string, or undefined if the request fails.
 * @throws {Error} - Throws an error if the request fails after the specified number of retries.
 */
export async function fetchPage(url: string, retry: number = 3): Promise<string | undefined> {
  try {
    const html = await axios.get(url)
    return html.data
  } catch (e: any) {
    const error = e as AxiosError
    if (error.response?.status === 429 && retry) {
      console.log('Waiting 15s to continue...')
      await setTimeout(15000)

      return await fetchPage(url, retry - 1)
    }
    console.log(`Failed to extract the data for url ${url} after ${retry} retries`)
    throw new Error(error.message)
  }
}

```

*Code 10: This function fetches HTML content from a webpage or cache, creates the cache folder if it doesn't exist, and writes to the cache if necessary, based on the ignoreCache parameter; Author: Own authorship in JavaScript*

```
/**
 * This function fetches HTML content from a webpage or from a cache.
 * If the cache folder doesn't exist, it creates it.
 * It then generates a path for the cache file based on the URL of the webpage.
 * If the cache file exists and the ignoreCache parameter is false, it reads the HTML content from the cache file.
 * If the cache file doesn't exist or the ignoreCache parameter is true, it fetches the HTML content from the webpage.
 * If the ignoreCache parameter is false and the HTML content was fetched from the webpage, it writes the HTML content to the cache file.
 * The function returns a promise that resolves to the HTML content of the webpage or undefined if the HTML content couldn't be fetched.
 *
 * @param {string} url - The URL of the webpage to fetch HTML content from.
 * @param {boolean} [ignoreCache=false] - A boolean indicating whether to ignore the cache and fetch the HTML content from the webpage.
 * @returns {Promise<string | undefined>} - A promise that resolves to the HTML content of the webpage or undefined if the HTML content couldn't be fetched.
 */
export async function fetchFromWebOrCache(url: string, ignoreCache = false): Promise<string | undefined> {
    /*If the cache folder doesn't exist, create it */
    if (!existsSync(resolve('./.cache'))) {
        mkdirSync('.cache')
    }

    const path = `./.cache/${Buffer.from(url, 'binary').toString('base64').replace(/[/+=]/gm, '')}.html`;
    if (!ignoreCache && existsSync(resolve(path))) {
        return await readFileSync(resolve(path), { encoding: 'utf8' })
    }

    const htmlData = await fetchPage(url)
    if (!ignoreCache && htmlData) {
        await writeFileSync(resolve(path), htmlData, { encoding: 'utf8' })
    }

    return htmlData
}
```

*Code 11: The script extracts and processes property data from web pages, handling pagination and errors, and saves the results to CSV and error pages to a text file; Auhtor: Own authorship in JavaScript*

```
import { readHtml } from '@/readHtml'
import ObjectsToCsv from 'objects-to-csv'
import { LogTimeUtil } from '@/util/logTimeUtil'
import { writeFile } from 'fs/promises'
import { resolve } from 'path'
import { formatDate } from '@/util/dateUtil'
import { getDataByYearRent } from '@/util/historical-urls'

/**
 * This function extracts data from a webpage and returns an array of objects containing property details.
 * It uses the Document object model of the webpage to select and extract the required data.
 * The function maps over each property container on the webpage, extracting details such as link, date, title, address, area, rooms, suite, bathrooms, garage, price, condo, and additional internal data.
 * The function also records the time of data extraction.
 *
 * @param {Document} document - The Document object model of the webpage.
 * @param {string} pageUrl - The URL of the webpage.
 * @returns {Promise<Array<Object>>} - A promise that resolves to an array of objects, each containing details of a property.
 */
async function extractData(document: Document, pageUrl: string) {
    const containers = Array.from(document.querySelectorAll('div.kG > div'))
    const createdAt = new Date()
    return await Promise.all(containers.map(async (el) => {
        const details = Array.from(el.querySelectorAll('ul.c0 > li')).map(item => item.textContent)
        return {
            link: pageUrl,
            date: formatDate(pageUrl.replace(/\D/g, '')),
            title: el.querySelector('.cK > a')?.textContent?.trim(),
        }
    }))
}
```

```

        address: el.querySelector('.cM')?.textContent?.trim(),
        area: details.filter(item => item?.includes('Área'))[0]?.replace(/[^0-9-]/g, ''),
        rooms: details.filter(item => item?.includes('Quartos') || item?.includes('Quarto'))[0]?.replace(/[^0-9-]/g, ''),
        suite: details.filter(item => item?.includes('Suites') || item?.includes('Suite'))[0]?.replace(/[^0-9-]/g, ''),
        bathrooms: details.filter(item => item?.includes('Banheiros') || item?.includes('Banheiro'))[0]?.replace(/[^0-9-]/g, ''),
        garage: details.filter(item => item?.includes('Vagas') || item?.includes('Vaga'))[0]?.replace(/[^0-9-]/g, ''),
        price: el.querySelector('.cI')?.textContent?.trim()?.replace(/\D/g, ''),
        condo: el.querySelector('.js-condo-price')?.textContent?.trim()?.replace(/\D/g, ''),
        ...await extractInternalData('https://web.archive.org' + el.querySelector('.ck > a')?.getAttribute('href')),
        createdat: createAt.toISOString().split('.')[0].replace('T', '-'),
    }
  )))
}

/**
 * This function extracts internal data from a property listing webpage and returns an object containing the details.
 * It uses the Document object model of the webpage to select and extract the required data.
 * The function extracts details such as zone, district, and characteristics of the property.
 * If there is an error while extracting the data, the function will return an object with undefined values.
 *
 * @param {string} url - The URL of the property listing webpage.
 * @returns {Promise<Object>} - A promise that resolves to an object containing the internal details of a property.
 * @throws {Error} - Throws an error if there is an issue with reading the HTML of the webpage.
 */
async function extractInternalData(url: string) {
  try {
    const document = await readHtml(url)
    const path = Array.from(document.querySelectorAll('.kU > li')).map(item =>
      item.textContent?.trim())
    return {
      zone: path.filter(item => item?.includes('Zona'))[0],
      district: path[path.findIndex(item => item?.includes('Zona')) + 1],
      characteristics: Array.from(document.querySelectorAll('ul.bs > li')).map(item =>
        item.textContent?.trim()).filter(item => item != ''),
    }
  } catch (e) {
    // console.log(`error extracting data for ${url}`)
  }
  return {
    condo: undefined,
    suite: undefined,
    zone: undefined,
    district: undefined,
    characteristics: undefined,
  }
}

/**
 * This function fetches the HTML content of a webpage and extracts data from it.
 * It uses the readHtml function to fetch the HTML content and the extractData function to extract the data.
 * The function returns a promise that resolves to an array of objects, each containing details of a property.
 *
 * @param {string} url - The URL of the webpage to fetch and extract data from.
 * @returns {Promise<Array<Object>>} - A promise that resolves to an array of objects, each containing details of a property.
 */
async function getData(url: string) {
  const dom = await readHtml(url)
  return await extractData(dom, url)
}

/**
 * This function fetches all data from a list of URLs for a given year.
 * It uses the getData function to fetch and extract data from each URL.
 * The function iterates over each URL and fetches data from up to 7 pages of listings.
 * If there is an error while fetching data from a page, the page number is added to an array of error pages.
 * After all data has been fetched, the function writes the array of error pages to a text file and the array of data to a CSV file.
 *
 * @async

```

```

    * @function
    * @returns {Promise<void>} - A promise that resolves when all data has been fetched and written to
files.
    * @throws {Error} - Throws an error if there is an issue with writing to the files.
    */
async function getAllData() {
  const urls = getDataByYearRent(2018)
  const data: any[] = []
  const errorPages: number[] = []
  for (const [index, url] of urls.entries()) {
    for (let i = 1; i < 8; i++) {
      const append = i > 1 ? `?pagina=${i}` : ''
      try {
        const logTimeUtil = new LogTimeUtil()
        data.push(...await getData(url + append))
        console.info(`Finished page ${index} - ${i} after ${logTimeUtil.getElapsedTime()} seconds`)
      } catch (e: any) {
        console.error('error processing data', e)
        errorPages.push(i)
      }
    }
  }
  await writeFile(resolve('./error_pages_rent_2018.txt'), errorPages.toString(), { encoding: 'utf-8' })
  await new ObjectsToCsv(data).toDisk('./final_rent_2018.csv')
}

getAllData()

```

*Code 12: This code extracts and processes property details from a webpage, including internal data such as zone and district, handling errors by returning undefined values when extraction fails; Author: Own authorship in JavaScript*

```

/**
 * This function extracts data from a webpage and returns an array of objects containing property
details.
 * It uses the Document object model of the webpage to select and extract the required data.
 * The function maps over each property container on the webpage, extracting details such as link,
date, title, address, area, rooms, suite, bathrooms, garage, price, condo, and additional internal
data.
 * The function also records the time of data extraction.
 * @param {Document} document - The Document object model of the webpage.
 * @param {string} pageUrl - The URL of the webpage.
 * @returns {Promise<Array<Object>>} - A promise that resolves to an array of objects, each
containing details of a property.
 */ async function extractData(document: Document, pageUrl: string) {
  const containers = Array.from(document.querySelectorAll('.property-card__container'))
  const createAt = new Date()
  return await Promise.all(containers.map(async (el) => {
    const details = Array.from(el.querySelectorAll('ul.property-card__details .property-
card__detail-item')).map(item => item?.textContent?.trim().replace(/\n\r\s\t/g, ' '))
    return {
      link: pageUrl,
      date: formatDate(pageUrl.replace(/\D/g, '')),
      title: el.querySelector('.property-card__carousel .carousel__item-wrapper:first-child
img')?.getAttribute('alt'),
      address: el.querySelector('.property-card__address')?.textContent?.trim(),
      area: details.filter(item => item?.includes('Área'))[0]?.replace(/^0-9-/g, ''),
      rooms: details.filter(item => item?.includes('Quartos') ||
item?.includes('Quarto'))[0]?.replace(/^0-9-/g, ''),
      suite: details.filter(item => item?.includes('Suites') ||
item?.includes('Suíte'))[0]?.replace(/^0-9-/g, ''),
      bathrooms: details.filter(item => item?.includes('Banheiros') ||
item?.includes('Banheiro'))[0]?.replace(/^0-9-/g, ''),
      garage: details.filter(item => item?.includes('Vagas') ||
item?.includes('Vaga'))[0]?.replace(/^0-9-/g, ''),
      price: el.querySelector('.property-card__price')?.textContent?.trim().replace(/\D/g, ''),
      condo: el.querySelector('.property-card__price-details--condo')?.textContent?.replace(/\D/g,
'').trim(),
      ...await extractInternalData('https://web.archive.org' + el.querySelector('a.property-
card__main-link')?.getAttribute('href')),
      createdAt: createAt.toISOString().split('.')[0].replace('T', '-'),
    }
  }))
}

/**
 * This function extracts internal data from a property listing webpage and returns an object

```

```

containing the details.
 * It uses the Document object model of the webpage to select and extract the required data.
 * The function extracts details such as zone, district, and characteristics of the property.
 * If there is an error while extracting the data, the function will return an object with undefined
values.
 *
 * @param {string} url - The URL of the property listing webpage.
 * @returns {Promise<Object>} - A promise that resolves to an object containing the internal details
of a property.
 * @throws {Error} - Throws an error if there is an issue with reading the HTML of the webpage.
 */
async function extractInternalData(url: string) {
  try {
    const document = await readHtml(url)
    const path = Array.from(document.querySelectorAll('div > ol > li')).map(item =>
item.textContent?.trim())
    return {
      zone: path.filter(item => item?.includes('Zona'))[0],
      district: path[path.findIndex(item => item?.includes('Zona')) + 1],
      characteristics: Array.from(document.querySelectorAll('ul.qt > li')).map(item =>
item.textContent?.trim()),
    }
  } catch (e) {
    console.log(`error extracting data for ${url}`)
  }

  return {
    condo: undefined,
    suite: undefined,
    zone: undefined,
    district: undefined,
    characteristics: undefined,
  }
}
}

```

*Code 13: Google API geocode; Source: (Agarwal, 2023); Author: Adapted from (Agarwal, 2023)*

```

/*
 * Google Maps Formulas for Google Sheets
 * Written by Amit Agarwal
 * Web: https://www.labnol.org/google-maps-sheets-200817
 */

const md5 = (key = "") => {
  const code = key.toLowerCase().replace(/\s/g, "");
  return Utilities.computeDigest(Utilities.DigestAlgorithm.MD5, key)
    .map((char) => (char + 256).toString(16).slice(-2))
    .join("");
};

const getCache = (key) => {
  return CacheService.getDocumentCache().get(md5(key));
};

const setCache = (key, value) => {
  const expirationInSeconds = 6 * 60 * 60; // max is 6 hours
  CacheService.getDocumentCache().put(md5(key), value, expirationInSeconds);
};

const geocode = (address) => {
  let key = PropertiesService.getScriptProperties().getProperty('api_key') // key salva nas
configurações -> propriedades do script
  let url = `https://maps.googleapis.com/maps/api/geocode/json?key=${key}&address=${address}`

  const response = UrlFetchApp.fetch(url)
  return JSON.parse(response.getContentText())
}

/**
 * Get the full address info of any
 * address on Google Maps.
 *
 * =GOOGLEMAPS_FULL_ADDRESS("10 Hanover Square, NY")
 *
 * @param {String} address The address to lookup.
 * @return {Array} The formatted_address, latitude, and longitude of the address separate in
multiple cells.
 * @customFunction
 */
const GOOGLEMAPS_FULL_ADDRESS = (address) => {

```

```
if (!address) {
  throw new Error("No address specified!");
}
if (address.map) {
  return address.map(LATLONG);
}
const key = ["address", address].join(",");
const value = JSON.parse(getCache(key)) ?? null;
if (value !== null && value.geometry?.location?.lat && value.geometry.location?.lng) {
  const location = value.geometry.location;
  const formatted_address = value.formatted_address;
  return [[formatted_address, location.lat, location.lng]];
}

const { results: [data = null] = [] } = geocode(address);
if (data === null) {
  throw new Error("Address not found!");
}
const { formatted_address, geometry: { location: { lat, lng } } = {} } = data;
setCache(key, JSON.stringify(data));
return [[formatted_address, lat, lng]];
};
```