

Jungle Metropolises: Manaus and Belém within the Brazilian economic system¹

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Abstract

This study analyzes the insertion of the metropolitan economies of Belém and Manaus in the economic system of Brazil with an inter-regional input-output (I-O) model. They are the capital cities of the states of Pará and Amazonas in the detached Amazon region. Their size is 3.2 million inhabitants and they have experienced rapid growth in the last decades. The state of Pará exports minerals and forestry products. The state of Amazonas is a major importer of manufacturing parts from abroad, which are assembled into final goods sold to other Brazilian regions. Manaus metro hosts a free import zone and an industrial pole established in the 1960s. We compare the economic structures of these areas in terms of production, value added, and employment, and how the regions trade with other Brazilian regions. We show that their productive structures and their insertion in the Brazilian economic system are quite different: the interaction of Belém with other areas within the state of Pará is more intense than that of Manaus to the other areas of the state of Amazonas. In spite of the similarities between these two metropolitan areas, there are important differences in their productive structure and in how they interact with other regions in the country.

KEYWORDS: Amazon metropolis; productive structure; input-output model, trade flows, Amazon region.

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1. INTRODUCTION

The large Brazilian states, Amazonas and Pará, are located in the detached Amazon region (Figure 1) and account for almost one third of the Brazilian territory (18.3% and 14.6% respectively). They compare in size to countries like Iran and Angola. The 3.5 million inhabitants of Amazonas put the state in the same population range of Uruguay; the 7.6 million of Pará is comparable to Bulgaria. Although the two metropolitan areas of these states have a similar population size of 3.2 million, according to the 2010 census, the density of Metro Belém is higher. Both states have experienced fast population growth, moving from a combined share in national population from 3.3% in 1970 to 5.8% in 2010 with each growing at a similar pace. Between 1970 and 2010, the population of Brazil doubled, while the population of Amazonas state multiplied by 3.5 and Pará state by 3.6. Metro Manaus grew even faster, multiplying its population by 5.2, with the capital city of Manaus multiplying its population by 5.8. Metro Belém grew more modestly: 3.1 times for the metro area, and 2.2 times for the capital city. These numbers show that the population growth in other areas of the state of Pará was important.

The cities share a common history. They were both established by the Portuguese in the early XVII Century to protect the area from the increasing interest of the Irish, English, Dutch, and French. A military expedition founded Belém in 1616 as a means to start the colonization of the “Empire of the Amazon”, but the first streets were only built in 1650. In 1676, a group of 50 Azorean families, totaling 234 people, established the first European settlement. In the XVIIIth century, Belém was both a defense fortress and an entry point to the conquest of the interior areas, but it lived in isolation from the rest of the country. In the beginning of the XXth Century, a boom in the extraction and production of rubber brought important positive results, although short-lived. Manaus, being located 1,600 km farther west, up-river, was founded only in 1669, but the economy only flourished during the rubber boom, which lasted until 1913⁶. With the end of the rubber economy, the city returned to economic isolation until 1970, when the Zona Franca de Manaus (Free Import Zone) was established.

The cities are only connected between each other by the Amazon River and by air. The straight-line distance between them is 1,300 km; by river, another 400 km are added. Travelling by river between the two cities can take more than 96 hours. The 3,000 km, mostly unpaved, road connection between them is not only long but also in a very poor condition,

⁶ The famous Manaus Opera House is an amazing product of that period.

given the rainy weather in the region. Manaus is totally road-isolated. The 2,772 km road connection between Belém and Brasília, and from there to the more developed areas of the country, started only in 1960. The road connection in the case of Belém and the Free Import Zone in the case of Manaus both occurred in the middle of the XXth Century. These place the two cities in a similar starting position, making the comparison even more interesting.

The economic activity of the state of Amazonas is more concentrated in Metro Manaus, which produces 79.8% of the state's value added, whereas Metro Belém produces only 29.2% of Pará's value added (Table 1). The predominance of the capital city within the metro region is more pronounced in the case of Manaus, which produced 92% of the value added within the metro region, while Belém, the city, hosts only 70% of the metro regions' value added. These differences between the two metro areas extend across the three economic sectors. The metropolitan cities of the Amazonas state are important producers of primary goods within the state, allowing the metro region to host almost 41% of the state's value added in that activity.

Table 1 –Region's share of the state's Value Added by economic activity/sector

| | Amazonas state | | Pará state | |
|----------------|----------------|--------------|--------------|-------------|
| | Capital City | Metro Manaus | Capital City | Metro Belém |
| All Activities | 73.6% | 79.8% | 20.6% | 29.2% |
| Primary | 5.1% | 40.6% | 0.5% | 3.0% |
| Secondary | 84.3% | 85.8% | 8.3% | 13.2% |
| Tertiary | 75.7% | 81.0% | 31.6% | 43.6% |

Source: IBGE, PIB dos Municípios. 2013

Although the territory of the state of Amazonas is larger than Pará's, it has only 62 cities, while Pará has 144 cities. Thus, the urban networks are quite different, with Pará being denser and more diversified than Amazonas. The area of Metro Manaus is much larger than Metro Belém, since the physical expansion of the latter is restrained by water bodies and government owned land. Manaus city is the sixth city in the country in terms of value added, while Belém is the 27th. In terms of tertiary activities (commerce and services), Manaus ranks 13th, and Belém 20th. The metropolitan area of Manaus encompasses eight municipalities⁷, with a demographic density of 21 inhabitants/km². The metropolitan area of Belém is composed of seven municipalities⁸, with a demographic density of 638 inhabitants/km². The average per capita income of the state of Pará in 2012 was 73% of the national average R\$ 11,199. The per capita income of Amazonas state in 2012 was 12.7% above the national

⁷ Careiro da Várzea, Iranduba, Itacoatiara, Manaus, Manacapuru, Novo Airão, Presidente Figueiredo, Rio Preto da Eva

⁸ Ananindeua, Belém, Benevides, Castanhal, Marituba, Santa Bárbara do Pará, Santa Isabel do Pará

average. Most of the state's GDP comes from the Industrial Pole of Manaus, where electronic products and motorcycles are assembled from imported parts and delivered to other states.

Table 2 presents information on the sectoral distribution of employment⁹ in 2011. In terms of total employment, the metro areas are quite similar, following their similar populations. The capital cities are quite different, however. The city of Manaus presents a total employment 22% larger than the city of Belém. Manufacturing employment in Metro Manaus is 3.9 times larger, confirming the numbers in Table 1. The advantage of Metro Manaus also reflected in transportation and postal service and in hotels and restaurants, probably related to this region's touristic attractiveness and its trade with other countries and other states. In all the other tertiary activities, Metro Belém surpasses Metro Manaus, which indicates that the role of the capital city as a central place is more significant in the case of Belém.

Table 2 – Sectoral employment distribution, 2011

| | Manaus | | Belém | | Metro Manaus/ Metro Belém | Manaus/ Belém |
|-------------------------------------|---------|---------|---------|---------|------------------------------|------------------|
| | Metro | Manaus | Metro | Belém | | |
| Agriculture, extractive | 3,994 | 2,323 | 8,507 | 3,064 | 0.47 | 0.76 |
| Manufacturing | 126,867 | 123,083 | 32,565 | 13,762 | 3.90 | 8.94 |
| Public utilities | 6,254 | 5,854 | 4,882 | 4,368 | 1.28 | 1.34 |
| Construction | 34,630 | 33,731 | 39,917 | 29,740 | 0.87 | 1.13 |
| Commerce | 79,850 | 76,788 | 105,530 | 72,554 | 0.76 | 1.06 |
| Transportation, postal | 33,373 | 31,994 | 27,250 | 17,431 | 1.22 | 1.84 |
| Hotels, restaurants | 16,974 | 16,525 | 14,089 | 11,292 | 1.20 | 1.46 |
| Info & Communication | 5,209 | 5,132 | 5,568 | 5,352 | 0.94 | 0.96 |
| Financial services | 4,814 | 4,530 | 8,093 | 7,338 | 0.59 | 0.62 |
| Real state | 530 | 526 | 726 | 573 | 0.73 | 0.92 |
| Professional, scientific, technical | 6,349 | 6,258 | 8,088 | 6,816 | 0.78 | 0.92 |
| Administrative, complementary | 48,032 | 47,921 | 51,914 | 45,803 | 0.93 | 1.05 |
| Public administration | 128,528 | 117,896 | 177,456 | 153,686 | 0.72 | 0.77 |
| Education and health | 29,549 | 29,142 | 40,087 | 33,757 | 0.74 | 0.86 |
| Other services | 13,195 | 12,235 | 16,295 | 14,487 | 0.81 | 0.84 |
| Total | 538,148 | 513,938 | 540,967 | 420,023 | 0.99 | 1.22 |

Source: Ministry of Labor, RAIS

In terms of social conditions, the metro regions are quite similar with 0.72 HDI for Manaus and 0.73 for Belém. The per capita income levels in 2010 were quite similar, with a small advantage to Metro Manaus, which grew much faster, as its level was lower in 2000. Metro Manaus has larger share of the population being poor and extremely poor, as well as a larger Gini coefficient. Given its higher per capita income, the similarity in HDI indicates that the other indicators included in the index (education and health) are much worse for Manaus.

⁹ Excludes employees without a labor contract.

Table 3 – Social indicators

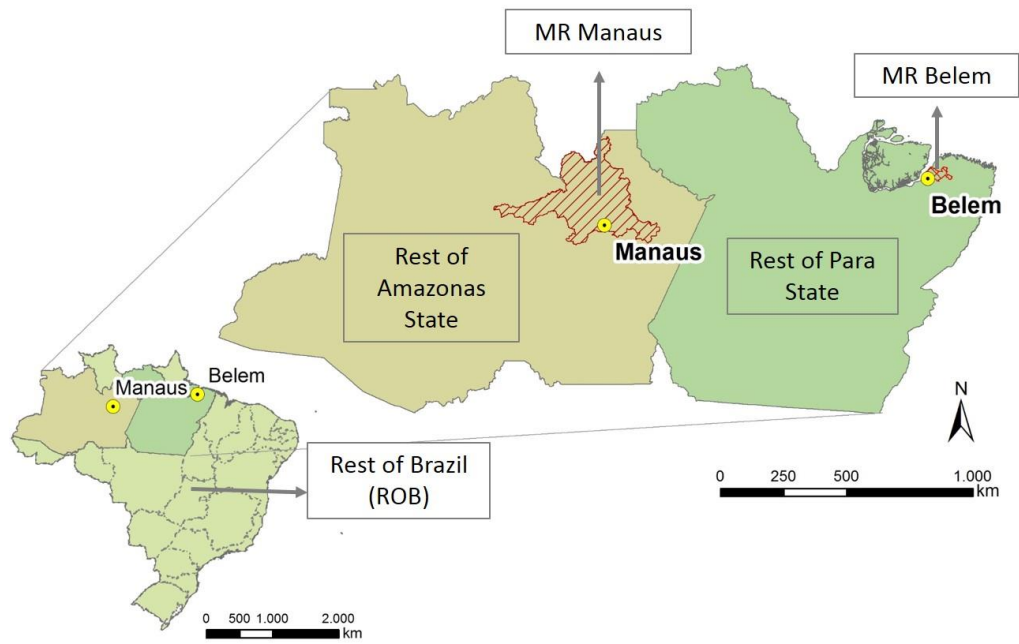
| Social indicators | Metro Belém | | Metro Manaus | |
|-------------------------|-------------|--------|--------------|--------|
| | 2000 | 2010 | 2000 | 2010 |
| Per capita income (R\$) | 524.82 | 715.11 | 487.67 | 725.17 |
| % of extremely poor | 9.19 | 4.28 | 13.23 | 5.85 |
| % of poor | 28.08 | 14.88 | 32.75 | 16.37 |
| Gini | 0.62 | 0.59 | 0.63 | 0.61 |

As shown in figure 1, the metropolitan areas are almost of the same size, located in the detached Amazon region, and belong to large states. However, the economic structures of these states are quite distinct. Starting with transport connections, the state of Pará is accessible by road, including the Belém metro area. In spite of the large distances, there are roads¹⁰ connecting Belém to Brasília, and, from there, to the main economic center of the country in the Southeast. There are also road connections to the northeastern states. The access to Manaus metro area is only possible by air or water, since there are no roads connecting the state to the other economic areas of the country, except to the northernmost small state Roraima.

The goods that are imported by Manaus from abroad and exported to other regions in Brazil, typically are of high value added (electronics, parts for transportation goods, etc.). The assembling of manufacturing goods occurs in the Manaus Industrial Pole within Metro Manaus. The economy of Pará is more diversified and more dispersed in the territory. It produces iron ore, bauxite, and other minerals, which are exported to other countries. Cattle ranching is also an important economic activity in the state, as well other agricultural activities. These mainly supply the market of other regions in Brazil. Thus, the flow of goods to/from other states is reversed: Amazonas imports from abroad and supplies the national market, with the production concentrated in its metro area; Pará exports primary goods, whose production is spread over its territory, to other countries. Both states import from other states in Brazil, mainly consumer goods. Therefore, although the metropolitan areas are almost identical in size, their roles within the respective states' economy are quite different. In order to analyze their insertion in their own state and in the national economy, we have defined five reference regions: Amazonas state, Manaus metro, Pará state, Belém metro, and the rest of the country. We have built an inter-regional input-output matrix for 2009 with 5 regions and 47 sectors.

¹⁰ The quality of the roads is questionable, especially during the rainy season

Figure 1 – Manaus and Belém within Brazil



Area between Manaus and Belém: a satellite view



Belém surroundings



Manaus surroundings



Given their common characteristics, which include distant location in relation to the main economic and population centers of the country, and the fact that they are surrounded by the rain forest, these two metropolitan areas are an interesting case to study. The objective of this paper is to compare their productive structures and their insertion within the economy of their own states and the economy of other areas of Brazil. In order to do that, an interregional input-output system produced by the Regional and Urban Economics Lab of the University of

São Paulo (NEREUS)¹¹ was used. It consists of an interregional input-output system estimated for all the 5,565 municipalities in the country, at the level of 134 industries and 187 commodities, for the year 2009. We have worked with this detailed system to come up with the numbers for the five regions considered in this study. The paper is organized in five sections, including this introduction. In the second section, we describe the theoretical basis and the methodology employed. The third section compares the productive structures of the regions, and the fourth section analyses the trade flows among them. The last section presents the conclusions of the study.

2. THEORETICAL BASIS AND METHODOLOGY

Products generated in one region can be sold in the same region, or exported to other regions. If the product is destined to final demand, it can be sold to consumers, government or capital formation in the region, or exported to other countries or regions. Intermediate goods (raw materials, parts, etc.) can be sold as inputs to other sectors in the region, or to other sectors in other regions. The same goes for purchases: families can consume goods produced in the region, or imported from other places; governments can purchase locally or in other regions. Purchases of capital goods (machinery, for example) can also be made locally or in other places. The five economies defined in this study had all their products and services allocated to 47 sectors. We have information on the purchases and sales of each sector to other sectors and to final demand (final consumption of families, government purchases, capital formation, and exports), both within the region and across regions. This information is organized in the inter-regional input-output system used in the study.

An input-output model shows the flows of goods and services among the sectors and agents of the economy in a given year (Leontief, 1951). The inter-sectoral flows are expressed in a system of simultaneous equations (Miller and Blair, 2009). Since the interrelationships among regions is of interest to this study, we consider the trade flows among regions, following previous work by Silva (2004) and Gonçalves-Jr and Guilhoto (2014). In matrix terms, the inter-sectoral flows in the economy can be represented by $AX + Y = X$, where X is a $(n \times 1)$ vector containing the total production value by sector; Y is a $(n \times 1)$ vector containing the final demand values; and A is a $(n \times n)$ matrix of technical coefficients of production. The final demand vector is usually considered exogenous to the system; thus, the total production

¹¹ <http://www.usp.br/nereus/?dados=matriz-inter-regional-de-insumo-produto-sao-pauloresto-do-brasil-1996>

vector is determined by the final demand vector, given by $Y = BX$, so $B = (I - A)^{-1}$. Matrix B is the Leontief inverse, a $(n \times n)$ matrix of direct and indirect coefficients, whose elements b_{ij} show the total amount of production required from sector i to produce one unit of final demand of sector j . From these equations, it is possible to estimate output multipliers that show the direct and indirect effects of a given sector, i.e., the total amount of production generated in the economy necessary to produce one unit of final demand of the given sector (Miller and Blair 2009). It is also possible to estimate, for each sector of the economy, the total amount of employment, value added, etc. directly and indirectly generated in the economy to supply one unit of final demand from the given sector.

Based on the Leontief system, important indicators can be estimated to unveil the economic relations and the productive structure of an economy. The works of Rasmussen (1956) and Hirschman (1958) led to the development of indices of linkages that have become part of the generally accepted procedures to identify key sectors. In this study we use the Pure Linkage Index, which measures the importance of a sector as a purchaser (backward effect) or supplier (forward effect) of inputs, taking into consideration the quantitative size of the sectors. As presented by Guilhoto, Sonis and Hewings (2005), the Pure Linkage Index measures the importance of the sectors in generating production, employment, and value added in the economy.

3. COMPARING THE PRODUCTIVE STRUCTURES

Based on the Pure Backward, Pure Forward, and Pure Total Linkages, we have identified the sectors with the strongest linkages in each region. Table 4 presents the results, highlighting the top 10 sectors in terms of linkage strength. It includes only sectors that showed at least one strong linkage in at least one region. The only sector common to all regions is “other services”; the next is “construction”, in nine cases, followed by “other commerce”, in eight cases. It is evident that the key sectors are concentrated in the bottom of the table, referring to tertiary activities. The overwhelming importance of “Public services”, ranked second or third in several cases, indicates the relevance of government activities in the region, which is a sign of the weakness of the economic system in the area.

In spite of these coincidences, it is clear from the table that the economic fabrics are different across regions. The number one sector in Metro Manaus is “medical, optical and measurement equipment”, with strong backward linkages (1st) and relatively strong forward links (10th); “Automobile, trucks and parts” is ranked 3rd in backward effects and 5th in total

linkages; “office and computing equipment” is 5th in backward, and 7th in total linkages. These three sectors do not show up in any of the other cases, characterizing a specificity of Metro Manaus economy. The rest of the state of Amazonas relies on oil production and refining, and on electricity production, which is also typical of this area alone. In the case of Metro Belém, only three sectors appear as having strong linkages, but none is among the top ten in terms of total pure effects (food manufacturing, glass, and electricity). On the other hand, the rest of the state of Pará has highlights in terms of total linkages: glass production (3rd), iron ore (5th), beverages (6th) and meatpacking (10th). Again, these cases are particular to this region, not showing up in the other cases.

In order to establish the degree or similarity between their productive structures, we have calculated rank correlations of the sectoral linkages between regions¹². The low coefficients of correlation between Metro Manaus and the rest of the state of Amazonas displayed in Table 5 show that Manaus has a productive structure quite different from the state, indicating that the metropolitan area stands out as a very different type of economy. In fact, its productive structure is more similar to Metro Belém and to the rest of Pará than to the rest of its own state. On the other hand, Belém has a productive structure quite similar to that of the state of Pará, as well as to other regions in the country. This characterizes the lower degree of geographic concentration in the state, as compared to the predominant role of Manaus in the state of Amazonas. In contrast, the economy of the state of Pará presents similarities with the economy of its metropolitan region, as the several correlation coefficients of 0.6 or above indicate.

In spite of these results, it is evident that, on average, the coefficients were low for all indices analyzed, indicating low similarity between the productive structures. It is also clear that both metropolitan regions are more similar to the rest of the country than to the rest of their respective states. This is interesting, because different productive structures may result in commercial advantages for the regions, for it would stimulate trade between the metropolitan regions and the rest of their respective states. We dedicate the next section to analyzing the commercial flows between the regions.

¹² In this case, all 47 sectors were included

Table 4 - Top ten sectors in terms of linkage strength

| Sector | State of Amazonas | | | | | | State of Pará | | | | | |
|--------------------------------------|-------------------|----|-----|---------------|----|-----|---------------|----|-----|---------------|----|-----|
| | Manaus Metro | | | Rest of State | | | Belém Metro | | | Rest of State | | |
| | Bw | Fw | Tot | Bw | Fw | Tot | Bw | Fw | Tot | Bw | Fw | Tot |
| Fruits | | | | 6 | | | | | | | | |
| Cattle Ranching | | | | | | | | | | 7 | | |
| Oil and gas | | | | | 1 | 2 | | | | | | |
| Iron ore | | | | | | | | | | 3 | | 5 |
| Meat packing | | | | 9 | | | | | | 6 | | 10 |
| Food manufacturing | | | | | | | 7 | | | 5 | | |
| Beverage & tobacco | 7 | | | | | | | | | | | 6 |
| Oil & coal refining | | | | 1 | 2 | 1 | | | | | | |
| Rubber, plastics & other chemical | | 7 | | | | | | | | | | |
| Glass, oth mining, steel & oth metal | | 6 | | | | | | 10 | | 4 | 2 | 3 |
| Office & computing equip | 5 | | 7 | | | | | | | | | |
| Medical, optical & measurement | 1 | 10 | 1 | | | | | | | | | |
| Automobile, trucks & parts | 3 | | 5 | | | | | | | | | |
| Electricity | | | | 3 | 3 | 4 | | 9 | | | 9 | |
| Infrastructure services | | 8 | | 10 | 8 | 9 | | | | | | |
| Construction | 4 | | 6 | 4 | 6 | 5 | 2 | 7 | 4 | 2 | 10 | 1 |
| Food, bev & tobacco commerce | | | | | | | | 8 | | | | |
| Other commerce | 10 | 1 | 4 | | 9 | | 4 | 2 | 3 | 8 | 1 | 4 |
| Transport & postal | | 3 | 8 | 8 | 5 | 6 | | 5 | 7 | | 3 | 8 |
| Passenger transportation | 9 | | | 5 | | | 6 | | 10 | | | |
| Telecom, computer & related act. | | 5 | 9 | | 7 | | 8 | 3 | 5 | | 8 | |
| Financial and insurance | | 4 | 10 | | 4 | 7 | 9 | 4 | 6 | | 4 | |
| Car rental, housing maint & repair | | 9 | | | | | | 6 | 8 | | 5 | 9 |
| Hotels and restaurants | 8 | | | | | 8 | 5 | | 9 | 9 | | |
| Other services | 6 | 2 | 2 | 7 | 10 | 10 | 3 | 1 | 2 | 7 | 6 | 7 |
| Public services | 2 | | 3 | 2 | | 3 | 1 | | 1 | 1 | | 2 |

Obs: Only the top 10 sectors with linkages above one in at least one case are shown. In some cases, there were less than 10 sectors in that situation. The numbers in the cells reveal the ranking of sectors in terms of linkage strength, which are also indicated by the shades (darker shades mean stronger effects).

Table 5 - Rank correlation of the sectoral linkages between regions

| | Manaus | | | Rest of Amazonas St. | | | Belém | | | Rest of Pará St. | | | Rest of Brazil | | |
|----------------|-------------|-------------|-------------|----------------------|------|------|-------------|-------------|-------------|------------------|-------------|-------------|----------------|-------------|-------------|
| | Bw | Fw | Tot | Bw | Fw | Tot | Bw | Fw | Tot | Bw | Fw | Tot | Bw | Fw | Tot |
| Manaus | | | | 0.27 | 0.14 | 0.15 | 0.56 | 0.90 | 0.69 | 0.40 | 0.77 | 0.45 | 0.60 | 0.86 | 0.66 |
| Rest of AM | 0.27 | 0.14 | 0.15 | | | | 0.50 | 0.09 | 0.24 | 0.33 | 0.04 | 0.13 | 0.46 | 0.26 | 0.34 |
| Belém | 0.56 | 0.90 | 0.69 | 0.50 | 0.09 | 0.24 | | | | 0.76 | 0.78 | 0.72 | 0.88 | 0.83 | 0.86 |
| Rest of PA | 0.40 | 0.77 | 0.44 | 0.34 | 0.05 | 0.13 | 0.76 | 0.80 | 0.72 | | | | 0.74 | 0.76 | 0.70 |
| Rest of Brazil | 0.60 | 0.86 | 0.66 | 0.46 | 0.26 | 0.34 | 0.88 | 0.83 | 0.86 | 0.79 | 0.80 | 0.75 | | | |

Obs: correlation ≥ 0.6 in bold

4. TRADE WITH OTHER REGIONS

One important issue in the analysis of the economic structure of a region is its trade relationship with other regions, summarized in Table 6. As is shown, Metro Manaus sells only R\$ 3,099 million to the rest of the state of Amazonas, and R\$ 1,250 million to the neighboring state of Pará (metro e non-metro). However, these numbers are small when compared to the R\$ 40,948 million sold to the rest of Brazil. Thus it is clear that the economy of Metro Manaus is heavily directed outwards, mainly to the more advanced areas of the country. The economy of the rest of the state of Amazonas supplies R\$ 1,705 million to Metro Manaus, and R\$ 6,085 million to the rest of the country. That is, although both areas are outward-looking, the economy of the rest of the state of Amazonas has the metro area as an important buyer. A column wise reading of the table informs about the purchases made by each region. Manaus metro buys from other states more than it purchases from its own state. Comparing its imports with its exports, it is evident that the metro region presents a trade surplus. The rest of the Amazonas state buys 36% of its purchases of goods and services from Metro Manaus, and 64% from the rest of the country. Although it also runs a trade surplus, its value is small, as compared to that of Metro Manaus.

With bigger numbers, Metro Belém sells more to the rest of Pará (R\$ 8,331 million) than to other states (R\$ 6,110 million). The rest of Pará state presents much smaller regional flows, 21% of which are directed to the metro region of Belém. In terms of purchases, Metro Belém is supplied basically by other states, likewise for the rest of Pará. Metro Belém exhibits a trade deficit, since it imports R\$ 16,608 million from other regions and exports R\$ 6,110 million). It is interesting to mention that the trade flows between the two metro regions are very low, in these terms characterizing a situation of two almost independent economies. Metro Manaus shows a deficit in its trade flow with its own state, since it imports almost twice as much in value than it exports. Metro Belém also exports more than three times as much as it imports from other areas within its state.

Table 6: Interregional flow of goods and services (R\$ million of 2009)

| | Amazonas State | | Pará State | | Rest of Brazil |
|------------------------|----------------|---------------|-------------|---------------|----------------|
| | Metro Manaus | Rest of State | Metro Belém | Rest of State | |
| Metro Manaus | | 3,099 | 539 | 711 | 40,968 |
| Rest of Amazonas State | 1,705 | | 34 | 49 | 6,085 |
| Metro Belém | 151 | 24 | | 8,331 | 5,935 |
| Rest of Pará State | 252 | 27 | 2,668 | | 10,130 |
| Rest of Brazil | 29,642 | 5,437 | 16,035 | 25,639 | |

Table 7 displays only the trade flows across regions, ignoring the sales and purchases occurring within the regions. Table 8 includes those flows, splitting them by the type of good or service traded: intermediate goods, that is, inputs used in the production of other goods, and final goods. Metro Manaus, for example, purchases a total of R\$ 40,833 million, of which R\$ 18.280 (45%) come from suppliers located right in the metro region. The remaining 55% come from the rest of Brazil (51%), the rest of Amazonas state (3%), and very little from Metro Pará and the rest of Pará state. A row wise reading of the table shows the sales of intermediate goods. Metro Manaus supplies mostly the rest of the country and itself, with very little to the rest of its state or to the neighbor state Pará. These numbers solidify the conclusion that Metro Manaus is outward-focused, even in intermediate goods.

Metro Belém purchases locally 44% of the intermediate goods it needs, and another 10% from the state of Pará, totaling 54.5% of purchases within the state, more than Metro Manaus. It also buys a sizable amount from the Rest of Brazil (44.2%). Around two thirds of its sales of intermediate goods go mostly to the state of Pará, with minor flows to the rest of Brazil. This is an important difference to Metro Manaus, which concentrates its flows mostly to the rest of Brazil. It is clear that Metro Belém is more deeply inserted into the economy of the state of Pará than Metro Manaus is into the state of Amazonas. The second part of the table presents information on the flows of final goods, that is, goods purchased for final consumption, by either families, government, buyers from other countries (exports), and goods that will add to the stock of capital goods. Metro Manaus buys almost 74% from within the state of Amazonas, mostly from itself. Metro Belém buys 64% within the state of Pará, mostly from itself.

Table 8 presents another way of looking at the economic relationship of the two metropolises with other areas. It shows the effects of an increase in final demand in one region to its economy and to the other regions. An increase in final demand originating in Metro Manaus produces a 55.3% increase in the amount of gross value added in that metro region, and 1.4% in the state of Amazonas. The remaining 43.3% “leak” to other regions, mostly the Rest of Brazil (42.7%). In the case of Metro Belém, 51.3% stay in the metro area, and 4.8% in the state of Pará, totaling 56.1%. The remaining 43.9% of value added is generated in the Rest of Brazil (41.1%). In terms of job creation, an increase in final demand in Metro Manaus generates employment across all regions of Brazil, but only 58% remain in Metro Manaus, with another 2% in the state of Amazonas; the remaining 40% are generated elsewhere. Metro Belém is able to retain a larger proportion of employment, 63%, with additional 9% remaining within Pará state, leaving only 28% for the other areas.

These numbers show that Metro Belém is more important to the state of Pará and to its own economy, than Metro Manaus to the state of Amazonas and to its own economy. Put in another way, the economy of the state of Pará is more self-sufficient and its metro area is very important to the state's economy. The case of the state of Amazonas is sharply different, with very few effects within the rest of the state and severe leaks to out-of-state regions. In both cases, the retention of employment is slightly larger than the retention of value added, and the difference is more important in the case of Metro Manaus.

5. CONCLUSIONS

We have compared the two jungle metropolises of Belém and Manaus, located in the detached Amazon region of Brazil, both in terms of their productive structures and their trade connections. The 2009 inter-regional input-output system developed by NEREUS Lab was employed, allowing for an analysis at the level of 47 sectors and 5 regions: the two metropolitan areas, their respective states, and the remaining states of the country.

The analysis revealed that, in spite of numerous coincidences, there are indications that their economic fabrics are different, as far as their key sectors are concerned. In terms of their linkages to other sectors, highlights that are specific to Metro Manaus are “medical, optical and measurement equipment”, “automobile, trucks and parts” and “office and computing equipment”. The remaining parts of the state of Amazonas rely on oil production and refining, and on electricity production. In the case of Metro Belém, only three sectors show backward or forward strong linkages, but they are not among the top ten in terms of total pure linkages (“food manufacturing”, “glass” and “electricity”). The highlights of rest of the state of Pará in terms of total linkages are: “glass production”, “iron ore”, “beverages” and “meatpacking”, which are specific to this region alone.

A rank correlation analysis of the sectoral linkages between regions has indicated that Manaus has a productive structure quite different from the state of Amazonas, standing out as a very different type of economy. On the other hand, Belém has a productive structure quite similar to that of the state of Pará, as well as to other regions in the country, revealing less geographic concentration in the state, as compared to the predominant role of Manaus in the state of Amazonas. In spite of these results, however, the analysis indicates low similarity between their productive structures and that both metropolitan regions are more similar to the rest of Brazil than to the rest of their respective states.

The analysis of the trade flows across regions revealed that Metro Manaus is outward looking, while the economy of the rest of the state of Amazonas, although being an important supplier to its metro area, also sells a lot to the rest of Brazil. Manaus metro runs a positive trade balance with the rest of Brazil. With larger numbers, Belém also concentrates its exports to areas outside the northern part of the country, and shows a trade surplus with the rest of Brazil too, but the rest of the state of Pará operates with a deficit. It is interesting to mention that the flows between the two metro regions are very small, characterizing two almost independent economies, as trade flows are concerned. Metro Manaus shows a surplus in its trade flows with its own state. Metro Belém also exports more than it exports to other areas within its state, but the surplus is proportionally larger.

Considering value added and employment generation, increases in final demand in Metro Manaus produces a 55.3% increase in the amount of value added in that metro region, and another 1.4% stay in the state of Amazonas. The remaining 43.3% “leak” to other regions. In the case of Metro Belém, 51.3% stay in the metro area, and 4.8% in the state of Pará. The remaining 43.9% of value added is generated outside the state of Pará. In terms of job creation, an increase in the final demand of Metro Manaus generates employment across all regions of Brazil, but only 58% remain in Metro Manaus, with another 2% in the state of Amazonas; the remaining 40% is generated elsewhere. Metro Belém is able to retain a larger proportion of employment, 63%, with additional 9% remaining in the Pará state, leaving only 28% to the other areas. Thus, Metro Belém is more important to the state of Pará, and to its own economy, than Metro Manaus to the state of Amazonas, and to its own economy. Put in another way, the economy of the state of Pará is more self-sufficient and its metro area is very important to the state’s economy. The case of the state of Amazonas is sharply different, with very few effects of Metro Manaus on the rest of the state, and severe leaks to out-of-state regions. In both cases, the retention of employment is slightly larger than the retention of value added.

Two metropolises of almost the same size, with similar recent history of fast growth of population and production, located in the detached Amazon region, in which forests prevail and transportation faces many limitations, and pertaining to large states, are surely an interesting case to study. As the analysis above reveals, in spite of many commonalities, there are important differences between them, both in terms of their productive structure and trade relations.

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