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## **The Evolving Role of Large and Middle Size Farms in Brazilian Agriculture**

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### 1. Introduction

The change in the economic policies that began with the military coup and the economic policies pursued in the wake of the economic crisis of the sixties turned Brazil from a coffee exporter to one of the most important agricultural and food exporters in the world. Starting in the seventies, Brazil rapidly assumed a prominent role in important external markets like oil seeds, meats, sugar, orange juice and cotton. At the same time, Brazil is one of the few countries in the world that still has a large stock of lands with natural vegetation available for incorporation into production.

This rapid expansion of agriculture in Brazil was based on a combination of a large stock of natural resources, technical progress that allowed the occupation of the vast central Brazil cerrados, and economic policies directed to import substitution and industrialization, which comprised “cheap food policies” that in the end facilitated the expansion of agriculture.

The Brazilian agriculture pattern of expansion has been criticized in many grounds, including for being based on large farms and, as a result of the import substitution policies, on export plantations, intensive in capital, industrial inputs and labor saving technologies. This seems, indeed, to be the pattern of expansion in the cerrados (savannahs) area in Center-west. At the same time, in more recent periods agriculture is moving again toward new frontiers, in northeast Brazil and the Amazon rainforest, apparently based on the same structural patterns that prevailed in the seventies

This criticism, however, overlooks the existence of many other important producing regions in southeast Brazil, in traditional agricultural areas and based on relatively smaller

farms. This structure has also been evolving with time, but this transformation has called much less attention.

In this paper, we document the evolution of this “middle” in Brazil, and discuss its importance in many different aspects. Initially, we discuss the meaning of “middle size producer” in Brazil, which has a very different meaning compared with other regions in the world. More than this, this classification has different meanings depending of the region inside Brazil. In a continental country with a relatively sparse population, what can be considered a large farm in one region is a medium or even small in others. We have compiled data from the Brazilian agricultural censuses since 1970 to describe how land structure has been evolving in Brazil, focusing on the most important agricultural commodities and livestock.

The plan of this paper is as follows. The next section presents some general facts about the Brazilian agriculture, its importance for the national economy and employment, as well as its distribution in the territory. Then we discuss the evolution of farm sizes in Brazil, as well as aspects of land concentration and regional aspects of farm sizes. Next, we present the evolution of agricultural supply of selected commodities and its relation to farm. Finally, we present our conclusions and final remarks.

## **2. Facts about the Brazilian agriculture**

Brazil's total area amounts to about 850 million square kilometers, one of the larger countries in the world. This vast territory is very heterogeneous in terms of agro ecological conditions, as well as in economic activities, population and development. The Brazilian territory has six administrative regions: the southeast and south region are the richest regions in the country, while the northeast and north regions are the poorest. The Southeast region responded for 55,2% the Brazilian GDP in 2012, while one state in the region, São Paulo, concentrated alone 32.1% of national GDP in the same year.

Table 2 shows the importance of those regions in terms of share in value added of broad economic activities. As it can be seen, agriculture (includes livestock) is better distributed in the country than the other economic activities, which tend to follow regional GDP closer.

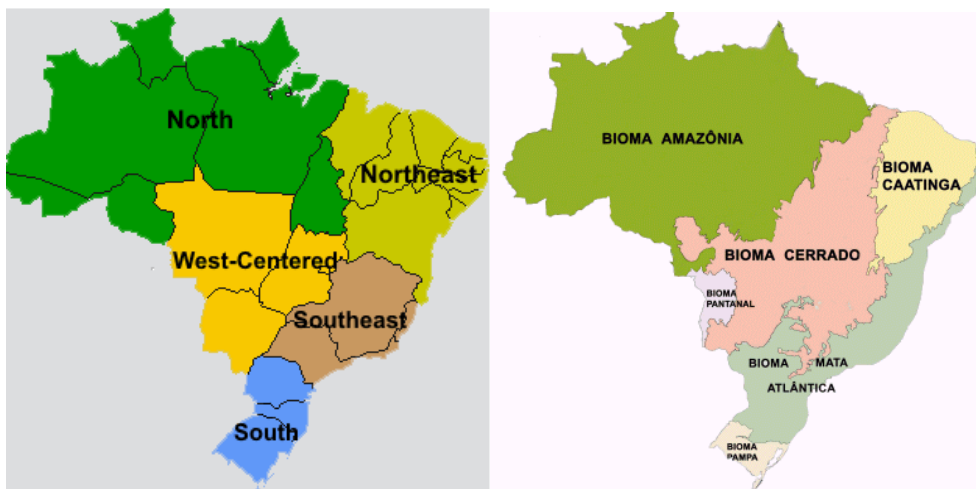


Figure 1. Brazilian territory: regions and biomes

The structure of the Brazilian agriculture start to change fast in the seventies, when several policy measures directed to industrialization stimulated the occupation of the vast territories in Center-west Brazil. The development of agriculture was necessary to supply food for the growing urbanizing population, as well as for exporting surpluses (Ferreira Filho and Vian, 2014). The success of that strategy transformed Brazil from a coffee exporter in the sixties to one of the most important agricultural and food exporters in the world presently (Table 1).

Table 1. Brazil's share in world production and exports: selected commodities, 2010.

Commodity	Share in world production (%)	Share in world exports (%)
Cereals	3.0	3.7
Oil crops	8.0	21.3
Sugar	23.0 <sup>a</sup>	38.5
Cotton	4.7	7.8
Beef	13.5	14.2 <sup>a</sup>
Pork	2.9	19.6 <sup>a</sup>
Poultry	11.3	11.6 <sup>a</sup>

Source: Ferreira Filho et al (2015).

It's important to notice that this prominent role of Brazil in world food markets was achieved with very low subsidies to agriculture, when compared to the world most important food suppliers. Since the mid-nineties public intervention in the agricultural sector in Brazil has been reduced markedly, due mostly to the stabilization plans and fiscal constraints, causing transfers to agriculture in the country to be one of the lowest among the most important agricultural producers worldwide. The Producer Support Estimate in the Brazilian agriculture was 4.6% in 2012, compared to the 18.6% average in the OECD countries, 14.3% in Canada, 19% in the European Union and 7.1% in the United States (OECD, 2014).

The economic activity has an uneven distribution in the Brazilian territory (Table 2). Agriculture (primary production, including livestock) accounted for 5.3% of Brazilian GDP in 2012, while manufacturing represented 26% and services 68.7%.

*Table 2. Share (percentage) of each Brazilian region in gross value added and per capita income. Selected broad economic activities. 2012.*

	Total	Per capita income (R\$)	Agriculture and livestock	Extractive Industries (includes oil)	Manufacturing	Construction	Electricity, gas, sewage
North	5,4	14,179.5	10,2	12,8	4,1	6,8	5,4
Northeast	13,9	11,044.6	15,0	7,6	9,3	18,3	22,7
Southeast	54,3	29,718.3	29,8	77,0	58,6	50,8	44,5
South	16,2	25,633.5	23,5	1,1	22,0	15,3	20,3
Center west	10,1	29,943.7	21,5	1,6	6,0	8,8	7,1
	100		100	100	100	100	100 <sup>1</sup>

*Source: IBGE (2012)*

The Southeast region of Brazil is still the most important agriculture and livestock producer in the country, accounting for 29.8% of total value added in 2012, followed closely by South and Northeast regions. The South and Southeast regions are the oldest agricultural regions, while the Center-west, North and part of the Northeast regions concentrate the dynamic agricultural frontiers of Brazil, located at the edge of the Amazon x Cerrado and Cerrado x Caatinga biomes.

### **3. The evolution of the average farm size in Brazil**

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<sup>1</sup> The Northeast region also has an agricultural frontier in the Caatinga biome.

The historical conditions during the occupation of the Brazilian territory shaped a particular distribution of farm sizes and land ownership that are still present today. Figure 2 displays the evolution of the average farm sizes, in Brazil and by region.

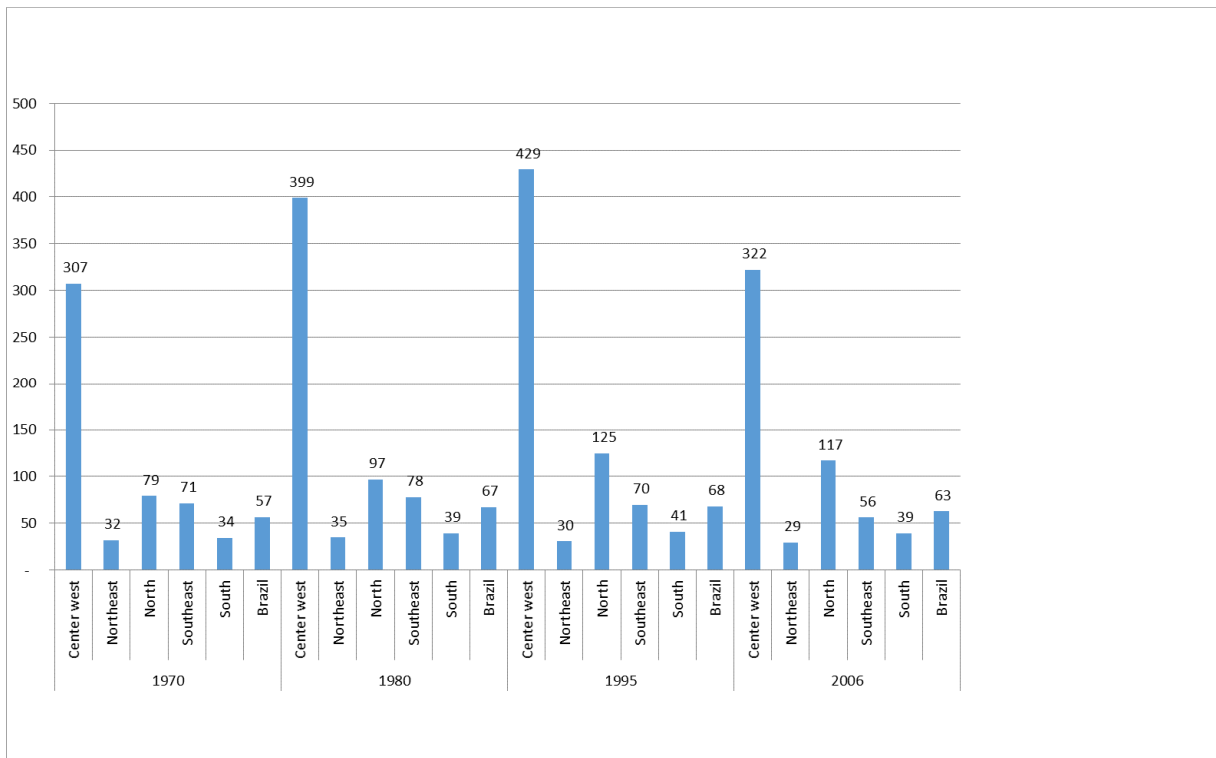


Figure 2. Average farmland area (ha), by region. Brazil, 1970-2006.

Source: Brazilian Agricultural Censuses. IBGE, various years.

We can see initially that the average farm size in Brazil is relatively stable over the 36 years' time span, changing from 57 ha in 1970 to 63 ha in 2006, peaking to 68 ha in the 1995 Agricultural Census. The number of farms changed from 4,920,345 in 1970 to 4,920,617 in 2006<sup>2</sup>. These figures, however, hide an enormous heterogeneity in terms of land structure, which become clearer analyzing the regional distribution. A remarkable regional difference in average areas stand out, with three main area groups. In one extreme of the distribution is the Center-west, the region with the largest average farm area that increased from 307 ha in 1970 to 429 ha in 1995, and reduced again in 2006 to 322 ha. In the other extreme are the Northeast and the South regions, with average areas between 30 ha and 40 ha since 1970. In the intermediate group are the Southeast

<sup>2</sup> The concept used by the Brazilian Statistical Agency (IBGE) is establishment, which considers two different properties owned by the same farmer as two farms.

and North regions, with areas between 70 and 120 ha. As will be seen, however, regions in same average area group can have very different farm structure.

The Northeast and South are predominantly regions of family agriculture, but with different characteristics. Note, in first place, that the per capita income in South in 2012 was more than the double of that observed in the Northeast. The colonization in Northeast started in colonial times, and happened through sugar cane production in the coastal regions, while subsistence local producers settled in the Caatinga region. In the South, on the other hand, the first colonization waves were of Europeans immigrants that started grain and livestock production. This generated a very different production pattern in South compared to the Northeast, as will be seen.

The Center west region, on the other hand, is the most recent in terms of agricultural development. As discussed in Ferreira Filho and Vian (2014), the occupation of the Brazilian Center west accelerated in the seventies, backed by specific credit and research policies that dramatically changed the regions' landscape. This involved gradual conversion of livestock production into soybeans, mainly, and, more recently, cotton, with extensive areas of pasturelands transformed into crops. The Center-west is also a region with a relative scarce population, what favored the adoption, since the early occupation stages, of labor saving technologies, with extensive use of mechanization.

Brazil is a country of a very high concentration in land distribution, as shown by Hoffmann and Ney (2010) who analyzed the distribution of land in Brazil using Agricultural Censuses data from 1975 to 2006. The main conclusion of the authors is that there is no trend of inequality reduction in the period, as measured by the GINI index of land distribution. The same authors pointed to the fact that the Atkinson index consistently increased, indicating that the inequality increases when the effect of changes in the inferior part of the tail distribution stressed, caused by the increase in the number of small properties. Table 3 displays some figures related to the land distribution in Brazil.

*Table 3. GINI index and proportion of area occupied by the 50% smaller (50-) and 5% bigger (5+) farms in Brazil.*

	1975	1980	1985	1995	2006
GINI	0.855	0.857	0.858	0.857	0.856
50% -	2.5	2.4	2.3	2.3	2.3
5% +	68.7	69.3	69.0	68.8	69.3

Source: Hoffmann and Ney (2010).



The figures in Table 3 illustrate how concentrated land distribution in Brazil is. Besides, the GINI index presents a remarkable stability since 1975, indicating a long run persistence in land ownership structure. The same is true for the share of land occupied by the 50% smaller or the 5% larger farms, which remain stable in the period. Notice that considering Brazil as a whole, the share of land occupied by the 5% larger farms is about 25 times higher than that occupied by the 50% smaller ones (Hoffmann and Ney, 2010). Still according to those authors, the median farm area in Brazil changed from 8.9 ha in 1975 to 9.7 ha in 2006.

Figure 3 displays the number of farms in each area group, and supports the idea that farm structure is stable since the seventies. The total number of properties with less than 100 ha was around 4.45 million, both in 1970 and 2006, and the same happens with the other area strata. As shown by Hoffmann and Ney (2010), however, changes are happening in the very low area stratum, with increases in the number of very small farms, with less than 10 ha<sup>3</sup>.

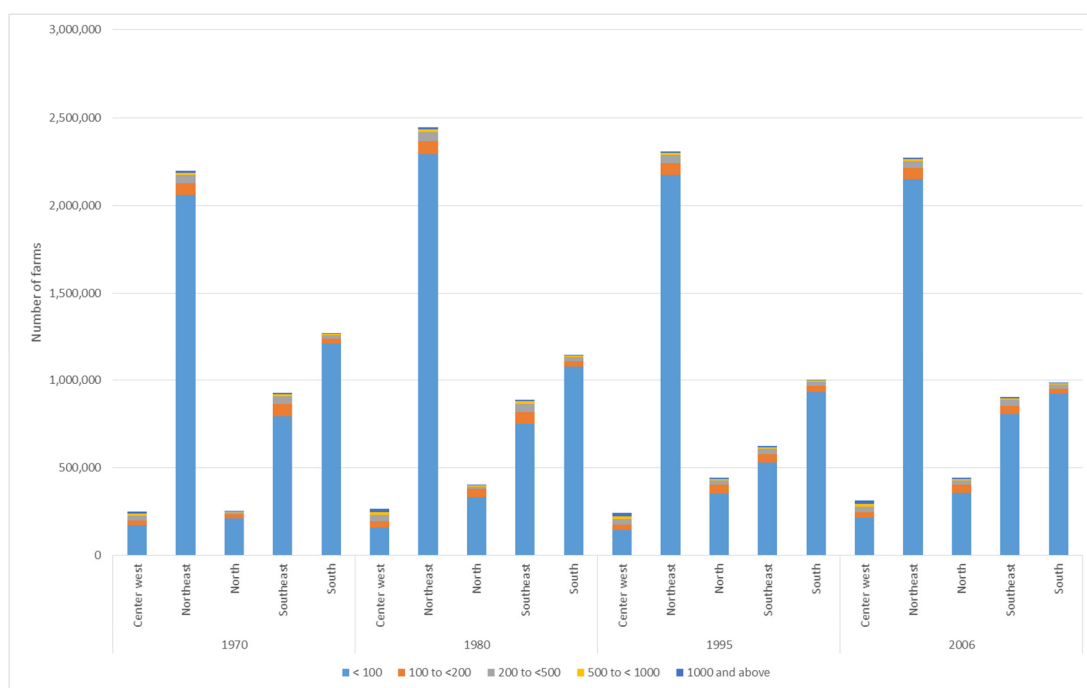


Figure 3. Number of farms by area group, by region. Brazil. Various Census years.

Table 4 shows the variation in the number of farms, by area group and regions in Brazil in the 1970/2006 period, and reveals details in the regional evolution of farm structure in the country.

<sup>3</sup> The authors suggest also that this increase is happening due more to fractioning of land close to urban areas, for leisure and lifestyle purposes, and not for agricultural production exclusively.

The numbers illustrate three different dynamics in land structure in Brazil. First, we see that the number of farms keep increasing in the frontier, as expected, as more land comes into production. The total number of farms increased by 24.4% and by 76.7% respectively Center-west and North, in 36 years. In those regions, it is clear too that the increase in the number of farms is happening faster in the larger area stratum: in North, for example, the number of farms with area above 1,000ha increased by as much as 437.9% in the period. The same happens in Center west, although with a smaller magnitude.

Second, the total number of farms has changed little in Northeast and in Southeast Brazil, respectively the poorest and the richest regions, where the number of farms stayed relatively stable. In both cases, the only observed increase was in the smallest area stratum, below 100 ha. The number of farms increased 3.5% in Northeast, where there is a recent agricultural frontier region<sup>4</sup> and decreased in Southeast. The fall in the number of large properties in Northeast is surprising, since most of the properties in the new frontier are large. This means that another land dynamic is present in the region, pointing to the fractioning of other large farms into smaller ones. In Southeast, however, the situation is clearer, since there is no possibility of further land expansion in the region. The observed dynamics is due to the fractioning of larger farms, caused by fast urbanization and family inheritance, leading to the increase in the number of smaller farms.

*Table 4. Number of farms variation (percentage), by farm area groups and regions. Brazil, 1970 to 2006.*

Area group (ha)	Center-west	Northeast	North	Southeast	South
< 100	26.7	4.3	67.9	1.2	-24.0
100 to <200	12.7	-6.6	105.5	-28.5	-0.7
200 to <500	3.9	-9.8	78.7	-25.2	19.4
500 to < 1000	34.4	-12.7	470.5	-26.5	13.3
1000 and above	53.5	-11.6	437.9	-23.1	-5.9
Total	24.4	3.5	76.7	-2.8	-22.5

Source: Brazilian Agricultural Censuses, various years.

In third place, the South region presents a fall in the total numbers of properties, which decreased by 22.5%, a fall in the number of farms in the smaller stratum, and an increase in the number of farms in the 200 ha to 1,000 ha range. Notice that this is the only region showing a fall in the total number of farms below 100 ha. As seen before, the colonization in this region started

<sup>4</sup> In the states of Maranhão, Piauí, Tocantins and Bahia, the so called Mapitoba region.

with European immigrants and grain production in small farms, including soybeans. The region is also the most important soybeans producer in Brazil. Soybean, however, is typically produced in large farms, due to the existence of size economies in production, what is driving the increase in the number of medium properties in the region.

In contrast to its share (5.3%) in GDP, agriculture still accounted for 19.3% of total employment in Brazil in 2006 (last Agricultural Census), or 17.9 million workers out of 93.3 million total workers. Table 5 shows the distribution of those workers according to farm area groups.

*Table 5. Number of workers in agriculture and livestock production in Brazil. 1995 and 2006.*

	1995		2006	
	Number	Share	Number	Share
< 1 ha	1,349,711	0.08	1,518,444	0.10
1 to < 2 ha	1,378,451	0.08	1,188,253	0.07
2 to < 5 ha	2,513,564	0.14	2,211,200	0.14
5 to < 10 ha	2,058,452	0.12	1,831,411	0.12
10 to < 20 ha	2,416,889	0.14	2,205,466	0.14
20 to < 50 ha	3,055,094	0.17	2,718,038	0.17
50 to < 100 ha	1,678,601	0.09	1,399,108	0.09
100 to < 200 ha	1,197,018	0.07	901,121	0.06
200 to < 500 ha	1,007,832	0.06	785,544	0.05
500 to < 1000 ha	481,096	0.03	365,977	0.02
1000 ha and more	751,002	0.04	768,247	0.05
Total	17,887,710	1	15,892,809	1

Source: Brazilian Agricultural Censuses.

We see that although the total number of workers in the Brazilian agriculture fell from 1995 and 2006, the distribution in the farm area groups is stable. The figures in Table 5 illustrate the importance of the smaller farms in terms of labor use in Brazil. Farms with 10 ha and below employ about 40% of total workers in agriculture and livestock, and farms with 100 ha and below about 80%. As will be seen further in this text, middle and large farms are responsible for a significant share of production, pointing to a more capital-intensive technology in those farms.

#### **4. The evolution of farm size, value of production and productivity**

The numbers on Figure 2 illustrate the difficulty of defining what a “medium size” farm in Brazil is, due to the multitude of situations. Area groups, however, may not be the best concept for this classification, since production not always has a direct relation with farm area. Table 6 brings more information on the issue.

*Table 6. Share in value of production of annual crops in Brazil and regions, by farm size. 2006.*

Farm size	Brazil	North	Northeast	Southeast	South	Center-west
>0 and <1	0,015	0,036	0,038	0,007	0,016	0,002
1 and <2	0,021	0,046	0,039	0,011	0,028	0,003
2 and <5	0,057	0,066	0,056	0,032	0,111	0,009
5 and <10	0,039	0,058	0,040	0,026	0,070	0,006
10 to <20	0,045	0,095	0,052	0,034	0,072	0,007
20 to <50	0,077	0,109	0,087	0,067	0,122	0,014
50 to <100	0,067	0,115	0,068	0,059	0,101	0,019
100 to <200	0,084	0,160	0,064	0,081	0,117	0,041
200 to <500	0,137	0,101	0,099	0,132	0,160	0,147
500 and more	0,456	0,213	0,456	0,550	0,194	0,752
Region's share in Brazil		0,044	0,164	0,270	0,303	0,218

Source: Agricultural Census 2006.

Considering Brazil as a whole, we see that farms between 100 and 500 ha have a share in annual crops production value around 20% of total. This is also true in the most relevant producing regions (Southeast, South and Center west), with the South region showing a slighter high share for that area range. In spite of the limitations of this classification, throughout in this text we will refer to farm areas between 100 and 500 ha range as “medium properties”. Notice, however, the high share in value of production of properties above 500 ha: in aggregate, large farms are responsible for the production of 45.6% of value of production of annual crops in Brazil in 2006, a value which riches 75.2% in Center-west. The middle and large farms, then, produced 67.7% of total value of production of annual crops in Brazil in 2006, a remarkable value.

Table 7 summarizes the farm size distribution and the share of production of annual crops by region, according to the farm area groups in 2006<sup>5</sup>. We can see that when considering Brazil as a whole there were in 2006 4,448,751 farms with area below 100 ha, about 90% of the total number of farms in the country. Those farms accounted for 31% of the total value of production of

<sup>5</sup> The use of different area groups in different tables is due to the different classification present in different Agricultural Censuses in Brazil, which sometimes require aggregation for the sake of comparisons.

annual crops in that year. In regional terms, the number of farms in this stratum is the highest in Northeast Brazil, and the smallest in Center west, with 69% of the farms in this area range.

In the other extreme of area groups we see that there were 47,578 farms in Brazil with area higher than 1,000ha, or only 1% of the total number of farms, and which produced a share of 42% of annual crops value of production in 2006. The region with the highest number of farms in this area group is the Center-west, with 20,436 farms that produced 72% of regional value of production of annual crops. The South region accounts for the lowest number of farms in this area range, with 4,507 farms that responded for 16% of total value of production of annual crops in 2006.

*Table 7. Number of farms and share in value of production or annual crops, by regions. Brazil, 2006.*

			Area group				
			<100	100 to < 200	200 to <500	500 to <1000	1000 to above
Brazil	Farms	Number	4,448,751	219,432	150,698	54,158	47,578
		Share	0.90	0.04	0.03	0.01	0.01
	VP	Share	0.31	0.06	0.11	0.09	0.42
North	Farms	Number	355,637	48,432	23,614	8,472	8,467
		Share	0.80	0.11	0.05	0.02	0.02
	VP	Share	0.53	0.11	0.07	0.03	0.22
Northeast	Farms	Number	2,149,260	62,318	40,831	12,335	8,212
		Share	0.95	0.03	0.02	0.01	0.00
	VP	Share	0.44	0.04	0.07	0.06	0.38
Southeast	Farms	Number	804,897	48,543	33,382	9,802	5,956
		Share	0.89	0.05	0.04	0.01	0.01
	VP	Share	0.21	0.08	0.14	0.08	0.50
South	Farms	Number	921,958	29,079	23,178	7,670	4,507
		Share	0.93	0.03	0.02	0.01	0.00
	VP	Share	0.51	0.09	0.13	0.11	0.16
Center west	Farms	Number	216,999	31,060	29,693	15,879	20,436
		Share	0.69	0.10	0.09	0.05	0.07
	VP	Share	0.05	0.02	0.08	0.12	0.72

Source: Brazilian Agricultural Censuses, various years.

We see, then, that farms in the middle to large range of area (above 100 ha) account for 68% of value of production of annual crops in Brazil in 2006, even though representing only 10% of the total number or properties. Even in the South region, where the number of farms below 100 ha is high the share of the medium and large properties account for 49% in value of production of annual crops. In the South, however, the distribution of production across the area groups is better

than in Southeast and Center-west. As seen in Table 4, this is the only region where the number of farms in the middle range area increased from 1970 to 2006.

The regional heterogeneity of farms also has implications for production composition, and Table 8 brings more information about the evolution of different types of land use in Brazil. The figures in the table include only land in use in agriculture or livestock, meaning that set aside land or natural forests are not considered. Still, we have selected only two points in time to avoid clutter. Again, different patterns of land use evolution appear in different farm area strata.

*Table 8. Share in land use, by type of use and land area group. Selected years. Brazil.*

	< 100 ha		100 to < 200 ha		200 to < 500 ha		500 to <1000 ha		1000 ha and above	
	1980	2006	1980	2006	1980	2006	1980	2006	1980	2006
Permanent crops	0.080	0.077	0.059	0.050	0.031	0.051	0.020	0.025	0.008	0.018
Annual crops	0.278	0.198	0.123	0.124	0.111	0.134	0.092	0.128	0.041	0.132
Natural pastureland	0.233	0.211	0.306	0.214	0.354	0.215	0.369	0.205	0.360	0.158
Planted pastureland	0.120	0.285	0.166	0.343	0.200	0.354	0.219	0.374	0.184	0.335
Others	0.289	0.229	0.345	0.269	0.305	0.246	0.300	0.268	0.409	0.357
	1	1	1	1	1	1	1	1	1	1

Source: Brazilian Agricultural Censuses, selected years.

First, we see that the share of permanent crops is more stable than the other land use types, is higher in both periods for the lower area range, decreases slightly in the two lower area stratum and increases in the three upper strata. Coffee and orange trees are included in this land use type, and are mostly produced in Southeast Brazil. Second, the share of annual crops reduces in the period in the lower stratum, and increases with land area group. In the largest area group the share of annual crops changed from 4.1% in 1980 to 13.2% in 2006, reflecting the expansion of cash crops like soybeans and sugar cane in the period. Third, in what refers to pastures, natural pastureland area falls in all area groups, while planted pastureland increases. The total share of pastureland, however, increases in the smallest farm groups, and decreases in the largest.

The next table adds more information about the changes in annual crops production in Brazil, displaying the evolution in time of the shares in value of production of selected crops, plus milk, by area group.

Table 9. Evolution of shares in value of production of selected agricultural activities, 1970 to 2006. Brazil.

		< 100 há	100 to < 200 há	200 to < 500 há	500 to < 1000 há	1000 há and more	
Cotton	1970	0.68	0.10	0.12	0.05	0.05	1
	1980	0.63	0.11	0.12	0.07	0.07	1
	1995	0.45	0.11	0.14	0.08	0.22	1
	2006	0.01	0.01	0.01	0.04	0.93	1
Rice	1970	0.55	0.12	0.15	0.07	0.11	1
	1980	0.37	0.11	0.16	0.11	0.25	1
	1995	0.31	0.10	0.17	0.13	0.29	1
	2006	0.35	0.08	0.13	0.14	0.30	1
Sugar cane	1970	0.24	0.09	0.16	0.22	0.30	1
	1980	0.14	0.09	0.20	0.20	0.36	1
	1995	0.14	0.08	0.14	0.13	0.51	1
	2006	0.13	0.06	0.13	0.08	0.60	1
Milk	1970	0.48	0.14	0.17	0.13	0.07	1
	1980	0.46	0.16	0.19	0.11	0.07	1
	1995	0.56	0.16	0.16	0.07	0.05	1
	2006	0.65	0.13	0.13	0.05	0.04	1
Cassava	1970	0.88	0.05	0.04	0.01	0.01	1
	1980	0.89	0.05	0.03	0.01	0.01	1
	1995	0.86	0.07	0.04	0.02	0.02	1
	2006	0.80	0.10	0.08	0.01	0.01	1
Corn	1970	0.74	0.08	0.09	0.04	0.04	1
	1980	0.68	0.10	0.10	0.05	0.06	1
	1995	0.47	0.10	0.15	0.10	0.18	1
	2006	0.50	0.07	0.10	0.09	0.24	1
Soybeans	1970	0.67	0.08	0.13	0.07	0.04	1
	1980	0.45	0.13	0.18	0.11	0.12	1
	1995	0.26	0.10	0.18	0.14	0.30	1
	2006	0.17	0.07	0.14	0.14	0.48	1

Source: Brazilian Agricultural Censuses, various years.

Some remarkable changes come out from the analysis of Table 10, frequently associated to a geographical change in the Brazilian territory that implied a very different production structure. Again, there is a differentiation between cash crops and food crops. Cotton, for example, faced a strong structural change in the period. While 68.3% of value of production of cotton happened in the lowest area group in 1970, this changed to 1.1% in the in 2006, against 93.2% in the largest farms in the same year. This happened on the wake of the change of cotton production from Southeast Brazil to the Center-west in the nineties and, more recently, to Northeast Brazil, with a

complete change in technology production compared to the previous period<sup>6</sup>. Soybeans and sugar cane also present a trend of increasing value of production in larger farms, although at rates not as high as observed in the case of cotton. In those cultures, however, the share of production in medium to large farms was higher since the seventies. Actually, one of the reasons that pushed cotton to large farm areas was the migration of producers from South Brazil to the Center-west, and which introduced the soybean-mechanized technology into cotton production.

Cassava, milk production and rice, on the other hand, show a different dynamics. The lowest farms produced 87.8% of total value of production of cassava in 1970, value that changed to 80.3% in 2006, what makes it a typical small farm product. Milk, on the other hand, increased its production share in the lowest farms, from 48.1% in 1970 to 64.6% in 2006. The share of milk production in the medium farm area range also reduced, pointing to a specialization of this activity for small farms. Rice reduced a little its production share in the smallest farms, but not as much as cotton and soybean. In this case, however, the share of medium farms is barely constant, around 21.7%.

Table 10 brings more details on the importance of specific products by farm area groups. The table displays a larger number of selected food and cash crops farm shares in production, by area groups, to illustrate the important difference in production specialization by farm size. Instead of presenting the evolution in time, however, we present only the situation in 2006.

*Table 10. Share of selected agricultural products in Brazil, by area group. 2006.*

	< 100 há	100 to < 200 há	200 to < 500 há	500 to < 1000 há	1000 há and more	
Cotton	0.017	0.013	0.012	0.040	0.919	1
Sugar cane	0.099	0.059	0.099	0.085	0.657	1
Soybeans	0.159	0.069	0.133	0.141	0.499	1
Livestock	0.248	0.155	0.213	0.132	0.253	1
Wheat	0.278	0.137	0.207	0.178	0.200	1
Rice	0.343	0.083	0.134	0.139	0.302	1
Potatoes	0.436	0.120	0.099	0.067	0.278	1
Corn	0.495	0.076	0.105	0.095	0.229	1
Peanuts	0.496	0.118	0.134	0.043	0.209	1
Tomatoes	0.659	0.077	0.164	0.045	0.055	1
Beans	0.668	0.059	0.074	0.056	0.143	1
Pumpkins	0.804	0.064	0.071	0.016	0.045	1

<sup>6</sup> This change in technology included the mechanical harvesting, not used previously in Brazil.

<sup>7</sup> This is linked to the labor-intensive technology in rice production, mostly in flooded areas in Southern Brazil.



Poultry	0.813	0.073	0.074	0.023	0.017	1
Cassava	0.833	0.087	0.058	0.014	0.008	1
Watermelon	0.859	0.044	0.036	0.020	0.041	1
Onions	0.910	0.035	0.038	0.008	0.009	1

Source: Brazilian Agricultural Census, 2006.

The table lists crops top down according to the production share of the smallest farms, starting with the smallest. A clear differentiation appears. Cotton, sugar cane, and soybeans are those that have the smallest share in small farms, and conversely the highest shares in the largest farms. Wheat and rice present a more even distribution, with the share of production in small farms almost equal to larger farms, and the same happens with livestock. Livestock production in Brazil is mostly extensive and in large farms in some regions like the Center-west. It's produced, however, in every farm, and frequently used in small farms as a risk reduction strategy.

Food production, however, happens mostly in small farms. Pumpkins, cassava, watermelon (and other table fruits) and onions have more than 80% of their value of production in small farms. Corn is not directly consumed as food in Brazil, but is the most important feedstock for chicken and pork production. Even though corn production in large farms and large scale exists in some regions, especially the Center-west, the larger share of production is in the smaller farms, and mostly for feedstock purposes. Notice the high share of poultry production in farms bellow 100ha.

Even though not shown in this paper, larger farms in Brazil tend to be more capital intensive and to be more intensive in use of inputs and technology. The productivity per area, than, is different across the different area groups. Table 11 displays the productivity per area of selected crops in Brazil in 2006.

*Table 11. Productivity index of selected crops. Brazil, 2006. Productivity of farms with area between 500 and 1000 ha = 100.*

	Cotton	Peanuts	Rice	Sugar cane	Beans	Cassava	Corn	Soybeans	Milk
< 100 há	39	44	54	73	43	80	69	90	96
100 to < 200 há	81	66	68	87	60	88	84	93	96
200 to < 500 há	75	69	87	94	78	79	91	95	98
500 to < 1000 há	100	100	100	100	100	100	100	100	100
1000 to < 2500 há	100	81	94	96	107	98	102	98	98
2500 há and more	104	147	86	101	111	49	98	105	95

Source: Primary data from the Brazilian Agricultural Census 2006. Author's elaboration.

The numbers in Table 11 are productivity indexes calculated taking as reference productivity per area of farms with size between 500 and 1000 ha. We see that with the exception of milk and cassava, the productivity index for all the selected agricultural products increase almost monotonically from the smallest to the largest farms. In the case of cotton, for example, the productivity index is 2.5 times bigger than the observed in the average of farms below 100 ha, in 2006.

Finally, it's interesting to verify that the productivity of farms between 500 and 1000 ha seem to be a ceiling for productivity per area, even in the case of sugar cane and soybeans, which are produced mostly in large farms<sup>8</sup>. In those last cases, however, the distance of productivity of the larger in relation to the smaller farms is not as high as observed, for example, in the case of corn, beans or even rice. Sugar cane and soybeans are mostly produced as raw materials for the agroindustry, and tend to be produced with a more homogeneous technology than, for example, corn, which has a large share used inside the farm, especially in small farms.

## 5. Final remarks

The analysis of the evolution of Brazilian agriculture from the seventies reveal a remarkable stability in the number of farms, as well as on the structure of land distribution across farms sizes. Land distribution, as measured by the GINI index, changed very little, and is still very high. More than that, the average size of farms is also stable during this 36 years period, even though a strong differentiation is observed across regions inside Brazil.

Although heavily outweighed in numbers, medium and large properties respond for the higher share of annual crops production in Brazil presently, and their share in crops (annual plus permanent) production value increased from 1980 to 2006, while the same share reduced for the smaller farms. The share of pastureland, on the other hand, increased for the smallest farms, and reduced for the largest in the same period.

Even though the land structure has been stable since the seventies, a closer look at production composition according to farm size reveals a pattern, in which larger farms increased their share of

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<sup>8</sup> The exception is peanuts, but this case should be with care, since there are very few farm producing it in such large areas.

production of most crops analyzed here (cotton, rice, sugar cane, corn and soybeans) while smaller farms increased their share in milk production and the larger farms reduced. This phenomenon is linked to the increase in the share of pastureland in small farms, as observed before.

Finally, an analysis of production composition according to farm area groups in the 2006 Brazilian Agricultural Census reinforces the fact that medium and larger farms are responsible for the bulk of cash crops production presently, while the smaller properties produce the bulk of food crops, including vegetables and fruits. Corn, due to its dispersion in the territory, has also a higher share produced in farms below 100ha. Medium and large farms also show a higher productivity per hectare for the crops analyzed here.

In wrapping up this discussion, our paper shows that, despite the diversity of cases observed in the evolution of small, medium and large properties in Brazil, a dual type agriculture still persists, and is very stable in time, in which small farms live side by side to the large ones, despite the differences in average productivity. The reasons behind the stability of this structure are certainly multifold, and is certainly an issue that deserves more investigation, especially in face of the large share of employment in agriculture in the smaller farms.

## 6. References

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