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Introduction

The rise of Brazil as a world agricultural powerhouse is one of the most important developments in modern world history. Since 1960 Brazil has gone from being a food importer to becoming the largest net food exporter in the world. It is now among the top five world producers of some thirty-six agricultural products and has become the world's primary exporter of dozens of agricultural products, from orange juice to sugar, from meats to soybeans. Brazil now is one of the world's most important granaries and the most important tropical one on the planet. Without Brazilian production the world's food supplies would be greatly reduced. Yet this growth to world power status has only occurred in recent times. Though Brazil was always an agricultural export country, it was essentially an exporter of a single product first with sugar in the colonial period and then with coffee in the nineteenth and twentieth centuries. From time to time it also exported cotton, rubber and cacao. But all this was produced with the simplest non-machine technology and with the constant use of virgin soils to which little or no fertilizer or insecticides were ever applied. Labor was unskilled, farm credit minimal and a moving frontier into virgin lands was the primary input into agriculture.

All this changed in the second half of the twentieth century and above all after 1960. Today commercial agriculture in Brazil is highly mechanized, with access to abundant public and private credit, and is a major world consumer of fertilizers and insecticides. It also has one of the most advanced agricultural research programs in the world and a large class of highly trained agronomists. Despite difficulties in transport and government regulation, since the 1990s this agriculture has been able to successfully compete in the world market even against the United States.

The modernization of Brazilian agriculture is here defined as the transformation of commercial agriculture with the introduction of new products, the occupation of new spaces and the utilization of the most modern technology available in the market, part of which technology was developed by Brazilian researchers, particularly focused on the technology of tropical agricultural production. It is also defined by new complex relations between producers, and processors and by a sophisticated system of public and private finance. This modernization was a carried out by government policies designed to support the creation of a major industrial park in Brazil and in which agriculture's role was to provide cheap food to the growing industrial workforce and exports to pay for capital goods imports.

Brazil at mid-twentieth century had a traditional low productivity agricultural economy based on a highly unequal land tenure system with quite extensive latifundia throughout the nation. While other Latin American countries in this period were turning toward land reform as a way to open up traditional agriculture to modern technology, the Brazilian governments of the era decided instead to provide incentives for traditional landowners to become modern farmers. The result was a process of modernization based on a traditional land tenure system, what many have called a conservative agricultural revolution. Given the abundance of underutilized lands the government could repress the demand for land reform by promoting massive colonization of poor farmers, leaving the highly stratified land tenure system intact in the settled areas.

It is the aim of this study to explain how and why this agricultural revolution occurred and how Brazil has evolved in the past half century from a monoproduction exporter of coffee into becoming such a world agricultural producer, completely open to the international market. We have defined a crucial turning point beginning with a major change in government policies in the 1960s which led to a massive infusion of capital into the rural world and to direct government intervention in the marketing of agricultural products. We next examine the impact of the government's partial withdrawal from this market in the crises of the 1980s and the subsequent impact of the adoption of free trade in the 1990s. This two-decade crisis seriously affected the agricultural sector and forced it to reorganize its systems of credit, marketing and integration with a host of new credit sources, from supermarkets and major cooperatives to producers of agricultural inputs and international trading companies. Paradoxically, national industry, the primary concern of earlier governments, would suffer from this opening to world markets, while agriculture would experience an extraordinary growth.

Throughout the book we are concerned with the causes of this agricultural "revolution." This involves everything from detailed analysis of the massive mobilization of capital which began under the military regimes of the 1964–1985 period to the systemic creation of a modern research program which was led by Embrapa, one of the world's largest agricultural research institutes. It also involved the creation of a national agricultural machinery program as well as a modern chemical industry to supply the basic inputs needed to modernize national agriculture. Finally we look at the human capital which has emerged in the rural area and how it has affected this modernization process.

What is impressive is that the process was not constant. After a promising start, the impact of the depressions of the 1980s followed by the opening up of the Brazilian economy to the world market in the 1990s had a tremendous shock on agriculture and forced it to make significant changes. Brazilian industry was also forced to go through this difficult period of adjustment to an open economy, but in contrast to what occurred in industry, agriculture was able to recover its footing and to compete in the international market in the following decades, evolving to become one of the world's largest agricultural producers and one of its dominant agricultural exporters. Why agriculture succeeds and industry, except in a few instances, fails is one of the issues we also examine.

We then analyze how the farm sector responded to these changes at the regional and state level. For this analysis we have provided a broad regional analysis of where and how this modernization evolved. We also examine three case studies which are most representative of this change: Rio Grande do Sul, the model of small commercial farming; São Paulo, home to large-scale farms producing a large number of different crops, and the leading agricultural state in the nation; and Mato Grosso, the classic example of the new grain-producing centers, which in turn has become the second largest agricultural producer in Brazil.

Given our interest in explaining this agricultural revolution, most of this study concentrates on the part of the rural world that would become modern. But we also examine in detail the parts which were left behind and still practice subsistence agriculture and how and why this has occurred. We also examine the debates about agrarian reform, and the alternative colonization models offered by both the military and civilian governments in the post-1985 period. We also try to explain why a significant sector of the rural world was unable to respond to the new market incentives.

Our survey is based on annual or monthly data and the agricultural censuses. This work went to press as the preliminary results of the latest agricultural census of 2017 are being published. From these partial data it is evident that no major structural changes have occurred since the census of 2006. There was a reduction of 2% in the number of farms, an increase of 5% in area cultivated and a modest increase in the average size estate from 68 to 69 hectares. Farms under 100 hectares increased from 86% to 89% of all farms with little change in their share of lands, while those over 1,000 hectares remained at 1% of all farms and only increased their share by 4% to 48% of all land. Earlier secular trends continued in 2017, with agricultural workers declining by some 1.5 million from 2006, with farm mechanization increasing and farm owners and managers having more years of education.

Finally we should note that what this book does not do is to try to study the social conflicts over land that have become the norm in the more traditional regions of the North and Northeast, or the major question of the dismantling of the Amazon. As we intend to demonstrate, this agricultural revolution has occurred and continues to evolve without the need for more land expansion or for the continued dismantling of the rainforest. The illegal mining and cutting of timber in the Amazon, though a major problem for Brazil and the world, is not fundamental to the modern commercial sector of the national economy.

We should stress that we do not treat all crops and all regions equally, but have used only selected crops and selected states which we feel define the basic problems we are dealing with. Given the complexities of this subject, we do not consider this a complete history of modern Brazilian agriculture, which would need several volumes to fully describe just the period since 1960. But it is hoped that this broad survey will provide a basic analysis of how and why Brazil has emerged as a world agricultural producer on a par with the United States, Canada, Australia, China and the European Union.

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Antecedents

Like all the European colonizers of the New World who followed the Spanish, the Portuguese had to obtain a product that was exportable to Europe to sustain their American colonial enterprise. Without precious metals, the Portuguese only had access to Indian slave labor and had to develop new products acceptable to the European market. The solution was the establishment of a slave-based plantation economy producing cane sugar, a product which the Portuguese had already developed in their Atlantic islands in the fifteenth century. First using captured Indian slave labor, the plantations of Brazil by 1600 were already being manned by African slave labor brought by Portuguese slavers from West Africa. By the middle of the sixteenth century Brazil had become the world's largest producer of cane sugar, and the industry provided the funds necessary for the Portuguese to maintain their continental possession in the New World.

The settlement of Brazil occurred in distinct phases. In the first phase the economy and population were concentrated on the northeastern coast. It was here that the sugar plantation economy was first developed on a major scale, and this region continued to dominate the colonial economy and the world sugar market for more than a century. A second center of settlement quickly developed in the southeastern region around the port of Rio de Janeiro and its hinterland and at the coastal ports to the south and in the interior zone around what would become the current city of São Paulo. Here a frontier culture developed with whites, mestizos (*caboclos*) and Indians and this population carried out raiding and exploration expeditions in the western and southern frontiers of the country. It was these raiders, known as *bandeirantes*, who discovered both gold and diamonds in this hinterland in the late seventeenth and early eighteenth century. Brazil then entered an intensive mining phase in areas now belonging to the states of Goiás, Mato Grosso and Minas Gerais. In the latter region the wealth of the alluvial gold deposits drew Africans and Portuguese in large numbers and there rapidly evolved a mosaic of major interior urban centers. The mining activity peaked in the mid-eighteenth century, which led to a long-term decline in what had now become the most populous region of the colony.

But the growth of sugar in the hinterland of Rio de Janeiro and in the highlands near São Paulo counterbalanced the decline of mining and also helped to shift the center of both population and economic activity to the southeastern region. The growth of the French and English Caribbean sugar plantation economies in the eighteenth century led to a decline in the relative importance of Brazilian sugar on the international market. Nevertheless Brazil was still a major exporter to southern Europe, and the sugar economy sustained the growth of the southeastern as well as northeastern regions until the early nineteenth century.

The arrival of coffee as a new slave plantation crop began in earnest in the late colonial and early imperial period. Moreover it was in the southeastern region that this slave plantation economy would be centered and it was to this region that several million African slaves arrived in the period up to 1850. The continued dynamism of Brazil, from sugar and gold cycles through the coffee boom, led to the massive introduction of African slaves over the three centuries of colonial settlement. It had already absorbed more African slaves, currently an estimated 3 million Africans, than any other single region in the Americas to 1850,[1] and with the end of slavery in 1888 it was able to attract an even greater number of free European immigrants. It was one of the few Latin American states able to compete with the North American countries in taking a share of the great European transatlantic migration of the late nineteenth and early twentieth century.

Despite the never-ending expansion into the western and southern frontiers, the population of Brazil was still highly concentrated near the coast even into the nineteenth century. Most of the interior space was lightly populated and consisted primarily of forest and grasslands. But much of this would change in the last quarter of the nineteenth century as the railroads and the coffee plantations moved westward to open the

[1] This is the latest estimate of Africans disembarked in Brazil generated from The Trans-Atlantic Slave Trade Database, accessed May 29, 2017, at www.slavevoyages.org/voyage/search#.

interior to settlement. The expansion of coffee production in the second quarter of the nineteenth century provided Brazil with an international export whose demand systematically grew through increasing adoption of coffee drinking by a growing and ever more urban and richer population in the advanced countries of the world. Given Brazil's exceptional physical conditions for coffee cultivation, the country quickly assumed the position of world leader in the supply of this product, and was easily capable of increasing production adequately to respond to expanding world demand. For more than sixty years, coffee was produced with slave labor, but at end of the nineteenth century slaves were replaced by free wage labor based on the participation of European and Asian immigrants. The concentration of coffee production in the axis formed by the states of Rio de Janeiro, São Paulo and Minas Gerais gave this region an economic and political supremacy within the nation which was maintained until 1930.

Along with the substitution of slaves by free wage workers in 1888, the monarchy was replaced by a republic a year later. The emergence of the republic led to a fundamental reorganization of the locus of national power, which shifted from a centralized state to a more federal one, and their appeared new regional political actors who would consolidate their position throughout the period of the so-called Old Republic to 1930. São Paulo state emerged as the leading economic center of the country as coffee production moved west to the interior of the state of São Paulo, and this allowed São Paulo to become the leading state within the national economy.[2]

The initial expansion of coffee occurred in the Paraíba Valley, first in the part pertaining to Rio de Janeiro in the region of Vassouras. Coffee plantations then moved north and west into the region called the *zona da mata* in the southwestern part of the province of Minas Gerais and the areas around the counties (or *munícipios*) of Areias and Bananal in the northeastern part of the province of São Paulo. Until the middle decades of the century the Paraíba Valley was the world's single largest producer of coffee. By 1850 Brazil accounted for half of world production, and coffee in turn accounted for half the value of national exports. As world demand increased, Brazilian coffee production expanded at an even faster pace,

[2] On the evolution of coffee see the two-volume survey by Francisco Vidal Luna and Herbert S. Klein, *Slavery and the Economy of São Paulo, 1750–1850* (Stanford, Calif.: Stanford University Press, 2003); and *The Economic and Demographic History of São Paulo 1850–1950* (Stanford, Calif.: Stanford University Press, 2018).

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and in the last five years of the century Brazil accounted for 70% of world production. Land was abundant and cheap, and thus labor was the principal factor limiting the expansion of coffee. Initially the end of the slave trade in 1850 put at risk the expansion of coffee, but this was resolved by importing slaves from the non-coffee-producing regions. The result was that the coffee areas steadily increased their share of slaves after 1850.

Although planters as early as the 1850s began to experiment with using salaried European workers in the coffee fields, these initial attempts failed as free workers did not accept the conditions offered nor were they willing to work alongside slaves. Eventually government subsidization was needed to attract free laborers. In 1884, under pressure from the coffee growers, the government of the state of São Paulo assumed the entire cost of the travel of all immigrants from Europe to the farms of São Paulo.[3] It was this law which definitely established the basis for a massive introduction of European immigrants to São Paulo. The formal abolition of slavery in 1888 removed the last obstacle. There now occurred a major flow of immigration to the state of São Paulo. Between 1827 and 1884, only 37,000 foreign immigrants had arrived to São Paulo, but in the decade after 1884 half a million immigrants reached the state. Of the 2.3 million immigrants who came to São Paulo between 1887 and 1928, half were subsidized by the government. Other states also received immigrants in this same period, and in total some 4 million foreign-born immigrants arrived in Brazil between 1884 and 1940.[4] Thus despite the progressive dismantling and final abolition of slavery in the decade of the 1880s, there was no discontinuity in the production of coffee.

In this new free labor era, the west of São Paulo became the hegemonic producer of coffee within Brazil. The movement of coffee toward the west paulista plains was initiated in the 1870s following the introduction of railroads. The paulista western zone and other newly evolving areas of the state were developed on virgin lands with high soil productivity, and local planters were more open to experimenting with new labor regimes. In contrast, the lower-productivity coffee plantations of the Paraiba Valley went into decline and were no longer competitive without slave labor.

[3] Law 28 of 29 March 1884. www.al.sp.gov.br/portal/site/Internet/
[4] For São Paulo see *Anuário Estatístico do Brasil* (hereafter cited as *AEB*),*1939–1940*, 1307, and for all Brazil *AEB*, 1950, 55.

Along with labor, the other obstacle to the expansion of coffee production was transport. From the middle of the nineteenth century the necessity of creating an efficient rail transportation system to ship coffee to the coast was recognized as a fundamental necessity. The traditional system of transporting the crop by mules created high costs and limited the potential expansion of the system. The solution came in 1853 when the government guaranteed interest on the funds invested in railroad construction.[5] The *Estrada de Ferro D. Pedro II*, which went from the port of Rio de Janeiro to Cachoeira in the state of São Paulo, was the first railroad to be successfully built. It served the coffee region of the Paraiba Valley, permitting the export of coffee to the port of Rio de Janeiro.

The newer São Paulo coffee zones continued to rely on mule transport to reach their natural export port of Santos, located some 60 km from the city of São Paulo. But in 1867 the São Paulo Railway was inaugurated which connected Santos to the city of Jundiaí, which was the traditional entrance to the western paulista region. Using local planter capital, a complex railroad network was created which spread through the interior of the province and reached into the unexplored backlands. The railroads permitted the exploitation of lands of exceptional quality, particularly apt for coffee cultivation. Thus by the second half of the century Brazilian coffee planters resolved the two crucial blockages that limited the expansion of coffee: the insufficiency of labor and the lack of a cheap transport system. These railroads also moved other types of goods between ports and between different regions, creating a more integrated regional market, both for domestic production as well as for imports and exports.

Given its extensive agricultural frontier and virgin lands, São Paulo could now meet the increasing world demand for coffee. Between 1852 and 1900 the rate of growth of world coffee consumption was 2.5% per annum. In this period world consumption went from 4.6 million sacks of coffee to 18.1 million sacks, of which 73% was produced by Brazil.[6] There were also important changes in the regional base of coffee production in this period. The state of São Paulo surpassed Rio de Janeiro as the dominant coffee region in the 1890s. This growth continued into the next

5 Subsidies were essential since private financiers feared that their profits would prove insufficient. William R. Summerhill, *Order against Progress: Government, Foreign Investment, and Railroads in Brazil, 1854–1913* (Stanford, Calif., Stanford University Press, 2003), 40.

6 Edmar L. Bacha and Robert Greenhill, *150 Anos de Café* (2nd edn. rev.; Rio de Janeiro: Marcellino Martins & E. Johnston Exportadores, 1993), tables 1.1 and 1.2.

century, and by the 1910s São Paulo alone accounted for 70% of total Brazilian production.

But the special characteristics of supply and demand for coffee created an unstable market with great fluctuations in price. World demand grew steadily due to the growth of population, urbanization and income in the consuming countries, but at the same time was seriously affected by periodic crises in the economies of Europe and the United States.[7] Although plantings were influenced by prices, other exogenous factors sometimes delayed this price influence for several years. Coffee trees, for example, only began to produce at four years of age and continued to produce for some twenty to thirty years, and sometimes even as much as fifty years. Finally, a factor of major importance was the exchange rate. Prices were quoted in English pounds but the relevant price for the producer was in national currency. Thus, beyond the internal costs in national money, fluctuations in the exchange rate influenced the decisions of producers as much as changing international prices. All of these factors led to delayed responses to changes in demand in the coffee market.[8]

Until the 1890s there was a stability between demand and supply. In 1892, however, the international price of coffee began a long secular decline. But given the strong devaluation of local currency these falling international prices did not lead to a decline in national production or new plantings, which created a structural excess of supply. This paradox of continued expansion and falling prices and profitability was the result of earlier coffee plantings gradually entering into production, thus leading to overproduction.[9]

Given the growing coffee overproduction crisis characterized by low coffee prices and the accumulation of stocks of coffee, there was increasing pressure on the government to intervene. By 1902 the state of São Paulo was forced to prohibit the planting of new trees for a five-year period. Even after this state intervention, there was another major harvest in 1906/1907.[10] By now Brazil alone in one year produced more than the

[7] On this theme see the seminal work of Antonio Delfim Netto, *O Problema do Café no Brasil* (São Paulo: IPE-USP, 1981), chap. I a IV. In various parts of this section devoted to interventions in the coffee market, we have used the work of Delfim Netto.

[8] Ibid., chap. I a IV. [9] Ibid., chap. II.

[10] The stockpile of coffee bags was 11 million bags for a consumption of 16 million. And the initial estimate of the 1906/1907 harvest was 16 million, but production reached 20 million bags. There was no place to offer a crop of this magnitude. As previously noted, coffee trees began to produce only at 4 years of age and continued to produce for some 20 to 30 years, and sometimes even as much as 50 years. Thus, although the crisis was evident, the production did not depend on current decisions, but plantings made at