



ISSN: 2452-5162

HAAL

Historia Agraria de América Latina

<https://doi.org/10.53077/haal.v3i02.127>

The emergence of Brazil as the Leading World Exporter of Chicken Meat

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Received: 07 February 2022 • **Accepted:** 21 June 2022

HAAL is published by the Centro de Estudios de Historia Agraria de América Latina – CEHAL (<https://www.cehal.cl>)



Abstract

The growing wealth of the world in the past seventy five years has led to an increasing demand for cheap animal protein. While the modern chicken meat or broiler industry was first developed in the United States and Western Europe, it is Brazil which today is the primary world exporter of broiler chickens. We examine the origin and growth of the industry in Brazil, and explain how and why it emerged as the leading world export of broiler meat in general and of halal chicken meat in particular.

Keywords: Meat, Chickens, Brazil, International Trade, Government Economic Policies

La emergencia de Brasil como principal exportador mundial de carne de pollo

Resumen

La creciente riqueza en el mundo en los últimos setenta y cinco años ha llevado a una cada vez mayor demanda de proteína animal barata. Mientras que la moderna carne de pollo o la industria *broiler* fue desarrollada primero en los Estados Unidos y Europa Occidental, hoy es Brasil el principal exportador de pollos *broiler*. Este artículo examina el origen y expansión de esta industria en Brasil, explicando cómo y por qué este país ha emergido como el principal exportador mundial tanto de carne de pollos *broiler* en general, como de carne de pollo *halal* en particular.

Palabras clave: Carne, pollos, Brasil, comercio internacional, políticas económicas.

Introduction and Methodology

How and why Brazil became the world's leading chicken meat exporter is the basic question asked in this essay. We examine the origin and evolution of the industry in Brazil, and how and why it emerged as the leading world export of broiler meat in general and of halal chicken meat in particular by the twenty first century. The methodology used to examine this question is based on an extensive documentary and statistical review of information on the poultry industry in Brazil from the mid twentieth century to the present, supported by a long-term vision that allows us to observe the different stages through which this industry has passed. It uses a regional historical approach and takes as fundamental variables: the change and displacement of

production regions over time; the introduction of value chains; the characteristics of the type of birds grown and marketed; the dynamics between production for the domestic and foreign markets; and finally the characteristics of the type of producers. It also considers other intervening variables such as the relationship between the government and producers, production practices, and the volume and value of output. It also seeks to explain the current success of the industry in international markets.

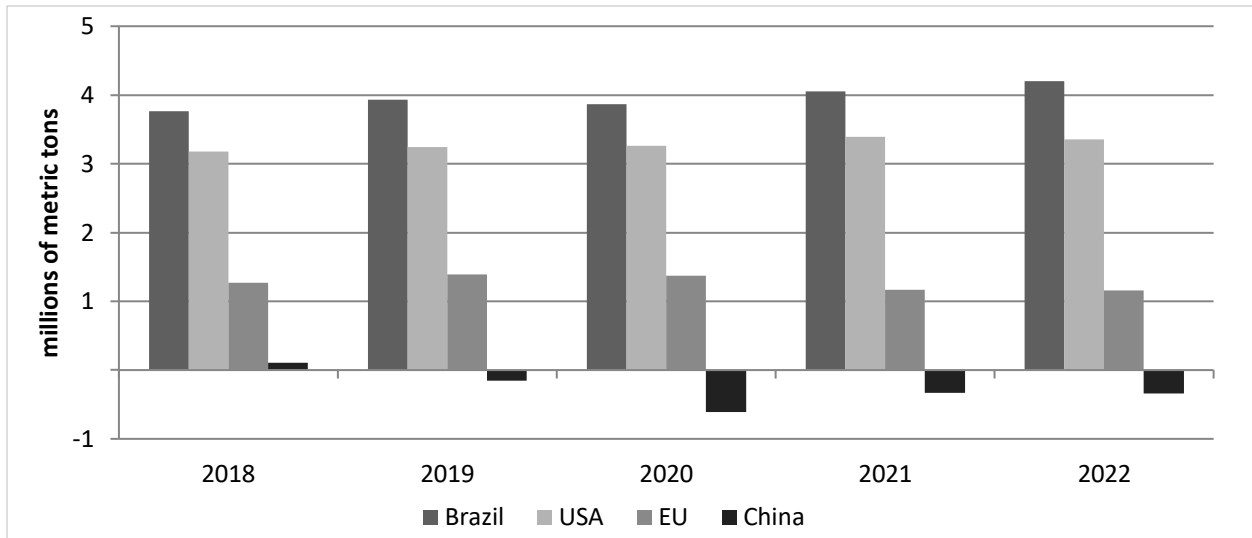
The Position of Brazilian Exports in the World Market

The growing wealth of the world in the past seventy five years has led to an increasing demand for cheap animal protein. It was chicken meat that met this demand due to the creation of a modernized and industrial style industry. Although the modern poultry industry was first established in the United States and Western Europe in the mid 20th century, today over half of the world's chicken are produced in developing countries, of which Brazil, China and India are the leading producers.¹ In the past quinquennium (2018-2022) the USA accounted for an estimated 20.6% of world production, and Brazil became the second largest producer accounting for 14.3% of total world poultry flocks just ahead of China.² But the USA was also the largest consumer of chickens, which meant that only some 16% of its production on average went for exports, whereas China was a net importer as the world's second largest consumer. Brazil, in contrast, despite being the third largest consumer of chicken meat in the world, was still able to export on average 28% of its production in this period and as early as 2004 replaced the United States as the world's largest chicken meat exporter (USDA, 2006). Of the other major producers only the European Union was able to satisfy their internal markets and also become a major exporter (see graph 1). China was always primarily a major importer, and already by 2010 Brazil had replaced the United States chicken meat exports in the Chinese market (USDA, 2017: 24).

¹ The OECD-FAO estimates that in 2018-2020 some 60% of world chicken meat production and 62% of world consumption of this meat occurred in countries of the developing world. "Table C4 World Meat Projections 2021-2030," accessed 1/1/2022 and found at https://www.oecd-ilibrary.org/agriculture-and-food/data/oecd-agriculture-statistics_agr-data-en

² USDA, *Livestock and Poultry, World Markets and Trade, October Oct 2021*: 4-5. The data for 2022 estimated production is from October 2021. In October 2021 the USDA shifted from reporting broiler chicken meat data in 1,000 Metric Tons (Ready to Cook Equivalent) to 1,000 metric tons carcass weight equivalent. The difference between these two rates varied by year between 39% to 43% in the years 2016-2020 when both figures are available making precise comparisons difficult between pre and post 2021 data. The ready to cook weight was defined as "dressed poultry, without feathers, head, feet, and most internal organs[and] includes neck and giblets." <https://www.ers.usda.gov/data-products/food-availability-per-capita-data-system/glossary/#boneless>. The carcass weight measures "the weight of skeletal muscle and bones after the other parts listed above have been removed. Also, for boneless meat products, the conversion factor "adds back" the weight of the bones removed from that portion of the carcass." <https://www.ers.usda.gov/data-products/livestock-and-meat-international-trade-data/documentation/>

Graph 1: Exportable Surplus (Production less Consumption) of World's Largest Chicken Producers, 2018-2022



Source: USDA, Livestock and Poultry, World Market and Trade, January 2022: 13-14

Origin of the Modern Broiler Chicken Industry in the United States

The broiler chicken industry was the first livestock industry to industrialize. This first occurred in the United States in the 1920s and was fully developed by the 1950s. The first broilers were male chickens that became redundant after the egg laying hens were produced and were sold for meat. The first exclusive broiler farm with 50,000 birds appeared in Maryland in the 1920s, and in 1937 Swift created the first broiler slaughter house. In 1926 vitamin D was synthesized permitting indoor growth of broilers. Then in 1933 the US government provided major support for the modernization of poultry production.

But initially the farmers sold their broilers on the spot market, with producers selling their animals after they had been raised. Production grew quickly during WW II as chicken meat was not rationed nor price controlled, so production expanded dramatically. Then in the 1950s a new system based on vertical integration of producers began to emerge. This was initiated by the major animal feed producers who began to supply the feed, the day old birds and the technical expertise for local farmers who grew the birds and delivered them to the feed companies, who in turn sold them on to the meatpackers. The farmers usually were poor small landowners and thus willing to abandon normal farming to concentrate on broiler meat production. In the United States the Southern states were the poorest in the nation which explains the concentration of the industry in this region.

Vertical integration meant that the feed companies expanded at both ends of the production chain, buying and creating both hatcheries and slaughterhouses. By the early 1960s some 90% of the broiler chickens were produced in this contract system and only 10% were sold on the spot market. Breeds were improved, technology was applied to housing and feeding and eventually the final weight of broilers doubled and their period of growth was reduced from 70

to 50 days. This enabled chicken meat to seriously compete in price to all other meats and it became the lowest priced meat on the national market (Constance, 2008; Constance et al, 2013; Boyd, 2001). Finally there was a shift from providing whole chickens, to a sophisticated market for body parts which required an entirely new processing industry.

In turn the breeding of chickens for either egg or meat production became a highly specialized separate industry due to the development of new breeds through hybridization and genetic manipulation that was essentially controlled by North American and European producers. The birds created for specific characteristics were the great grandparents, their offspring (the grandparents) were called the multiplier flocks which in turn produced the birds sold to the hatcheries. It was these fourth generation birds that produced the eggs for the hatcheries. These flocks could produce the needed eggs for meat and egg production, but the quality of their offspring declined with each breeding. Thus, breeders had a lock on production, as only pure breeds (the great grandparents and grandparents) could produce the desired animals grown for the specialized broilers and layers (Bugos, 1992). Given the constant genetic engineering involved, many of these breeding companies eventually were taken over by the big international biotechnology firms which franchised their animals throughout the world (Narro and Fuglie, 2000; Narrod, Pray and Tiongco, 2008).

The Origin and Evolution of the Modern Broiler Chicken Industry in Brazil

The production of chickens evolved slowly in Brazil. In many ways the evolution of chickens followed a pattern similar to other European animals imported into the New World. Chickens were introduced into the Americas by the Portuguese and Spanish colonizers, and were eventually ubiquitous in all rural and even urban areas from colonial times until the 20th century (Storey et al, 2012). Chicken meat was a locally consumed product everywhere and many households kept hens for their egg production. The stock of poultry was in fact growing quite significantly even before the introduction of modern production methods. In 1920 Brazil counted some 53 million birds, which increased to 63 million in the census of 1940 and some 78 million in 1950 for a growth rate of 2.8% per annum between 1920 and 1960.³ Already by the census of 1960 there were indications of a new system of farm production emerging. Although the average farm had 53 chickens, in the southeastern states there was already significant difference, with the average for São Paulo producers already reaching 100 chickens per establishment (see Table 1).

³ Brasil, *Censo Agrícola 1960*, Série Nacional, vol. II, 2a parte: 116, tabela IX.

Table 1: Number of Chickens in the Census of 1950 and by Region and Principal State, 1960 Census.

Regions/States	Farms	No.of Animals
North	79.625	4.037.476
Northeast	954.125	30.651.158
Southeast	614.868	49.975.381
South	713.822	40.078.886
Center-West	132.849	7.532.297
Brasil	2.495.289	132.274.998
São Paulo	226.998	22.712.950
Rio Grande do Sul	345.808	19.052.252
Minas Gerais	293.693	17.716.439
Paraná	223.087	12.730.761
Bahia	262.719	7.285.252
Pernambuco	180.389	4.993.136
1950 Census	1.656.809	77.830.259

Source: Censo Agrícola 1960, Série Nacional, Vol. II, 2a parte, p.31, table 27; Censo 1950 Série Nacional, Vol. II, Censo agrícola, p.53, table 41.

Although chickens were grown for local consumption since the earliest colonial period, the Brazilian broiler industry only began in the 1940s. São Paulo farmers introduced the Leghorn race in 1940, and the Hampshire breed was introduced in 1947. By the 1950s farmers with government support were importing breeding stock and chicks (pintos) from the United States. In the next several decades international breeding companies from all over the world established branches in Brazil. At the same time, Brazilian company research groups and universities established breeding and genetics programs. In 1960 the US breeding company Arbor Acres set up a branch in Brazil, with other European and Canadian companies quickly following. A key development in this processes occurred in 1965 when Brazil prohibited the importation of chicks and matrices or parent breeders, thus guaranteeing local production of these two key groups of animals and encouraged the establishment of international breeders in Brazil.⁴

⁴ By the 1960s Brazil was importing breeding stock and chicks from France as well as the United States. In 1970 the government prohibited the importation of chicks and parent breeding stock and only allowed the importation of primary breeders (the great grandparents). Celso de Jesus Junior, Sergio Roberto Lima de Paula, José Geraldo Pacheco Ormond, and Natália Mesquita Braga, *A cadeia da carne de frango: tensões, desafios e oportunidades* (Brasília: BNDES, 2007): 196. It should be noted that the more advanced countries of Europe also adopted the US practices at around the same time as Brazil. See Andrew Godley, “The emergence of

In the 1970s the newly established Agricultural Faculties at state and federal universities and the national research foundation EMBAPA, set up special poultry breeding programs all financed by the Federal government. Finally in 1985 the innovative Granja Guanabara in Rio de Janeiro, which had been a leader in breeding since the 1950s, was purchased by the government and joined Embapa. By 1980 there were 32 breeding companies in residence producing breeding stock (matrizes) for local farmers, of which only three were Brazilians. In this decade, an average of 250,000 purebred birds (great grandparents) per annum were being imported. These imported birds in turn were mated for desired characteristics and produced grandparent purebreds with the desired traits. These in turn produced 12 million parents (matrizes) who produced on average of 1.2 million broiler chicks, known as pintos de corte (Rizzi, 1993, p.86 table 16; Espindola, 2012, pp. 94-98). The Swine and Chicken branch (Suínos e Aves) of Embrapa in 1975 was able to create a new breed called Embrapa². Two other Brazilian developed breeds were the Chester and the Ag Ross. Both were developed by Brazilian companies with the collaboration of foreign multinationals. The Chester was developed by Perdigão with the help of Tyson and was created from a mixture of seven imported purebred lines, and the Ag Ross was created by the Brazilian company Agroceres with Aviagen.⁵

Since these broiler chickens and those producing eggs were cross bred from pure genetic lines it was impossible for their descendants to maintain the quality of the original purebred lines, thus the original foreign breeder companies were protected from competition.⁶ Most of these international companies aligned themselves with local producers. Arbor Acres was represented in Brazil by Sadia, the Scottish Breeder Ross by Agroceres, and the Tyson Cobb company from the United States by Perdigão. While most of the great-grandparent birds were imported, Tyson Foods in 2001 appears to be the first to set up a local farm producing these purebred animals (Rizzi, 1993, p. 75; table 14).

Role of Government in this Process

In the 1960s a major government investment began in the Broiler industry which was instrumental in modernizing the industry. An essential reason that the various Brazilian

agribusiness in Europe and the development of the Western European broiler chicken industry, 1945 to 1973," *Agricultural History Review*, 62, no. 2 (2014): 315-336.

⁵ Jesus Junior, et al, *A cadeia da carne de frango*, 197, table 1. On the origin of the special Embrapa institute established in Santa Catarina to deal with chickens and pigs, see <https://www.embrapa.br/en/suinos-e-aves/historia>. Currently there are two dominant breeds used in Brazil: the Cobb types accounts for 60% and Ross chickens for 35% of these broiler poultry Goga, Sumayya and Teboho Bosiu. 2019. "Governance of poultry value chains—a comparative perspective on developing capabilities in South Africa and Brazil," (Johannesburg: CREED, IDTT and SARChI Chair, 2019): 7, table 1

⁶ The great grandparents are created from a male and female of one pure stock (A). They give birth to a new bird which is crossed with a bird from another pure line (Male a x Female b) and these are the grandparents. They in turn produce a new male or female bird, the parent birds called a matriz which combines lines A & B. These parents are then bred with another crossed breed C & D of the opposite sex. These matriz birds produce the eggs which are the broiler chicks (or *pintos*) which thus have 4 purebred lines (ABCD) in their genetic makeup. See Jesus Junior, et al., *A cadeia da carne de frango*: 195 figure 1.

administrations were willing to provide such support for this industry was the impact meat prices had on the price index. Especially under the military governments (1964-1985) there was a basic policy of reducing consumer prices so as to contain worker wages. Given the impact that the cheaper chicken meat would have on the cost of living index, this new industry was actively promoted since it could provide meat far less costly than beef (Sorj, Pompermayer, and Coradini, 2008). The military governments of the period thus wanted to develop a national broiler industry. It was thus willing to invest heavily in farming in general and in the chicken industry in particular though offering below market credit, state agricultural research, and subsidization for the latest techniques and machinery needed to develop this industry.

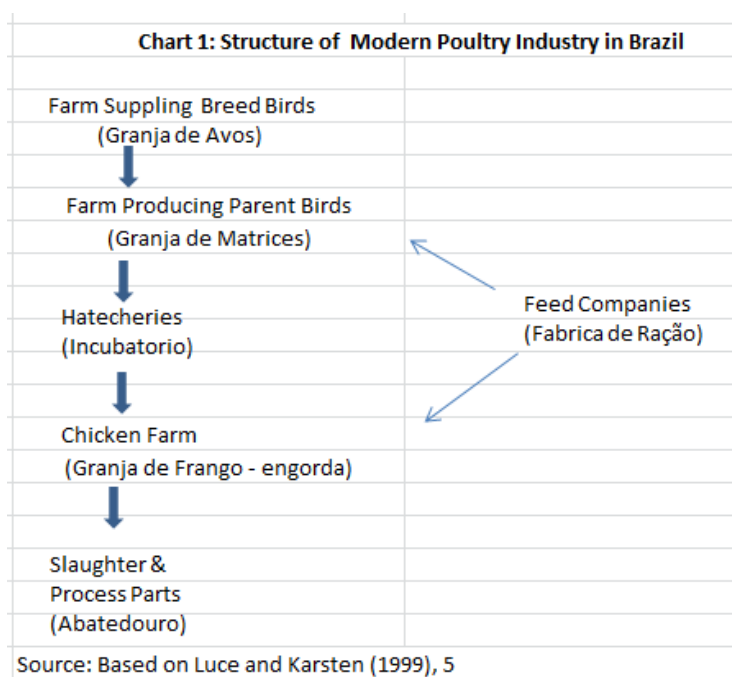
For the industry to meet growing demand there was also the need to adopt new business practices in farming, shifting from a spot market to the evolution of contract farming whereby processors of meat or feedstock companies provided the inputs for farmers to produce quality animals, with the grown animals given to the feed or processing companies. But the industry also needed government subsidized credit, the introduction of imported breeding stock, and construction of new abattoirs to produce parts of chickens and the marketing of final products to consumers and much of these activities were subsidized by the government. It also introduced price controls and stock purchasing to guarantee farmer incomes (Klein and Luna, 2018).

Arrival of Foreign Feed and Breeding Companies

In the 1960s the first international companies providing animal feed arrived in Brazil. The US companies Purina establishing a center in São Paulo in 1967, Cargill arrived in 1970, and the Swiss Company Roche in 1972 (Espindola, 2012, pp. 99-101). Another group of providers were Brazilian feed companies who were mostly granaries that processed cereals. It was Purina that started to provide free feed for contracted chickens, as it had done in the United States. By the end of the century the pattern was for the application of 2 kg of cereal feed to produce 1 kg of meat with the final chicken ready within 50 days of birth. Of this feed, made up of grains, vitamins, and medicines, the grains were the costliest ingredients, with maize accounting for 65% of the cost of this feed, and soybean meal or cake another 20%. Thus, the evolution and the cost structure of the broiler industry were closely tied to maize and soybean production and its evolution in Brazil (Jesus Junior, Paula, Ormond, and Braga, 2007, p. 201, table 2; Klein and Luna, 2021). In fact most of the maize dedicated to animal feed went to chickens. It was the international companies that were crucial in providing the chemical and biological inputs to guarantee the health of the broiler chickens. These included such international companies as Roche, Pfizer, Rhodia, Hoechst, and Bayer which established local branches in Brazil in the 1970s and 1980s, but also a local Brazilian company called Tortuga which became the leading producer of vaccinations (Espindola, 2012, pp.102-103).

Thus, either produced locally or imported were the purebred grandparent birds, who in turn produced the breeding stock (matrizes). This second unit produced the specific eggs, either for meat (broilers or de corte) or for egg production (laying hens or de postura). These parent eggs were then sent to a hatchery to be grown into day old chicks, which were then vaccinated

and sold to chicken farmers who bred them until they reached a given weight, at which time they were given (under contract) to the packinghouses which slaughtered, cleaned and cut the chickens into the desired parts. Under the vertical contract system, the Feeding Houses, the Slaughter/Packaging Companies, or a producer coop offered the chicken farmer a contract in which they would supply the chicks, feed, premixes, and medicines to the farmer who would in turn be required to give all his birds to the processing company, the feed company, or the coop which supplied all the original inputs. This vertical integration chain model can be seen in chart 1. It sometimes occurred that one organization owned both the feeding company and the processing plant. This was the case of the LAR cooperative of Paraná which had several feed operations in the state, Santa Catarina, Mato Grosso and Paraguay and ran a slaughter house which processed 300 thousand chickens per day (Ben and Wizniewsky, 2021).



As in the case of the United States, the growing of broiler chickens was primarily done on relatively small farm units. Production was organized into newly designed thousand bird sheds which used limited space, since these animals were less dependent on climate and soils given their feeds and medicines. The volume of birds produced could be substantial even on a relatively small farm in terms of the number of hectares it owned.

In the early period of the broiler industry live weight was more important than carcass yield. But basic changes in the meatpacking sector in the 1980s which involved automation of poultry cuts and packaging and the introduction of electronic weighing, led to carcass weight being more important than live weight. This led to the introduction of new breeds of birds adopted to these new production methods. These breeding programs have produced a major change in these animals and it is estimated that since the mid 20th century the body mass of broilers has increased by a factor of 5 (Bennett, et al. 2018). [Paco I moved this sentence here

from the section on JBS and BRF] Meatpackers now shifted from supplying whole animals, to producing cut up parts of chickens both boned and deboned. This packaging of chicken parts began in Brazil in 1985 and soon dominated local production. This required the introduction of new chick types with high meat yields of parts and better feed conversion ratios. It also led to specialized exclusive broiler chicken slaughterhouses which required new improved equipment to cut and package the parts (Patricio, Mendes, Ramos, and Pereira, 2012, p. 234; Rizzi, 1993, p. 40).

The Evolution of National Consumption

The social and economic transformation of the 1970s and 1980s was the driving force for the modernization of the chicken industry in Brazil. The massive migrations of rural populations to urban centers led to the rising demand for cheap meat to feed these expanding urban populations. Given its declining costs, this meant that chicken meat began replacing beef in national consumption. In 1970 beef consumption was 22.2 kgs per inhabitant compared to just 3.3 kgs per inhabitant for chickens, but by 1990 beef was down to 12.5 kgs per inhabitant and chicken was up to 13.4 kgs per inhabitant. By 2010 national consumption of chicken meat reached 44 kgs per inhabitant a figure roughly the norm to the present day. Prior to 1970 there were only 4 meatpacking plants devoted to processing chickens, in the 1970s this increased to 80 such companies and 32 more were added in the 1980s. By this later decade some 32 of the largest *frigoríficos* could process 3,000 birds per hour.⁷ At the same time feed costs kept declining as national production of maize and soybeans kept increasing from the 1980s onward. Along with the growth in volume, there was a growth in efficiency of production. Whereas in 1960 it took 2.2 kilos of food to produce a 1.6 kg broiler in 56 days, by 2010 it took 1.8 kilos of feed to produce a bird weighing 2.3 kilos in just 41 days from birth (Costa, Garcia, and Brene 2015, p. 322; table 1). By 2021 the average broiler chickens reached 3.0 kilos and could be produced with just 1.7 kilos of feed (Talamini, 2022, p.15). Finally the use of inoculations and other sanitary programs resulted in a long term secular decline in chick mortality (Goga and Bosiu, 2019, p. 13, table 2).

As in the case of the United States, the increasing industrialization of chicken production would be based on a complex contract system between the suppliers of day old chicks, the farmers who grew chicken for meat consumption, the feed companies and the slaughterhouses. In contrast to the North American experience, the initial prime movers in the creation of these vertical chains were the meatpacking companies who were supported by cheap government credit. Whereas the meatpacking plants throughout the first half of the 20th century were owned by foreign multinationals, by the second half of the century most of these foreign owned

⁷ Rizzi, "Mudanças Tecnológicas e Reestruturação da Indústria," 61, 63, tabelas 8 and 9. The consumption data from 2010 comes from ABPA [Associação Brasileira de Proteína Animal], Estatístico do Setor found at <https://abpa-br.org/mercados/>. From 2010 to 2019 average consumption was 43.2 kgs, see ABPA *Relatório Anual_2020*: 30.

companies had sold their plants to Brazilian companies. Among these Brazilian based companies, the key producers of chickens and of swine meat were Sadia, Perdigão, Chapecó, FrangoSul and Seara of the Grupo Hering (Belik, 1992, p.44). The first of such totally vertically integrated chicken producing chains, was introduced by Sadia in 1964 in the city of Concordia, Santa Catarina and was modeled on the vertical integration system Sadia had used for pork farmers (Freitas and Bertoglio, 2001, p. 102). This system soon dominated local swine and chicken production in this crucial southern state. As this system developed, these slaughtering companies supplied the producers with their animal stock, the needed feed, chemicals and finally provided technical assistance. In turn the farmers delivered their entire stock of animals to Sadia, which processed, packaged and sold the final product.

By the 1970s these vertical chains were established with strong government support in all regions and were organized both by cooperatives as well as private meatpacking companies. By 1977 it was estimated that 95% of the chickens slaughtered in Santa Catarina had been obtained via this vertical chain and only 5% were sold on the spot market (Sorj, Pompermayer, and Coradini, 2008, p. 26). Chicken farmers in the three southern provinces of Paraná, and Rio Grande do Sul and Santa Catarina essentially only used these vertical chains. The big chicken producers in the state of São Paulo initially remained independent of these vertical production chains even though they contained some of the largest of meatpackers concentrated on chicken production.

The next phase in this evolution of the poultry industry in Brazil would occur in the late 20th and beginning of the 21st century with the rise of the Center-West as the new heart of soybean and maize production. This in turn led to the migration of the major chicken producer companies to the Center-West states of the nation. In 2005 Sadia, which had been founded in Santa Catarina in 1944, established a major meatpacking plant in Lucas Rio Verde, a key center of soybean and corn production on the BR 163 highway in Mato Grosso, and another *gaúcho* company, Perdigão, founded in Santa Catarina in 1934, opened up a plant in 2005 in nearby Nova Mutum off the same highway. In 2009 these two companies were joined into the BFC (Brazilian Food Company), the second largest meat exporter in Brazil and the world's tenth largest food company.

The Transition to a Free Trade Model

There was systematic investment by the national government in these breeding activities until the 1990s when the national government transitioned from using an import substitution industrialization model, to adopting a liberal free trade system. At the same time, local companies stopped their laboratory work and relied on the major international breeders who had established themselves in Brazil. Although the 1990s were a difficult transition period for Brazilian farmers, the chicken industry had already reached a level of growth which enabled it to turn toward the private credit market to survive. Also thanks to the growth of soybeans and corn, it had a comparative advantage in animal feeds, since soybean meal was the principal

protein source and corn the principal energy source for growing these animals. Only premixes, the third ingredient in animal consumption, were still imported.⁸

Although most government support ended after 1990, new government support would return in the current century when the Brazilian National Development bank (BNDES) decided to promote national meat producing companies. Today most of these breeding companies along with the processors have come under control of two Brazilian companies JBS and BRF. Both of these companies began in the beef industry. JBS was founded by José Batista Sobrinho in Goiás in 1953 and with government loans and support from the BNDES expanded both in Brazil and overseas, buying US meat companies Swift (2007) and Smithfield Farms (2008) and the world's largest chicken processor Pilgrim's Pride in 2009. It eventually expanded in Europe, Canada and Australia and also purchased leading Brazilian competitors, such as Seara, the French owned Frangosul and the Tyson operation in Brazil. BRF was founded in 2009 with the merger of the two Santa Catarina companies, Sadia and Perdigão. At the time of its amalgamation, Sadia was the largest Brazilian poultry processor. Today JBS and BRF account for 70% of Brazil's chicken exports and just under half of all the chickens slaughtered.⁹ Currently the only breeders not owned by these companies, are Aviagen (Arbor Acers and Ross) Hybro and Isa (Hubbard) (Jesus Junior, Paula, Ormond, and Braga 2007, p.197).

Current Structure of the Industry and its Regional Distribution

It was in the late 20th century that a modern chicken industry arose in Brazil as it did in much of the world, which turned production of chickens into a modern industrial activity with hundreds of thousands of birds being raised for slaughter or egg production on specialized poultry farms. By the agricultural census of 2006 two thirds of chickens were resident in farms that produced no other products, with the ratio being 90% in the state of São Paulo. The average chicken farm in the Southern state of Paraná, the largest producer, contained 466,000 birds, and those of São Paulo, the second most important state, held on average 229,000 birds.¹⁰ By the agricultural census of 2017 the 1.3 billion chickens being raised in Brazil represented 83% of all animals in the country's farms and ranches, despite the fact that Brazil by this date was the second largest cattle population in the world.¹¹ Chicken producing farms were averaging 478 animals per establishment nationally and those of the Southern region were averaging 1,265 chickens on its

⁸ Together these three feeds account for half to 60% of the cost of raising broiler chickens. Henry and Rothwell, 1995, p. 10.

⁹ For the history of JBS, <https://jbs.com.br/sobre/nossa-historia/>. On the history of the two companies that founded Brazilian Foods (BRF) see Zanela, 2019 and for the creation of BRF see <https://www.brf-global.com/sobre/a-brf/nossa-historia/>, both accessed January 3, 2022; and A. Campos, "Brazil's Poultry Industry (2016) techreport" accessed January 3, 2022 at https://reporterbrasil.org.br/wp-content/uploads/2016/07/Monitor2_ENG.pdf.

¹⁰ IBGE, Sidra, tabela 946

¹¹ https://censos.ibge.gov.br/agro/2017/templates/censo_agro/resultadosagro/pecuaria.html; and USDA, 2021, p.6.

half a million chicken farms.¹² The most outstanding large producer was the Southeastern state of São Paulo which averaged over 3,404 chickens per establishment. Paraná was second with an average of 2,041 chickens of all types, and Santa Catarina with 1,455 animals. Unusual was the Federal District, which had just over 2,000 chicken farms which averaged over 4,000 birds per farm.

Although private commercial companies would become important in this livestock sector, the family farms remained an important element. Family farms in the agricultural census of 2017 represented 80% of the farmers producing chickens and had a significant 46% of the stock of chickens. Of course, the commercial producers were generally much larger and averaged 1,312 chickens per unit, while the family farmers averaged just 272 chickens per farm.¹³ But it is worth noting that in the three southern states, and especially in Paraná, family farms were more important than they were nationally (see Table 2). Moreover in the three southern states family farms contained the majority of the chickens, even though the average size of their flocks was smaller than the commercial farms. In the Southeastern and Central-West states the commercial farms dominated production.

Table 2: Importance of Family Farms in the Key Producing States in the Census of 2017

Region/State	Farms		Chickens	
	Commercial	Family Farms	Commercial	Family Farms
<i>Southern Region</i>				
Paraná	32.835	130.460	159.071.345	174.218.266
Santa Catarina	18.670	91.475	41.440.761	118.819.554
Rio Grande do Sul	33.888	205.269	32.753.050	122.088.721
<i>Southeast Region</i>				
Minas Gerais	79.134	262.494	78.712.708	33.939.776
São Paulo	14.441	37.719	123.962.357	53.607.710
<i>Center-West Region</i>				
Goais	33.640	68.642	72.432.434	19.112.680
Mato Grosso	19.758	54.002	42.612.447	10.839.723
Brazil	565.614	2.281.956	742.187.294	620.066.215

Source: IBDE, Sidra, tabela 6907

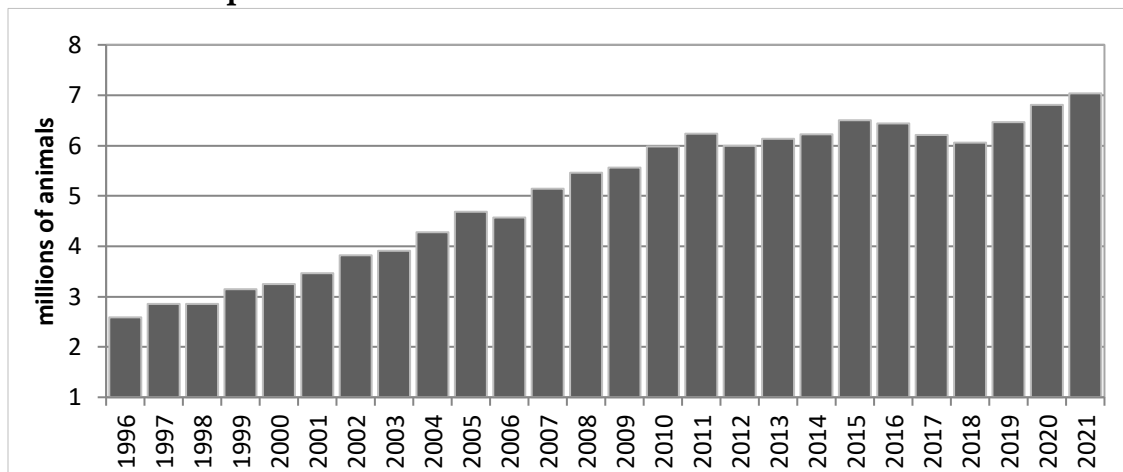
The number of meat producing chickens grew steady from 2.5 billion animals in 1996 to 6.8 billion by 2021, which indicated a growth rate of 4.1% per annum, in this period (see Graph 2).

¹² Unfortunately the census does not break down the division between broilers, or meat birds, and layers, or egg producing ones.

¹³ IBGE, Sidra, tab 6624. The data in this table includes all farms, including those unknown as to their status as commercial or family farms.

In turn, the production of poultry meat doubled from 4 million tons in 1996 to 8 million tons in 2004, and by the end of the second decade of the twenty first century settled to a constant 12 to 14 million tons. Although Brazil was the second largest consumer of chicken meat in the world, its per capita consumption put it in the middle range of countries in terms of consumption. In an estimate of per capita consumption in 2010, the world leaders were the countries of the Middle East, with Kuwait and the United Arab Emirates consuming over 60 kgs (of ready to cook) chicken meat per capita, with Hong Kong, the US, Brazil and Saudi Arabia in the 40 kg per capital range, most of the Latin American countries and Australia in the 30kg range , the EU-27 at 18 kgs and India the lowest at just 2.3 kgs per capita (USDA, 2010). Thus of the almost 14 million tons of broiler production in Brazil in 2020, 69% were internally consumed and 31% exported (ABPA, 2020, p. 37). This allowed for a very solid growth in exports and even a more spectacular growth in national consumption, which went from an estimated 22.1 kilos per person per year in 1997 to 49.7 kilos in 2021 (see Graph 3). By 2021 Brazil earned US\$ 6.9 billion dollars for the 4,2 million metric tons of its poultry meat exports.¹⁴

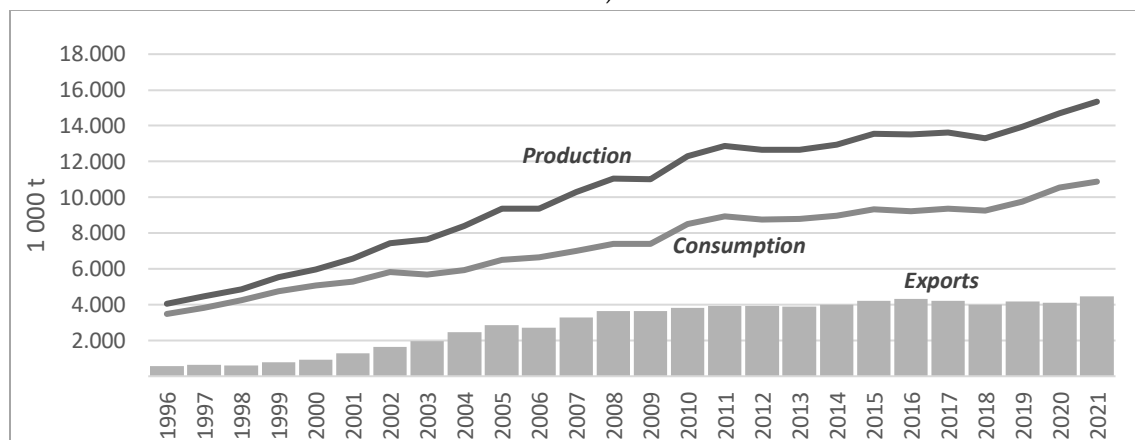
Graph 2: Growth of Meat Chickens in Brazil from 1997-2021



Source: CONAB, “Oferta e Demanda de Carnes - Nov 2021,” found at <https://www.conab.gov.br/info-agro/analises-do-mercado-agropecuario-e-extrativista/analises-do-mercado/oferta-e-demanda-de-carnes>

¹⁴ The export of Soybeans in 2021, ranked second to iron ore in the total value of Brazilian exports, followed by Petroleum. Fourth most important exports were animal meats, valued at US\$ 18.2 billion. Of this total of meats, child and frozen beef was valued at US\$ 7.9 billion and Chicken exports at US\$ 6.9 billion value which was roughly equal to the value of cellulose exports in this year. MDIC, “Exportação brasileira”2020-2021 “Produtos por ISIC: acumulado” accessed Jan 10, 2022, found at <https://www.gov.br/produtividade-e-comercio-exterior/pt-br/assuntos/comercio-exterior/estatisticas/balanca-comercial-brasileira-acumulado-do-ano>

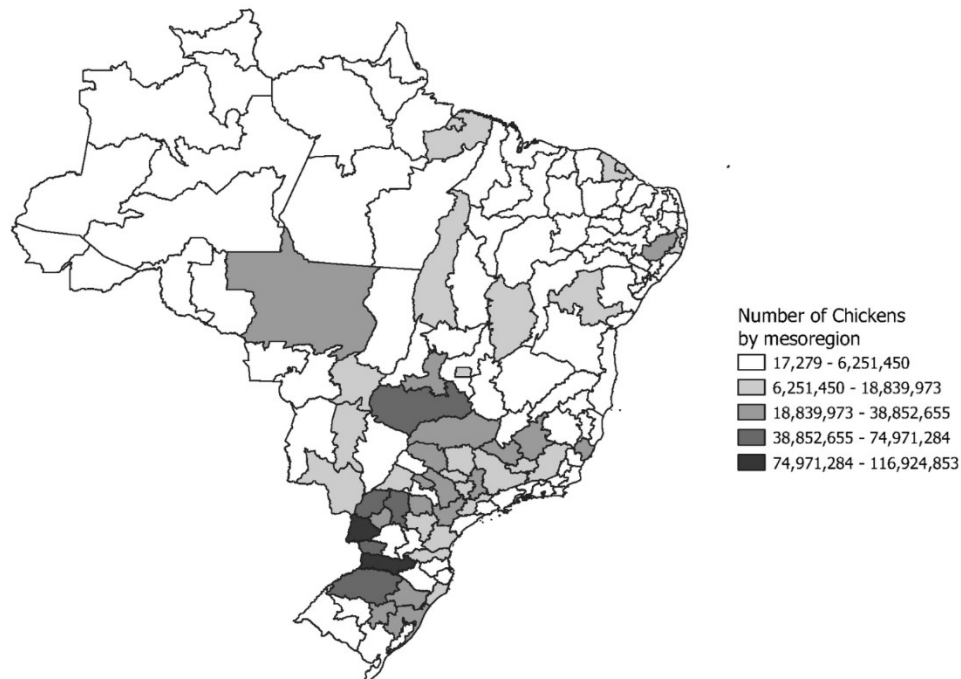
Graph 3: Production, Export and Internal Consumption of Poultry Meat, 1996-2021 (in metric tons)



Source: CONAB, “Oferta e Demanda de Carnes - Nov 2021, found at <https://www.conab.gov.br/info-agro/analises-do-mercado-agropecuario-e-extrativista/analises-do-mercado/oferta-e-demanda-de-carnes>

Although the three southern states and the two Southeastern states of São Paulo and Minas Gerais still dominated chicken meat production in the late 2010s, the second decade of the century saw the growth of chicken production in the Center-West states of Goiás and Mato Grosso do Sul. The leading state producers of all types of chickens were Paraná, São Paulo, Rio Grande do Sul, Santa Catarina, and Minas Gerais. By 2019 the distribution of farms producing chickens of all types showed the same approximate distribution as it had in the mid 20th century. Moreover, production of broiler chicks (pintos de corte) averaged just over 6 billion birds per annum from 2016 to 2021 with only modest yearly variation.¹⁵ The major difference was the growth of production in Goiás and Mato Grosso, two zones which only emerged in the twenty first century as significant producers (see Map 1).

¹⁵ Data by month as well, shows little variation. Statistics found 1/6/2022 at <https://www.avisite.com.br/estatisticas-precos/>

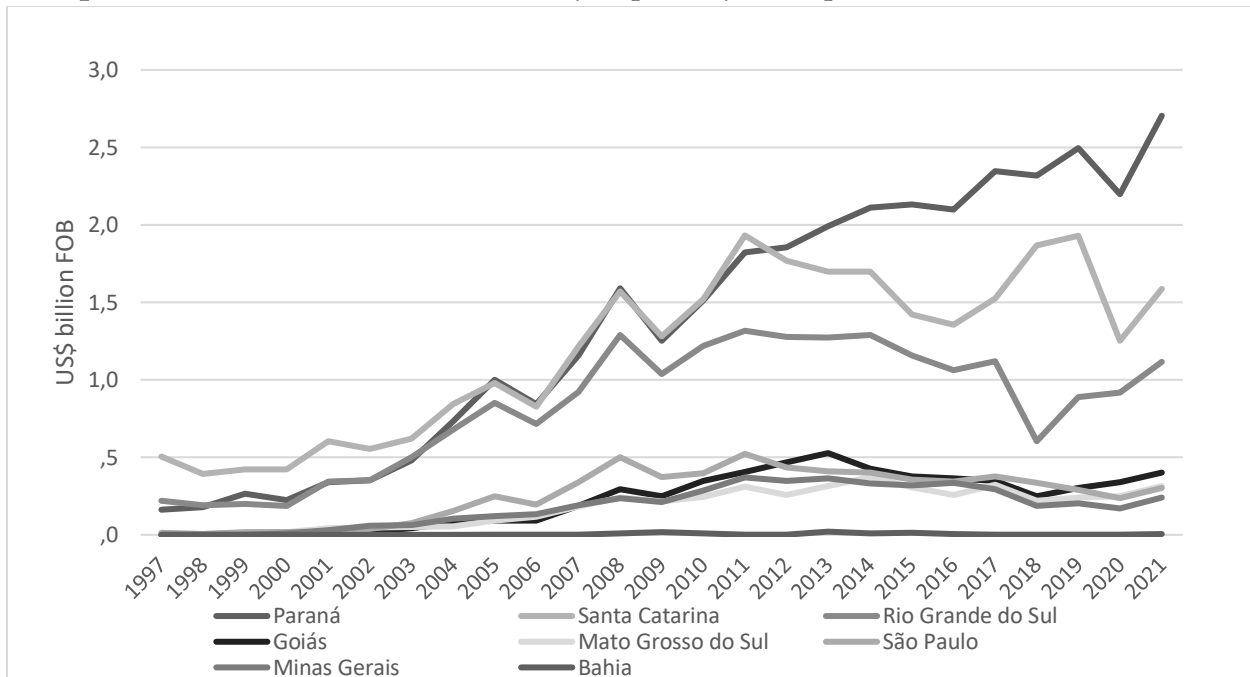
Map 1: Number of Chickens by Mesoregion in Brazil in 2019

Source: IBGE Bases Cartográficas sidra, table 3939.

Growth of an Export Industry

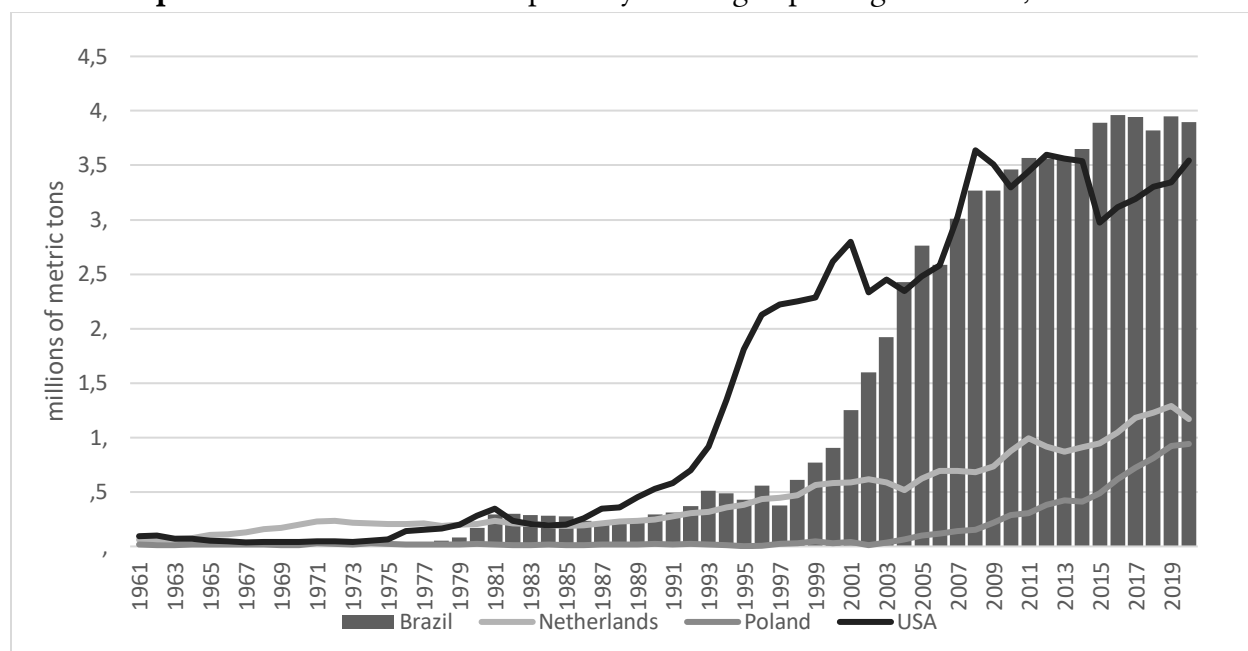
Just as the three southern states of Paraná, Santa Catarina and Rio Grande do Sul were the dominant producers and processors of chicken meat they were also the dominant states exporting chicken. From the beginning, they were the leading exporters of broiler chickens. Paraná exported some 2.7 billion dollars' worth of chicken meat, and Santa Catarina 1.6 billion US\$ in 2021, and Rio Grande do Sul 1.1 billion US\$. São Paulo a big producer, only exported US\$ 300 million, as much more of its output was domestically consumed. In fact, of the 14.3 million tons of broiler chicken meat produced in 2021, 68% was consumed by the domestic market and 32% exported (ABPA, 2022, p.42). In turn, the Center-West states of Goiás and Mato Grosso do Sul were slowly increasing in importance as exporters, though the region still accounted for less than a fifth of the value of all exports in the latest period (see Graph 4). The three states of the Southwest region systematically accounted for four fifths or more of exports from 1997 to the present, averaging 80% in the quinquennium from 2017-2021. The value of their combined exports rose from US \$ 880 million FOB in 1997 to US \$ 5.4 billion FOB in 2021.¹⁶

¹⁶ COMEXSTAT using SH4 Code 0207, accessed December 29, 2021 and found at <http://comexstat.mdic.gov.br/en/geral>, and

Graph 4: Growth of Value of Meat Poultry Exports by Principal States, 1997-2021 (US\$ FOB)

Source: COMEXSTAT using SH4 Code found at <http://comexstat.mdic.gov.br/en/geral>

So successful was this new industry that it not only produced more than enough meat to satisfy the growing and increasingly wealthier national population, but it would eventually replace the United States as the world's most important exporter of chicken meat. Brazil only began to export chicken meat in 1975, and only reached a million tons by 2001. But by 2004 it had surpassed United States exports for the first time, and since 2014 Brazil has led all world exporters (see Graph 5).

Graph 5: Volume of Chicken Exports by Leading Exporting countries., 1961-2020

Source: FAOSTAT

These chicken exports were controlled by both private companies and cooperatives, most of which were in vertically integrated production systems. The dominant players were all Brazilian owned companies. The biggest companies were BRF, the world's largest meatpacker, SHB and SEARA. The four cooperatives were also significant and they exported almost as much as SEARA, the leading exporter (see Table 3).

Table 3: Volume of Exports of Leading Company Exporting Chickens from Brazil in 2018 (in metric tons)

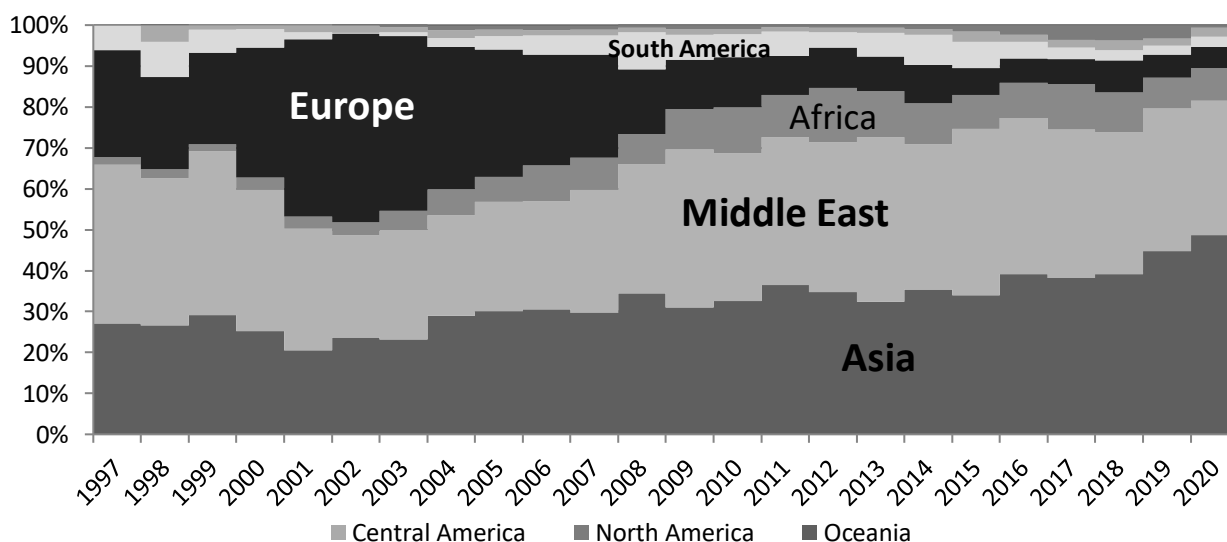
Company	Volume
SEARA Alimentos	823.831
AHB Comercio e Industria de Alimentos S.A.	771.294
BRF	541.702
Cooperativa Central Aurora Alimentos	295.828
C-VALE - Cooperativa Agroindustrial Consolata	195.296
Copacol - Cooperativa Agroindustrial Consolata	176.106
LAR Cooperativa Agroindustrial	138.865
JBS Aves LTDA.	107.160
Vibra Agroindustrial S.A	106.545

Source: https://trase.earth/flows/data-view?toolLayout=1&countries=27&commodities=25&selectedColumnsIds=0_14-1_22-2_9-3_16

As with production, the export of chicken meat was dominated by the three states of the South. Paraná in 2020 was the single largest exporter, followed by Santa Catarina and Rio Grande do Sul and together they accounted for 81% of the volume of exports. São Paulo and Minas Gerais (the two major states of the Southeast region) though major producers of chickens accounted for only 8% of exports, devoting most of their production of chicken meat for the internal market, while the states of the Center-West (Goiás, Mato Grosso and Mato Grosso do Sul) accounted for 12% of the volume of exports and had become the second most important region for exports. Despite the growth of a major production center in the Center-West, a recent study found that the total costs of chicken production, no matter what the system used, was still cheaper in Santa Catarina than in Goiás (Sandi and Miele, 2012, pp. 20-29). In Paraná in the period January to November 2021 it was estimated that 76% of the average cost of raising broiler chickens was made up of food, another 17% for other general costs, and only 4% for labor and 2% for the cost of capital.¹⁷

Although Brazil exported chicken meat all over the world, there were changes over time of which countries and regions imported these Brazilian products. While initially Europe was a major importer along with Africa and the Middle East, its purchase of Brazilian chickens systematically declined in the 2010s. In turn Asia expanded as did Africa, while the Middle East remained a steady purchaser (see Graph 6). China was Brazil's leading chicken meat importer, accounting for 46% of Brazilian exports in the current period and Japan was the third largest recipient. It sourced almost three quarters of its imported chickens from Brazil in the most recent period.

Graph 6: Regional Share of Imports of Brazilian Broiler Meat, 1997-2020



Source: COMEXSTAT

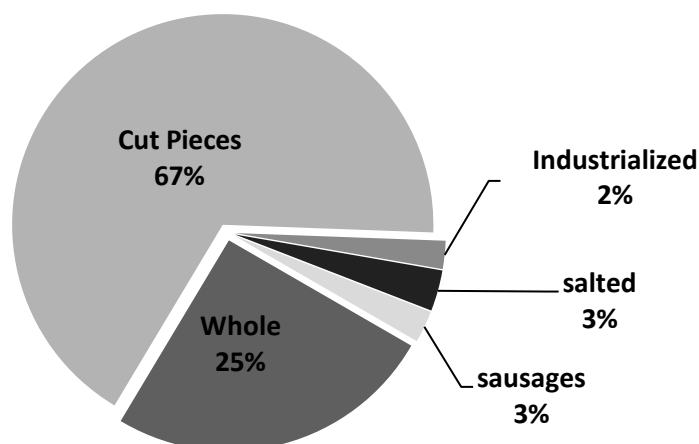
¹⁷ Embrapa Swine & Poultry, found at <https://www.embrapa.br/en/suinos-e-aves/cias/custos/frango-uf>

At the same time as Brazil became the leading broiler chicken exporter, it also became the world's leading producer and exporter of halal chickens. The exports to the Middle East and some African countries required special production under halal religious codes which was carried out in Brazil by trusted Brazilian Islamic Centers and Certification Companies which trained and employed Muslim inspectors to work in the slaughterhouses. This entire process was supported by government regulation, the local Arab Brazilian Chamber of Commerce, the national association of chicken producers, and with a constant interaction with religious authorities from the major importing countries which guaranteed the validity of the certification and the correct training of Brazilian Muslim inspectors. The first halal certified chickens were exported in 1975 and by 2014 it was estimated that 44% of Brazilian chicken exports were certified Halal-labeled and by the second decade of the current century Brazil became the leading halal meat exporter in the world.¹⁸ Saudi Arabia was Brazil's second leading importer of chickens in terms of volume and the United Arab Emirates its fourth largest consumer in 2020. So effective was Brazil in this market that in the five year period 2015-2019 some 83% of the chicken imported into Saudi Arabia came from Brazil, in Oman it was 70%, in Yemen it was 60% and in the United Arab Emirates it was 58% in this same period. Overall Middle Eastern countries took 32% of Brazil's chicken exports in 2020, Asian countries 40% and African ones.14% of the total in that year (see Table 4).¹⁹

Some two thirds of the exported meat was in cut parts (cortes), and a quarter was made up of whole chickens. The remaining 9% was made up of salted meat, industrialized products and sausages (see Graph 7). However, there were regional differences in these exports. Most of the halal chickens were primarily exported as whole chickens. While most of the world concentrated on imports of Chicken meat parts, 64% of Middle East imports were whole chickens, and the European Union was the unique as the most diverse importer, with salted meats accounting for 52% if imports, chicken parts 25% (ABPA, 2021, pp. 38-43).

¹⁸ Araújo, Shadia Hussein de. 2019, Macau, Cunha, Alssabak, and Leandro. 2016. All these data are from partner trades at <http://www.fao.org/faostat/en/#data/TM>; and total import data in <http://www.fao.org/faostat/en/#data/TP>

¹⁹ Calculated in January 2022 from Agrostat at <https://indicadores.agricultura.gov.br/agrostat/index.htm>

Graph 7: Relative Importance of Types of Chicken Meat Exports by Volume, 2020

Source: ABPA, Relatório Anual 2020: 40-41.

Table 4: Top 25 Importers of Broiler Chicken Meat, 2019-2020 (in metric tons)

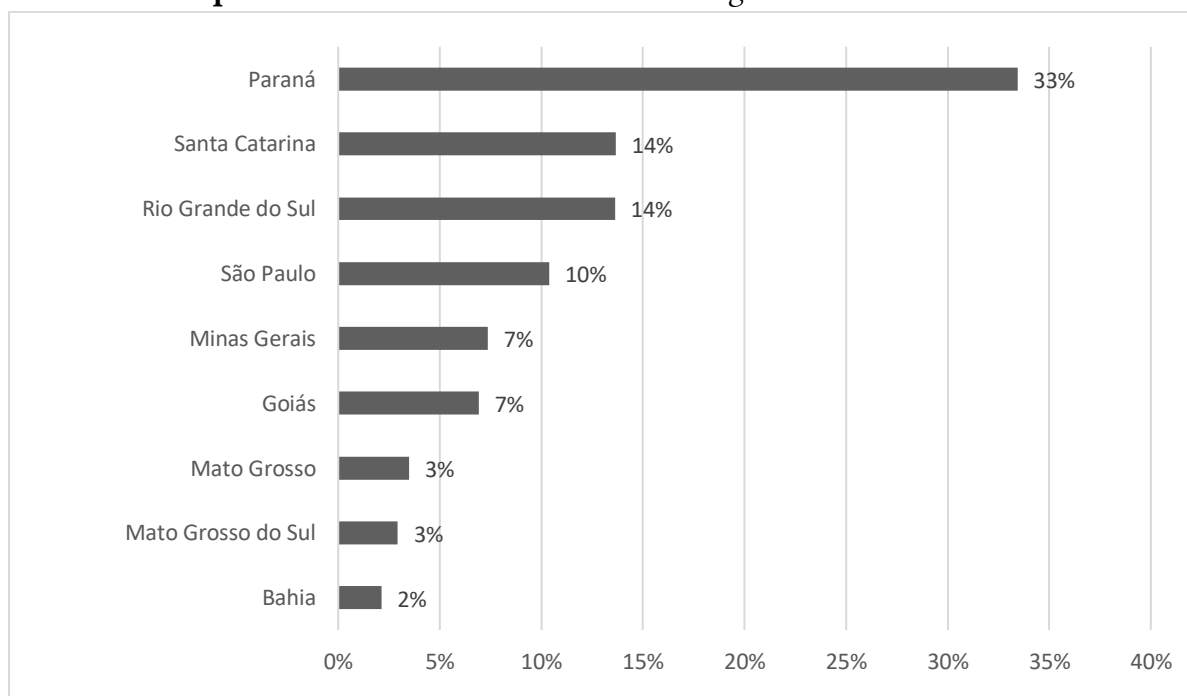
Country	2019	2020
China	585.377	673.215
Saudi Arabia	468.827	467.546
Japan	424.063	410.543
United Arab Emerites	341.191	303.022
South Africa	270.494	261.951
European Union (28)	249.722	252.219
Hong Kong	182.822	148.455
South Korea	119.821	127.460
Singapore	97.509	124.206
Yemen	105.969	112.420
Kuwait	114.791	108.897
Russia	64.332	83.907
Qatar	74.276	76.307
Iraq	110.073	75.618
Oman	82.436	71.177
Philippines	61.979	59.878
Angola	58.244	59.547
Egypt	51.019	58.789
Jordan	47.821	56.862
Libya	42.477	53.669
Chile	46.794	53.614
Vietnam	25.967	53.135
Cuba	32.045	40.952

Barein	31.177	36.239
Peru	21.208	35.810

Source: ABPA, Relatório Anual, 2021: 45-46.

Given the fact that 64% of the exported chicken meat was processed in the three southern states of Paraná, Rio Grande do Sul and Santa Catarina, it is no accident that 42 % of chicken meat exports went through the port of Paranaguá in Paraná, and another 36% in the Santa Catarina port of Itajaí, while only 8% went through Santos, which otherwise was the primer agricultural port of Brazil (ABPA 2021, p. 43). As could be expected, the largest slaughterhouses were in the three southern states. In 2020 these states contained one third of the 280 abattoirs specializing in chickens, but they accounted for 61% of the 6 billion animals slaughtered.²⁰ Thus, in processing the final meat as well as in the production of chickens, Paraná stands out as the single most important state, followed by the other two southern states which made this southern region the center of the industry from its earliest days until today (see Graph 8).

Graph 8: Distribution of the Chickens Slaughtered in Brazil in 2020



Source: IBGE, Sidra, tabela 1094

²⁰ IBGE dataset found at <https://sidra.ibge.gov.br/home/abate>

Conclusion

Supported by the government from the 1960s onward, the raising and processing of chickens has become a major sector in both the national and export markets. The per capita consumption of chickens in Brazil almost doubled between 1970 and today. It became the meat of choice for the majority of the population because of its low price compared to all other meats. At the same time Brazil also found that its costs of feed and labor made its production of chickens competitive on the world market. It even used its resources from immigrant groups to create a modern halal sector of the industry. As the industry became more international establishing sanitary norms became ever more important and by 2006 the federal government implanted an effective sanitary inspection of all chicken slaughterhouses based on international standards in order to guarantee the viability of exports.²¹ Although all sectors of the country produced chickens, it was the three southern states, and above all Paraná that dominated all aspects of the industry from the earliest period until today.

In contrast to cattle ranching and the production of beef, the growing of chickens occurred on smaller properties with a significant role played by family farms. Most chicken farmers were integrated into value chains by national meatpacking or feeding companies or by cooperatives, and Brazil adopted the latest technology and use of purebred birds from all the producing countries of Europe and North America. Private companies also engaged in major R&D activities to adapt to the tropical and semi-tropical conditions of Brazil. Entering the market first for whole chickens and then quickly moving to cut parts as demand changed, Brazil was able to progressively advance in the world market, emerging as the leading world producer by the twenty first century. It was also able to develop a dominant role in halal processed animals which enabled it to conquer the markets of Arab countries in North Africa and the Middle East, at the same time it replaced the United States in the Asian market. By 2020 the chilled and frozen products of chicken were worth close to US\$ 6 billion in exports, which represented 35% of all meat exports in that year, and 7% of the total value of all agricultural exports. All of this development was based on entrepreneurial activity and major government support, from subsidized credit to direct investment in processing companies under BNDES, from providing research through state and federal research centers to establishing sanitary standards. Finally this growth of a poultry industry was not an isolated phenomenon, but was part of a major effort by Brazil to modernize and expand beef, chicken and pork production which allowed it to become a dominant player in world markets for animal protein.

²¹ Priscilla Zygmantas Novelli, Daniela Cabral Paiva, Nadir Lopes Garcia, and Thiago Brava Izidoro. "Panorama sobre a regulamentação do sistema APPCC em estabelecimentos de carne de aves sob inspeção federal," *Revista Higiene alimentar* 30, no. 254/255 (2016): 139-145.

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