

Fostering Agriculture under the Industrializing State: The Caja de Crédito Agrario and Agricultural Credit in Post-Depression Chile, 1926-53

IGNACIO GONZÁLEZ CORREA AND CLAUDIO ROBLES

KEYWORDS: agricultural credit, Caja de Crédito Agrario, Chile, small farmers.

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This paper analyzes the role of the Caja de Crédito Agrario (CCA) in the development of the agricultural credit market in post-depression Chile. Employing its official annual reports, reports from the Superintendency of Banks, and Chile's Statistical Yearbooks, we constructed the first series of CCA's credit operations, and established trends in the number, the average amount, and the social, geographic, and specific economic activity distribution of all loans. From 1927 to 1952, CCA loans represented 11.5% of all commercial bank loans, and in the latter year the CCA lent more money to agriculture than any other bank. The CCA became Chile's largest agricultural bank, right before being merged with other institutions to create the State Bank of Chile. The CCA's credit was decentralized: its operations evolved towards a fairly balanced distribution of loans among Chile's main agricultural provinces. This was a micro-credit institution that allocated the vast majority of its loans to small farmers, who otherwise would not have access to formal credit. The CCA was a public policy tool for helping small farmers produce food for domestic consumption. Contrary to conventional views, in Chile the industrialization-promoting state did also foster agricultural growth through CCA public credit.

Fomentando la agricultura en el Estado industrializador: La Caja de Crédito Agrario y el crédito agrícola en el Chile postdepresión, 1926-53

PALABRAS CLAVE: crédito agrícola, Caja de Crédito Agrario, Chile, pequeños agricultores.

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***E**ste trabajo analiza el papel de la Caja de Crédito Agrario (CCA) en el desarrollo del mercado de crédito agrícola en Chile después de la Gran Depresión. Empleando sus memorias anuales, los reportes de la Superintendencia de Bancos y el anuario estadístico de la República de Chile, construimos la primera serie de operaciones de la CCA y establecemos las tendencias en el número, valor promedio, y la distribución social, geográfica y por actividad económica específica de todos los préstamos. Desde 1927 a 1952, los préstamos de la CCA representaron el 11,5% de los préstamos de los bancos comerciales, y en ese último año prestó a la agricultura más dinero que cualquier otro banco. La CCA se convirtió en el principal banco agrícola de Chile, justo antes de ser fusionado con otras instituciones para formar el Banco del Estado de Chile. El crédito de la CCA estaba descentralizado: sus operaciones evolucionaron hacia una equilibrada distribución de los préstamos entre las principales provincias agrícolas de Chile. Esta fue una institución de microcrédito que asignó la vasta mayoría de sus préstamos a pequeños agricultores, quienes de lo contrario no habrían tenido acceso al crédito formal. La CCA fue un instrumento de política pública para ayudar a pequeños agricultores a producir alimentos para el mercado interno. Al contrario de nociones convencionales, en Chile el Estado promotor de la industrialización también fomentó el crecimiento agrícola a través del crédito público de la CCA.*

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Ignacio González Correa [orcid.org/0000-0003-0964-8017] is Research Assistant in the Department of Economics, Universidad de Santiago de Chile (USACH). Address: Av. Bernardo O'Higgins, 3363, Universidad de Santiago de Chile, Santiago (Chile). E-mail: ignacio.gonzalez@usach.cl

Claudio Robles [orcid.org/0000-0003-3041-7838] is Associate Professor of Economic History at the Universidad de Santiago de Chile (USACH), and Director of the Centro de Estudios de Historia Agraria de América Latina (CEHAL). Address: Av. Bernardo O'Higgins 3363, Universidad de Santiago de Chile, Santiago (Chile). E-mail: claudio.robles@usach.cl

1. INTRODUCTION

The so-called *stagnation* that the agricultural sector experienced through the 1960s was one of the main problems in Chile's economy after 1930. Agriculture's lower growth and incapacity to meet demand from an increasing urban population and the expanding industrial sector, became a crucial issue in national politics. Although the unequal agrarian structure was far from conducive to economic growth, the accepted interpretation is that sector was negatively affected by economic policies aimed at promoting industrialization. In particular, price controls and over-valuation of the peso ultimately "prevented an increase in the rate of return in agriculture, lowered the rate of growth, and invited imports" (Mamalakis, 1965: 148; Díaz, 2006). Agriculture was a "neglected sector" in terms of access to public credit, since in the 1950s it received less than 4% of credits from the State Bank of Chile and the main state agency for fostering economic development, Corporación de Fomento de la Producción (CORFO, established in 1939). In sum, according to this view, the state subordinated agriculture to the needs of a "largely artificial industrial expansion" (Mamalakis, 1965: 138).

However, as this article demonstrates, until the creation of the State Bank in 1953, the main source of agricultural credit in Chile was a public institution: the Caja de Crédito Agrario (CCA), established in 1926¹. Analyzing why and how the CCA became Chile's largest agricultural bank is relevant not only to better understand the development of the under-studied agricultural credit market, but also to shed new light on the role of the state in fostering recovery of the Chilean economy after the Great Depression, especially considering the debate on the performance of the agricultural sector. In order to examine the growth and role of the CCA, this paper focuses on the following questions: Why and how did the CCA come to be a leading institution in Chile's agricultural credit market? What were the main trends in the CCA's credit from 1926 to 1953? For what kind of farmers was the CCA's credit primarily intended and why?

In response to those questions, we argue that the CCA was a public policy tool that, especially after 1938, when Law No. 6290 established the "social function" of its credit operations, post-depression governments employed to allocate credit to small farmers, who could not meet the restrictive requirements set by private banks. As such, the CCA provided subsidized credit, even at negative real interest rates, which, how-

1. Although providing credit was its main function, the CCA also promoted agricultural growth through a number of different programs. These included the sale and distribution of seeds, fertilizers, machinery, and agricultural extension books; the preparation of technical studies and livestock trading.

ever, was compensated by its growing and diversified commercial operations. Its socially-defined role was strengthened as it branched out, becoming a nation-wide institution. This expansion gradually corrected information asymmetries that resulted in the concentration of credit operations in Central Chile and allowed the CCA to provide credit to borrowers in the main agricultural provinces throughout the country. Thus, the CCA contributed to reduce long-term inequalities that characterized the Chilean credit market. Market imperfections and the need of economic recovery after the Great Depression justified providing subsidized state credit for agriculture. The CCA could offer lower interest rates because of its supervision of collaterals and other ways to deal with information asymmetries (through its General Inspectorate department), which reduced both selection adverse and moral hazard. Small farmers, for their part, had incentive to repay their loans because of the risk of being expelled from the financial system by default. For example, in the early forties, credit amount recoveries were over 75%². Moreover, information asymmetries were reduced, as local CCA offices created a relation with customers in rural areas excluded from the main banking system. This dynamic would explain why credit would be increasingly allocated to agricultural provinces in the south, as the CCA gained a better understanding of farmers' behavior and assets in those areas.

The agricultural credit market has been under-studied in Chilean economic history. The early studies focused on the Caja de Crédito Hipotecario (CCH), the National Mortgage Bank established in 1855, depicting it as an institution that large landowners controlled to syphon money off the state (Bauer, 1975). Among agricultural economics studies, Nisbet (1967) discussed the informal agricultural credit market for small farmers on the eve of the agrarian reform, concluding that most of those in his sample were not able to reach the formal credit sector. In turn, in a comprehensive study on the stagnation of the agricultural sector after 1930, Lundahl (1985) contended that the agricultural credit market did not undergo any significant changes from 1930 to 1955, but he did not consider the role of the Caja de Crédito Agrario, which, as we argue, focused on small farmers. More recently, several works by Brock (2009, 2016, 2017) have revitalized the study of the credit system, by examining the CCH from a financial perspective. Despite its importance, the CCA has not been thoroughly studied in Chilean economic history literature. The earliest study of note was a report by a joint commission of the International Bank for Reconstruction and Development (IBRD) and the Food and Agriculture Organization (FAO), which first pointed out the change in the CCA's policy after 1933, from making large loans to the livestock sector to small loans for middle-sized farms (IBRD-FAO, 1952). A general mention is found in the comprehensive work by Drake (1989),

2. *Memoria anual de la Caja de Crédito Agrario (MCCA)*, 1944: 57.

which characterized this institution as an extension of the highly criticized CCH, that is, an instrument to secure large landowners' access to inexpensive credit. In the most relevant work among previous studies, Bernedo (1989) argued that the CCA played a significant role in fostering economic growth, as its operations tripled during its first five years, and in 1931 its loans came to represent 10.9% of the total value of all loans made in the whole banking system. Similarly, an institutional study of the State Bank of Chile positively assessed the CCA's role in its first ten years of activity, as credit operations multiplied to the point of reaching small farmers, who became its main borrowers. In addition, this work established that the CCA credit was geographically directed towards Chile's most important agricultural provinces (Friedmann, 1993). This article is part of new research on the CCA, which also includes (González-Correa & Llorca-Jaña, 2021), a study of this institution from the perspective of business history.

This article makes a contribution to the study of agricultural credit in Chile by focusing on the main institution that provided funds to small farmers. Specifically, we provide the first systematic data series on the CCA's credit operations for the entire period it remained in activity. Using information from its official annual reports (*memorias anuales*), reports from the Superintendencia de Bancos (Superintendency of Banks), and Chile's main Statistical Yearbook (*Anuario Estadístico de la República de Chile*), we established trends in terms of the number of operations, the average amount of loans, and the social, geographic, and specific economic activity distribution of CCA credits from 1927 to 1952. According to the series that we constructed, we found that, on average for that period, loans made by the CCA represented 11.5% of all loans by commercial banks, and that by 1952 this institution had become Chile's largest agricultural bank, which was even pointed out by a IBRD-FAO report³. The CCA loaned farmers 89% more money than the amount involved in all agricultural loans issued by the main private bank, the Banco de Chile, and five times more than that loaned by the third-largest agricultural credit institution, the Banco Español-Chile. As a micro-credit institution, the CCA gave small farmers state credit at very low or, because of inflation, even negative real interest rates. CCA credit operations were also decentralized because they were directed primarily at Chile's main agricultural provinces, which were located not only in Central Chile, but also in the Frontier and Llanquihue regions. In addition, the CCA was a public policy tool for the government to encourage farmers to produce goods for domestic consumption, namely, meat, milk, and cereals. In sum, the important contribution of the CCA to the development of the agricultural credit market shows that, contrary to long-held views, in

3. "In the past few years, the ratio of farm credit outstanding to national income derived from agriculture has been above 35 percent. Compared to other countries, this is a very high percentage; we may conclude that there is no real lack of credit facilities" (IBRD-FAO, 1952: 122).

post-depression Chile the industrialization-promoting state did foster agricultural growth through credit geared for small farmers.

This article, therefore, contributes a case study of public agricultural micro-credit in an understudied country to a scholarship that has dealt primarily with banks and credit for other economic sectors, such as those on state-owned developing banks (Lazzarini *et al.*, 2015; López, 2012; Arés, 2007; Doctor, 2015), or the relationship between banks and Latin America's economic performance (Haber, 1991; Hanley, 2005; Triner, 2000; Zegarra, 2014, 2018a). Among the latter, Haber (1991) concluded that the lack of banks had a negative impact on the industrial development of Brazil and Mexico during the 19th century, which was shared by Hanley (2005) and Triner (2000) regarding the economic growth of Brazil and the financial sector between the middle of the nineteenth century and the Great Depression. Yet, Zegarra (2014) found that the export sector's expansion contributed to the growth of banking in Latin America between 1840-1920, and that from 1870 to 1920 the bank output had a positive long-term impact on GDP per capita in five Latin American countries (Zegarra, 2018a). In turn, studies of agricultural credit have received less attention despite the economic importance of the agriculture sector. Among the few recent studies, Aguilar and Grijalva (2011) shows that in Mexico an alliance between farmers and the state led to the creation, in 1933, of both the Banco de Sinaloa and the Banco Agrícola de Sonora, to give loans to small farmers and *ejidatarios*. Likewise, the Banco Nacional de Crédito Ejidal c. 1936-46 has been thoroughly analyzed (Mottier, 2017, 2019), as well as its role in promoting agriculture during the Cárdenas administration (Castaño, 2014). For Peru, Zegarra (2017) demonstrated that mortgage credit at the end of the 19th century allowed large farmers to access long-term credit and facilitated interregional financial mediation, but did not lead to greater access to credit. Indeed, the beneficiaries were the owners of large coastal plantations of sugar and cotton (Zegarra, 2015). Also, the role of notaries in reducing information asymmetries has been examined in the pre-banking era (Zegarra, 2018b). In the case of Argentina, studies have analyzed agricultural credit in general aspect (Tulchin & Seibert, 1987) and also the commercial networks and credit for agriculture in the pampas of the early 20th century (Lluch, 2006). Furthermore, the pioneering work by Adelman (1990) showed that in the province of Buenos Aires formal financial services for agriculture were scarce between 1890 and 1914, despite the presence of three large banks. Most of the credit for agriculture was obtained through informal channels, that is, merchants and suppliers involved in agricultural markets. More recently, the role of large merchants as credit providers for Argentine farmers has been underscored by Barcos and Martirén (2020). In contrast, the study of agricultural credit in Spain has been more relevant, as important works have dealt with *pósitos* or village grain banks, and other forms of credit in rural society (Cuevas, 2001; Martínez, 2007; Carmona & Simpson, 2019).

This paper is composed of the following three sections. The first section explains the rather peculiar origins of the CCA in 1926 out of an unremarkable parliamentary debate on Chile's economic problems which, nonetheless, took place in a context of growing consensus on the need to redefine the role of the state in the economy. This section also discusses the CCA's organization and the changes it underwent as a result of political intervention. The second section examines the trends in the CCA's credit operations, in order to establish this public institution's importance in the agricultural credit market. To that effect, we determined the trends in the total number of operations, the real value from loans, and the average loan amount. The third section deals with the geographic, social, and productive allocation of loans, demonstrating that the CCA focused on small farmers and evolved towards a balanced allocation of credit among Chile's agricultural provinces. Finally, the Conclusion interprets the CCA's leading role in the agricultural credit market as an expression of the industrializing state's policy for promoting agriculture in the post-depression Chile.

2. A PUBLIC FARM CREDIT BANK FOR CHILEAN AGRICULTURE

In the early 1920s, the limited agricultural credit market was a reflection of the oligarchic character of Chilean rural society. Land ownership was the basis of large landowners' social status and political power, while the *hacienda* system, the main unit of production, was the result of persistent inequality and land concentration. Along with a small rural middle class, a poor peasantry was comprised of precarious smallholders (called *minifundistas* in official statistics), sharecroppers, resident tenant laborers (*inquilinos*) on large estates, and a growing rural proletariat of landless laborers. Inequality notwithstanding, the growth and modernization of Chile's export economy stimulated the development of agriculture, and rural society was transformed by the agrarian expansion that took place from the 1870s to the Great Depression. Indeed, the demand for agricultural products in the domestic market increased and diversified significantly because of demographic growth, urbanization, and industrialization (Cariola & Sunkel, 1982). Simultaneously, the territorial scale of agriculture grew drastically with the colonization of the Llanquihue Territory in southern Chile, the occupation and subsequent development of capitalist agriculture of the Frontier region (Robles-Ortiz, 2020a), and the "internal expansion" of Central Chile's *hacienda* system (Bauer, 1972). In response, agriculture underwent unprecedented growth in all sectors and crops. The area under cultivation and output of the main crops (cereals) doubled, even though population grew from 2.5 to 4.2 million inhabitants, and despite massive rural-urban migration, which reduced the size of the agricultural labor force. Moreover, growth of the agricultural sector rested on the gradual, but uneven, adoption of technological innovations, namely irrigation, mechanization and, right before

First World War, the beginnings of tractorization (Robles-Ortiz, 2020b). Agricultural modernization, however, concentrated on large and medium-sized estates, and had scarce, if any, diffusion among the vast majority of small farmers. Lack of access to formal credit was one of the many factors that prevented the development of small farmers' agriculture.

The formal financial sector was geographically concentrated and comprised institutions in which small farmers had hardly any access to credit. The main national and foreign banks had offices virtually only in Santiago and Valparaíso, except for a few branch offices in provincial capitals. Thus, in the vast majority of small cities located in the agricultural provinces, there were no formal financial institutions. In 1931, 74 of the 114 *comunas* surveyed in a study by the Statistical Office, which included the most important agricultural towns of Central Chile, La Frontera and Llanquihue, did not have a single commercial bank office⁴. In addition, credit offered by the banking system was drastically restricted in 1925 because of regulations introduced following the Kemmerer mission's policy recommendations. Along with the creation of the Central Bank, terms for commercial loans were reduced to only three months and, exceptionally, to six months with agricultural goods as collateral; significantly, even large landowners protested what they found to be quite unfair conditions (Drake, 1989). Not having the privileges of the upper-class, the medium-sized and small farmers had to resort to informal lenders, that is, the large landowners themselves and local merchants or commercial houses in rural towns. The so-called *venta en verde*, the advancement of capital and the imposition of prices for the crops yet to be harvested, was common practice for landowners and merchants, who could easily squeeze the small producer. In both cases, this informal credit mechanism implied not only short terms, but also usurious rates (Matthei, 1939; Bauer, 1975). In sum, given the political economy of the financial market in Chile, only the state could provide credit to small farmers; that was to be role of the Caja de Crédito Agrario (CCA).

The CCA was created by Law No. 4074, known as the "Ley sobre Crédito Agrario" (Agrarian Credit Law), which allowed the CCH to set up a subsidiary agricultural credit institution. As debate on the "agricultural credit bill" shows, there was consensus in Congress in order to provide the agricultural sector with a type of special credit, that is, loans at low interest rates and in terms that would better meet the requirements of the agricultural production cycle. In particular, the congressional committee charged with studying the matter stated that agricultural credit should facilitate investment in machinery and livestock-raising modern methods. The committee also asserted that banks offered loans on checking accounts for only 90 days, making access to credit very difficult since agriculturalists would not make any profits for several months, until they could harvest

4. *Anuario Estadístico de la República de Chile*, vol. Finanzas, Bancos y Cajas Sociales, 1931: 30.

and market their crops. More generally, interest rates were higher than the typical rate of return in agriculture. Until the creation of the CCA, the credit market was characterized by large landowners' dominant position as informal moneylenders, and by high interest rates for agricultural loans. Typical profits for large estates ranged from 5 to 8%, while mortgage credits varied from 6 to 8% (Bauer, 1994: 136). The situation was dramatically different for medium-sized and small farmers, who paid very high interest rates. In Central Chile, in the late 19th century, the interest rate of agricultural credits for those types of farmers usually started at 12% but could reach up to 24% per year (Bauer, 1994: 123).

In addition, there was strong criticism of the existing mortgage credit system; the CCH did not have a loan surveillance system, and like other critics one senator complained that its loans were used to build "palaces for the aristocracy"⁵. In short, the committee concluded, the lack of credit was the main cause of insufficient agricultural growth in Chile. As a result of favorable opinion in Congress, the "agricultural credit bill" was approved almost in its entire original terms just five months after being submitted, certainly not a bad record in Chile's discredited "Parliamentary Republic". The only contested matter was the role that the CCH was to play, as several congressmen were against setting a limit to the funding it should provide to the CCA⁶. Although the CCA law was quickly passed, it took several more months for the executive to approve the statutes of the new institution, which finally took place in November 1926 by means of supreme Decree No. 1261.

The creation of the CCA was part of a broader, emerging interest in redefining the role of the state in economic development. At a time when a Chilean school of "economic nationalism" was contesting the prevailing liberalism, the idea of a leading, enterprising state gathered wide support in public opinion. In Congress, for example, one senator argued in favor of the "agricultural credit bill" by asserting that the agriculture was an essential industry that should be supported as was the case in the United States and Britain⁷. Others demanded active state intervention in the economy based on economic theory, holding that the state should promote private initiative in line with the public interest. As for credit, some called for the state to establish a public banking system to foster national economic development⁸. These new ideas were certainly related to important institutional developments underlying the creation of the CCA.

5. *Boletín de Sesiones de la Cámara de Senadores* (hereafter *BSCS*), Sesión Extraordinaria No. 7, 03/16/1926: 203.

6. *Boletín de Sesiones de la Cámara de Diputados* (hereafter *BSCD*), Sesión Ordinaria No. 40, 07/23/1926: 1641-42.

7. *BSCS*, Sesión Extraordinaria No. 7, 03/16/1926: 204-05.

8. *BSCS*, Sesión Ordinaria No. 8, 06/07/1926: 195.

Indeed, the CCA was one of the many institutional consequences of the rise of the authoritarian regime led by Col. Carlos Ibáñez del Campo, first as minister of War (1925-27), and then president (May 1927-July 1931). This turbulent period in Chilean politics began with a military coup (September 10, 1924) that forced Arturo Alessandri out of office, closed Congress, and was followed by the imposition of a military junta which, among other important decisions, called for the assistance of an economic mission led by Princeton professor Edwin Kemmerer, known as “the Money Doctor”. Working in Chile from July to October 1925, the Kemmerer Mission recommended a set of measures including the creation of the Central Bank and the adoption of the gold standard (Drake, 1989). Alessandri was reinstated in March 1925, but by then his long-time rival, Ibáñez, had seized power. Backed by the military and various political groups, Ibáñez was able to pressure Congress to apply his corporative vision of the state, and “[t]aking inspiration from the European fascists”, as Wright notes, “fostered the corporate organization of the society and government as a means of offsetting the growing political power of the masses” (Wright, 1982: 90). As a result, the emerging corporatist state was characterized by the creation of fostering institutions, such as the Caja de Crédito Agrario (1926), the Mining Credit Bank (1927), and the Industrial Credit Bank (1928). The state’s funding for the CCA, in particular, was a response by the Ibáñez government to the impact of the new economic policies set in accordance to the Kemmerer Mission. Significantly in this realm, Drake observed, “the Chilean central bank adopted policies mainly favorable to urban interests”, which in terms of credit meant offering short-term loans only, and for a maximum of six months to agriculturalists with collaterals. According to Drake, as agriculturalists complained that “this system was not furnishing enough low-interest, long term credit to producers”, the Central Bank “extended short-term credits to newly established government lending agencies” such as the CCA (Drake, 1989: 97-8)⁹.

The CCA was a rather complex institution. As a public firm, it was permanently subjected to political intervention primarily on its board of directors, the body responsible for determining policies on credit, investment, and assistance to farmers. The board’s composition was first drastically changed in 1928 under the dictatorship of Col. Carlos Ibáñez del Campo (1927-31). It was decided that the president of the Republic would designate the CCA’s president from a list submitted by Congress, and would also choose which of Chile’s various agricultural societies could appoint the two directors that represented those organizations; the remaining three directors would be CCA shareholders, and the last one

9. In addition, as the president of the National Agricultural Society (SNA), Luis Correa Vergara, explained in retrospect, the *prenda agraria* law passed in Argentina in 1914 served as a learning case for Chilean legislators to adopt similar legislation, thus allowing agriculturalists, especially small farmers, to use agricultural implements and inputs as collaterals, instead of exclusively land (CORREA, 1938).

would be one of the members of the Central Bank's Board of Directors. Two years later, as the Great Depression severely hit Chile's economy, through Law No. 4806 the Ibáñez dictatorship determined that all ten directors would be directly appointed by the President of the Republic (CCA, 1941: 15). After the fall of Ibáñez's dictatorship (July 1931), a short-lived Socialist Republic that remained in power from June to September 1932 dissolved the CCA's Board, seeking to make the institution fulfill its mission, namely, helping small farmers. Later that year, another reform was carried out, and a completely new board of directors was appointed. Thereafter, directors were elected every three years. Yet, in 1942 the Juan Antonio Ríos administration (1942-46) determined that the president of the Republic would appoint four directors, while the other six would be the representatives of Chile's various agricultural societies. Thus, although government intervention was reduced in the last years of the institution, the composition of the CCA's Board remained determined by political considerations.

The CCA underwent a number of institutional changes while its presence extended throughout the country. It was created as a subsidiary anonymous society of the Caja de Crédito Hipotecario as part of the Ministry of Development without a legal provision. In 1931, on account of the nature of its role, it was transferred to the Ministry of Agriculture (CCA, 1932: 146). A year later, it was granted institutional and financial autonomy, which allowed it to get into debt on its own with the guarantee of the state¹⁰. In 1945, its Organic Law¹¹ confirmed its financial autonomy and established that it could obtain capital from private firms, not only from other state institutions. Yet the CCA remained closely related to the Ministry of Agriculture; indeed, in 1945 by law the minister of Agriculture was made also president of the CCA Board. At the same time, as its credit and complementary agricultural development operations increased, the institutional structure of the CCA became more complex with the creation of new departments and a number of local branches. In 1933, it comprised the following sections: Prosecution, General Inspectorate, Procedures, Livestock, Commercial, Discounts, Reports, Monitoring and Single Debtor, Insurance, Propaganda, Promissory Notes, and Materials. Subsequently, the Statistics, Guarantee Liquidation, and Personnel sections were added between 1934 and 1937. At the same time, the CCA reached all of Chile's agricultural provinces. Along its headquarters in Santiago, it had branch offices in all major cities from north to south, namely, La Serena, Talca, Chillán, Concepción, Los Ángeles, Temuco, Valdivia, and Osorno. In addition, the CCA had an agreement with the Caja Nacional de Ahorros that allowed farmers to apply for credit at any of the latter's more than 100 offices (Correa, 1938: 388; Matthei, 1939: 235). In the late 1940s, it opened offices in Ovalle, San

10. Decree-Law No. 221 of July 19, 1932.

11. Law No. 8143, published in the *Diario Oficial* on August 11, 1945.

Felipe, Linares, Angol, La Unión, Puerto Montt, Castro, and Punta Arenas¹². By the time it was merged with other institutions to form the State Bank of Chile, the CCA had 16 branch offices and 30 inspectorates. As a result, it had become “the most decentralized state entity in the country”, a point made by a major newspaper that the CCA proudly quoted in its annual report¹³. Indeed, its institutional structure and wide geographical presence allowed the CCA achieve a great deal of success in Chile’s expanding agricultural credit market. This success, however, did not come easily.

According to its statutes, the CCA did not receive deposits from the public nor seek to make profits for its shareholders, and the state was its main source of capital. Yet securing funding from different state institutions was often difficult and contingent upon political factors. Moreover, devaluation of the Chilean currency and the growing demand for agricultural credit made the CCA dependent on state capital increases. As the annual reports suggest, this relationship was established through a series of decisions adopted in the late 1920s and early 1930s, precisely under Ibáñez’s corporatist regime. In 1927, when the CCA capital was only \$2,000,000 *pesos*, state funding came from the CCH, which in turn had to seek financing abroad, issuing bonds that were acquired by the US firm Kuhn, Loeb and Company & Guaranty Company of New York. This operation made it possible to obtain an agricultural loan for US\$10 million, signed by the Chilean ambassador himself on behalf of the government and the Caja de Crédito Hipotecario (CCH, 1927: 27-8). Although this was the minimum operational capital, it was insufficient to run the business, and the Ibáñez regime stepped in again. In 1928, capital was increased to \$20,000,000 by Law No. 4423, which authorized the Caja Nacional de Ahorros (National Savings Bank), another public financial institution, to buy all the new shares of the CCA. Yet, the participation of the Caja Nacional de Ahorros was ended two years later with Law No. 4806, which allowed the Treasury to acquire the former’s 450,000 CCA shares, pay with internal debt bonds, and thus control CCA’s capital¹⁴.

After the fall of Ibáñez, the second Alessandri administration (1932-38) maintained the CCA’s state financing. The government authorized the CCA to secure several loans for substantial amounts from the Central Bank in the late 1930s, when the bank became a lender of the Treasury and several semi-fiscal institutions. Then, in October 1938, Law No. 6290 had a major effect on the CCA. Mainly the work of Socialist Deputy Emilio Zapata, this law defined the CCA’s credit as having a “social function” and allocated \$30 million for credit to small farmers, in loans for amounts below \$10,000 and \$5,000, at

12. *Memoria anual de la Caja de Crédito Agrario*, 1950: 25.

13. *Memoria anual de la Caja de Crédito Agrario*, 1952: 9.

14. *Memoria anual de la Caja de Crédito Agrario*, 1952: 14.

an interest rate of just 5%, for a term of seven years, and with no processing fees. The small farmer was defined as one who owned or rented a property of up to 50 hectares, and this definition applied to small owners, sharecroppers, and *inquilinos* (tenant laborers on large estates). Moreover, the law also allowed for loans without collaterals for those individuals known to be “industrious and honorable persons”¹⁵. Nonetheless, further funding requests suggest that capital injections may have not been enough for the CCA to keep pace with the growing demand for agricultural credit. In 1940 the CCA Board petitioned the president of the Republic to send to Congress a bill that would increase its funding; as a result, Law No. 6820 (1941) allowed the CCA to take more loans from the Central Bank, this time for \$150 million¹⁶. Still, recurring inflationary outbreaks, growing demand for credit, and shortage of agricultural products caused a crisis in CCA’s finances in 1943. There were no resources to solve this problem because the government had not increased the institution’s own capital since 1928 and borrowing from the international financial markets was not an option because of the Second World War. The CCA’s internal financing problems were brought to an end only in 1945, with its Organic Law, which established its definitive capital structure. It comprised \$18 million in CCA shares owned by the National Treasury, \$128 million in debt to the CCH, \$37 million in CCA’s reserve funds, and \$370 million in a credit from the Central Bank, which the Treasury took over. The CCA was allocated a total capital of \$520 million. Following this reform, in terms of agricultural credit the CCA became far more relevant even than CORFO, Chile’s main economic development agency. Interestingly, since most credit from CORFO went to manufacturing and mining, agriculture seemed to be a “neglected sector” (Mamalakis, 1965). In reality, however, the CCA also channeled CORFO credit to agriculture for more than \$100 million between 1939-44¹⁷.

3. CCA’S AGRICULTURAL CREDIT TRENDS

The impressive number and value of its operations show the CCA’s relevance in the credit market in Chile. During the period 1927-53, it performed an average of 17,640 transactions per year, the total nominal value of which was \$15,075,941,414 *pesos*, while the average amount per transaction was \$44,045. However, given the inflationary context in which the CCA operated, real values are more appropriate to assess its contribution to

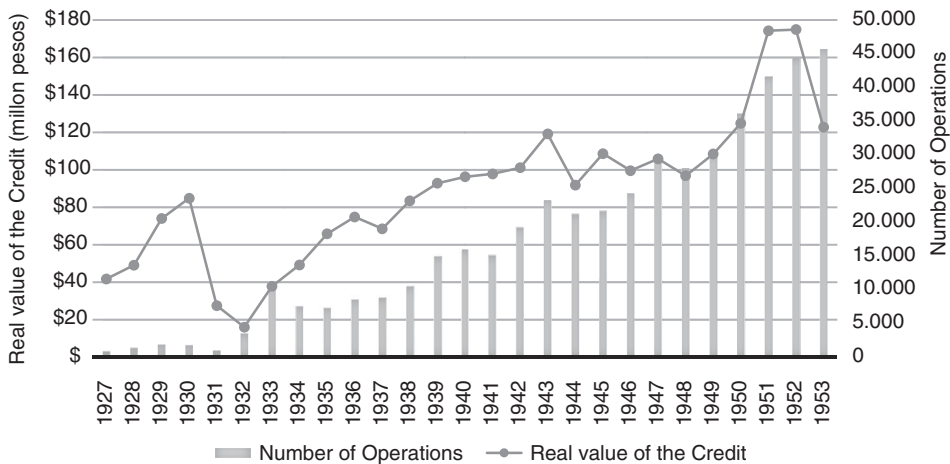
15. Boletín de la Liga Nacional de Defensa de los Campesinos Pobres, No. 2, December 1938: 1.

16. *Memoria anual de la Caja de Crédito Agrario*, 1941: 26.

17. *Memoria anual de la Caja de Crédito Agrario*, 1952: 46. Nonetheless, as we show below, that amount represented only 6% of the total credit the CCA provided between 1939 and 1944 (see Appendix).

the development of the credit market. It must also be considered that CCA credit was not indexed and it was supposed to be used only in agriculture; indeed, it was primarily geared for small farmers, that is, the poorest of agriculturalists, which were also those most affected by inflation. Chilean inflation was very high *c.* 1930s-1950s: the annual growth rate of CPI in the years 1932, 1946 and 1953 reached 23, 30 and 56%, respectively (see Appendix). Since the macroeconomic context affects the purchasing power of money, it is necessary to deflate the credit series by CPI to determine the effectiveness of the CCA credit for farmers. The real value of the CCA operations, which is obtained by deflating their nominal value by CPI¹⁸, makes it evident that this public institution was a major source of agricultural credit. Indeed, from 1927 to 1953 the CCA carried out 476,288 credit operations for a total real value of \$2,388,696,690 pesos, with an annual average of \$88,470,248 (Fig. 1).

FIGURE 1
Number and real value of CCA Operations, 1927-1953



Note: In September 1953 the CCA was transformed into the Agricultural Department of the Banco del Estado de Chile (State Bank of Chile), therefore, the value for 1953 has been completed with its latter operations from September to December 1953.

Source: Estimated with data from *Memoria 25 años: 1927-1951: Caja de Crédito Agrario. Memoria 1950-1951 y de sus 25 años de labor (1952: 52)*, *Anuario Estadístico de la República de Chile. Finanzas, bancos y cajas sociales (1954: 27)* and *Díaz et al (2016). Chile 1810-2010. La república en cifras. Historical Statistics.*

The operations series shows that three distinct periods can be distinguished in the activity of the CCA. In the first period (1927-31), when the CCA had yet to make itself known

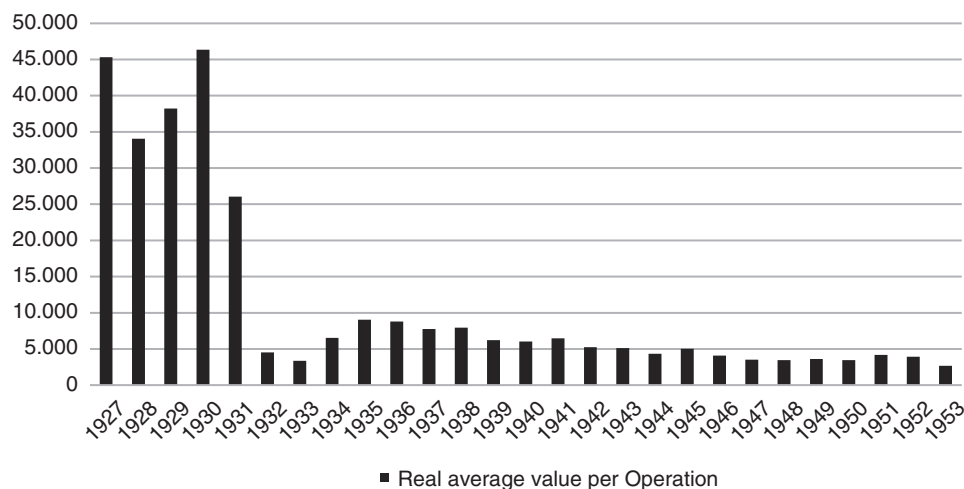
18. All real series in this paper were deflated by CPI from Díaz, LÜDERS and WAGNER (2016: 358-60) using 1927 CPI as base year.

among farmers, the number of operations was low and the average amount per operation was high. Then, the Great Depression hit the Chilean economy harder than any other country in Latin America (Bulmer-Thomas, 2014). The crisis was felt not only in the main export sector, the nitrate industry located in northern Chile, but also in the agricultural sector, whose growth was fundamentally related to the domestic market. The demand for agricultural products decreased; agricultural laborers' wages abruptly fell from 1929 to 1935, reaching a level as low as that of 1906 (Robles-Ortiz *et al.*, 2021); and farmers fell into default because of plummeting agricultural prices, just like in many other parts of the world. This situation had a significant impact on the CCA's activity. There was a big drop in the number of loans in 1931 and 1932, and profits were reduced from \$1.29 million in 1930 to merely \$258,000 in 1931. In addition, in December 1931, the Superintendency of Banks demanded from the CCA a global provision of \$4 million, which caused a loss of 20% of its capital. Both the nitrate crisis and drop in agricultural prices triggered the default of farmers which caused the CCA losses for \$804,000 in 1932¹⁹.

In the second period, from 1932 to 1938, which coincided with the second administration of Arturo Alessandri, the number of operations grew slowly, and the pre-crisis real value of the company's credit was restored in 1936, just as Chile's GDP recovered from the Great Depression. More importantly, the government reorganized the CCA to redirect its credit towards small farmers. The result was a sharp drop in the average amount per operation, from \$37,993 between 1927-31 to \$6,847 between 1932-38 (Fig. 2). Although there was not a new agrarian development program, the CCA reform was part of a growing concern for stimulating agricultural growth, even considering setting domestic prices for key agricultural products, such as wheat, higher than the international prices (Millar & Fernández, 2008: 414, 417). Finally, from 1939 to 1953, as the agricultural credit market expanded, the CCA reached its maximum activity in terms of the number of operations and real value of credit: the CCA lent 2.8 million *pesos* (real value) in the entire period it remained in activity, but between 1939-53 alone it made loans of 1.7 million *pesos*, reaching its maximum loans per year in 1952 when the public credit institution lent around \$175 million *pesos* (Fig. 1). The expansion of CCA operations was related to several policies aimed at helping small farmers that the three Popular Front governments of that period implemented. Those policies included an agricultural education program, a land colonization project and, certainly, the extension of credit programs for farmers (Millar & Fernández, 2008: 419). The CCA had become a leading actor in the agricultural credit market when the government merged it with other public institutions to create the State Bank of Chile.

19. *Memoria anual de la Caja de Crédito Agrario*, 1937: 17.

FIGURE 2
Real value of Loans per Operation, 1927-1953



Source: Estimated with data from *Memoria 25 años: 1927-1951: Caja de Crédito Agrario. Memoria 1950-1951 y de sus 25 años de labor* (1952: 52), *Anuario Estadístico de la República de Chile. Finanzas, bancos y cajas sociales* (1954: 27) and Díaz et al (2016). *Chile 1810-2010. La república en cifras. Historical Statistics.*

In addition to its growing importance in Chile's credit market, the most distinctive aspect of the CCA was its focus on microcredit operations. In its early years, however, most of the CCA loans were for rather large amounts; indeed, from 1927 to 1931 the average amount per operation was \$38,000 pesos, which suggests that its main borrowers were large landowners (Figure 2). It seemed that the CCA was going to be just like Chile's highly criticized National Mortgage Bank. Yet, in the aftermath of Great Depression growing dissatisfaction with the CCA led the government to reorganize it, seeking to end what was considered the "abandonment" of the small farmer. At the same time, the CCA became an instrument for economic recovery, which was the main economic policy goal of the post-depression administrations, especially that of Arturo Alessandri (1932-38) (Marfán, 1984; Duarte, 2019). Therefore, the CCA implemented a policy primarily aimed at providing inexpensive credit for small farmers in the form of loans for small amounts of money. As a result, from 1932 to 1953, the average amount per operation in every year was less than \$10,000 and it fell below \$5,000 in 11 years. Interestingly, then, although it was a microcredit institution, the CCA did have a significant share of the highly competitive Chilean credit market.

The CCA was not the only institution that provided credit to agriculture, but it was one of the most important financial institutions in Chile, as it came to be the largest agricultural bank in the country. Before the creation of the CCA, mortgage banks and com-

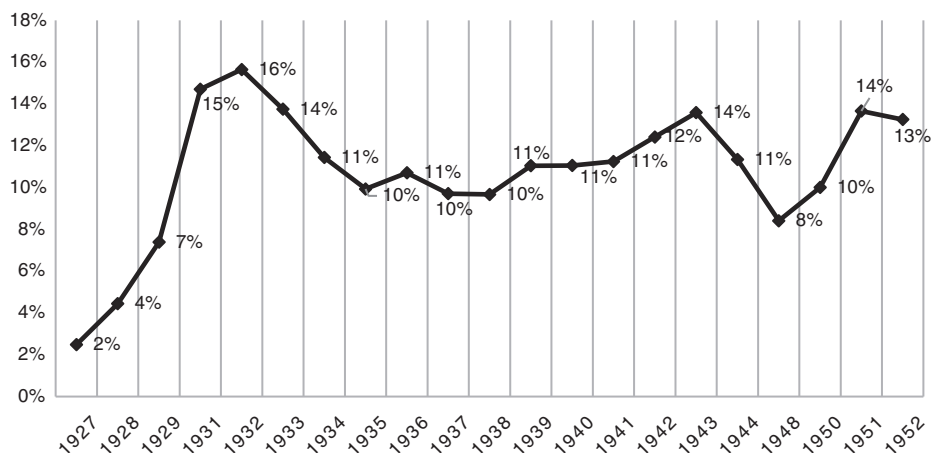
mercial banks were the main formal sources of credit for farmers, but the requirement of a mortgage or a bank account meant that access to credit was restricted to large landowners. Moreover, unlike the CCA, private banks had no legal obligation to promote agriculture. There were also other financial institutions, such as agricultural credit cooperatives and the Caja Nacional de Ahorros. Credit cooperatives were not relevant in the credit market, as they depended on the CCA to obtain funding and the credit they provided was negligible compared to that of public credit institutions²⁰. The Caja Nacional de Ahorros was a public savings institution for the poor, but it also provided small credit to farmers. Thus, to assess the CCA's place in the credit market, its share of the market has to be compared with that of commercial banks. In the 1927-52 period, there were an average of 20 private banks with national and foreign ownership.

A comparison of the outstanding loans of the commercial bank sector with the outstanding loans of the CCA (Fig. 3) shows that the latter's performance was exceptional²¹. It managed to keep its market share through the 1927-53 period despite macroeconomic problems and lack of capital. In its first two years the CCA had a ratio of less than 5% of all outstanding loans of commercial banks, but in 1931 it was 10% and it reached its highest point (15.6%) the next year. For the 22 years that we found data, the outstanding loans of the CCA represented on average of 11.5% of all commercial banks loans. That is, the CCA made loans equivalent to 11% of the total amount lent by all twenty of Chile's commercial banks. Moreover, in 1952, the CCA lent more money to agriculture than any private bank, and 89% more than the amount of all agricultural loans issued by the Banco de Chile, the country's largest private bank. Specifically, the CCA made \$2,841 million of agricultural loans while the Banco de Chile loaned \$1,515 million, followed by the Banco Español-Chile with \$554 million. The remaining 17 banks lent \$1,718 million combined (Superintendencia de Bancos, 1953: 36). As the most important agricultural bank in the country, the CCA was so relevant in the credit market that in 1953 the government merged it with other three public financial firms to create the state's bank: Banco del Estado de Chile.

20. This is shown by the annual reports of the CCA during the 1940s. For example, in 1940, the CCA lent to agricultural credit cooperatives \$1,5 million *pesos* while the total amount lent of CCA in the same year was \$192 million *pesos*, that is, not even 1% (*Memoria anual de la Caja de Crédito Agrario*, 1941, pp. 70-1). In 1941, the percentage was the same (*Memoria anual de la Caja de Crédito Agrario*, 1943: 35). In 1943 there are some mentions of agricultural credit cooperatives, then they disappear until 1947 and then disappear again until 1951 when these cooperatives lost relevance as it is evidenced that there were only two cooperatives that continued with CCA credits for agricultural credit cooperatives (*Memoria anual de la Caja de Crédito Agrario*, 1952: 16).

21. Outstanding loans are the portion of total loans that has yet to be repaid. In this case, outstanding loans are the part of the current loans from the CCA that have not yet been paid at December 31 of each year.

FIGURE 3
Outstanding loans of the CCA as share of outstanding loans of the whole Commercial Bank sector, 1927-1952 (current pesos)



Source: Estimated with data from *Anuario Estadístico de la República de Chile* (1929-1954). Finanzas, bancos y cajas sociales and *Memoria of Superintendency of Banks* (1930-1953).

The credit that the CCA provided had three special characteristics that contributed to its successful development as the largest agricultural bank in Chile. The first one was that its loans were given for longer terms than loans taken from private banks, which allowed farmers to carry out the production cycle from seeding to harvests, and thus have time to sell their crops to obtain income for repayment. The second one was that the CCA allowed farmers to take loans using their seeds, cattle, tools, or movable property as loan collaterals (*prenda agraria*) allowing the CCA to reach farmers who otherwise had no access to the formal capital market and even those who did not own land at all. Credits with a *prenda agraria* as collateral could not exceed five years, but the CCA also accepted other assets as collaterals. In addition, the CCA offered loans for terms of up to seven months with a mortgage or a *fianza* (surety note), and for up to twelve months if the guarantee was a *pagaré agrario* (promissory note) (CCA, 1928: 32). Indeed, all these types of collaterals allowed farmers to obtain funding for longer terms than those available in the commercial bank system. These terms changed over time to fit better the needs of agriculture and give more flexibility to farmers. The third distinctive aspect to CCA credit was its loans' moderate interest rates, which, in addition to "special rates," attracted large numbers of small farmers. Indeed, the CCA's interest rate was not only lower than that of the whole banking system (Fig. 4), but also remained very low even in inflationary contexts, which at times led to a negative "real interest rate" for farmers, that is, the farmers had

to repay less money in purchasing terms than what they took in loans²². From the beginning of its operations in 1927 until March 1932, the CCA charged 9% annual on loans in a context where, until the crisis of 1929, there was a relative abundance of capital in Chile. This rate was equal to that of the banking system because of the high financing costs of the CCA, as it obtained funding from the CCH, which in turn got capital from the international financial market by issuing bonds²³. However, during the following years the interest rate declined. In 1932, amidst Chile's economic and political crisis, Law No. 5076 (1932) determined that the CCA interest rate could not exceed 5.5%; then Decree-Law No. 221 set the annual interest rate at 5%, which remained in place until 1953, when the CCA was integrated into the State Bank of Chile²⁴. In contrast, the bank system's interest rate was never less than 7%.

In addition, the CCA had even lower "special interest rates" for specific circumstances, such as years of bad harvests, or to promote the cultivation of key agricultural crops. In 1935, for example, Law No. 5558 allowed the CCA to make loans to farmers severely affected by frost at only 3% of annual interest²⁵. Then, in 1936, due to shortage of basic food items in the previous year and pursuant to the government's indications, the CCA Board offered credit at only 2% to farmers who needed seeds for growing crops geared for the domestic market, such as potatoes and beans²⁶. Finally, as Chile faced a shortage of wheat, by far the most important crop in the country, in 1942 the CCA made loans at an annual interest of 4%, provided that farmers invested in soil preparation, seeds, sacks and fertilizers for wheat production. The special interest rate for wheat cultivation remained in place at least until 1947²⁷. Accordingly, loans from the CCA could be up to three times less expensive than loans from the private credit institutions and, in several years, they were made at a real interest rate that was less than zero. Even though it had to deal with screening and monitoring costs, as its healthy finances show, the CCA provided loans to farmers who were able to repay them but could not get fair terms in the

22. The real interest rate, following Fisher's equation, can be understood as the approximate difference between the nominal interest rate and inflation. From an economic approach, the real interest rate is the most appropriate tool to decide whether to lend or apply for a loan because it considers the purchasing power over the return of the loan and the real cost to the customer. However, in practice the rationally economic decision to make/take a loan is made *ex ante*, with the expected inflation due to the lag in official inflation data. The real interest rate series are from DÍAZ, LÜDERS and WAGNER (2016).

23. *Memoria anual de la Caja de Crédito Agrario*, 1950: 14-5.

24. *Memoria anual de la Caja de Crédito Agrario*, 1952: 15.

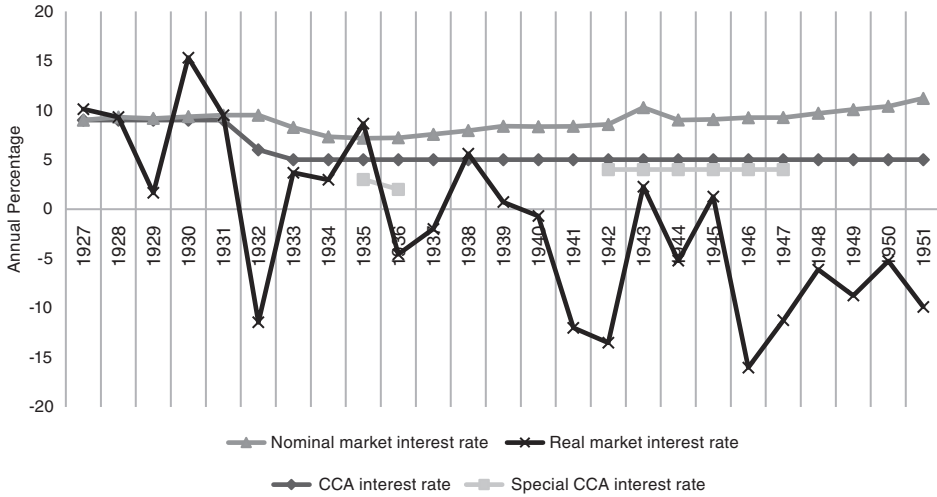
25. *Memoria anual de la Caja de Crédito Agrario*, 1935: 53.

26. *Memoria anual de la Caja de Crédito Agrario*, 1937: 63.

27. *Memoria anual de la Caja de Crédito Agrario*, 1948: 29.

informal credit sector. In fact, the only year that the CCA faced losses was the year 1932 because the impact of the Great Depression.

FIGURE 4
Real and Nominal interest rate of Banking System and Regular and Special interest rate of CCA (%), 1927-1953



Source: Estimated with data from *Memoria Anual CCA (1934-1952)* and *Díaz et al (2016). Chile 1810-2010. La república en cifras. Historical Statistics.*

The CCA used other mechanisms to ensure the repayment of loans. As Hoff and Stiglitz pointed out, in rural credit markets merchants-lenders or landowners-lenders may interlink the terms of transactions with transactions in the product or rental markets to affect the probability of default. For example, lenders may offer a borrower-farmer lower prices on fertilizers (Hoff & Stiglitz, 1990: 240). The CCA did this: it sold seeds, fertilizers, pesticides, among inputs through its Commercial Department, at lower prices than those in regular markets. This strategy reduced the default risk of small farmers but also produced profits that allowed the CCA to extend cheap credits. The average income from the Commercial Department in the form of rights, utilities, and commissions was more than 10 million *pesos* per year between 1933 and 1943. Moreover, rights, utilities, and commissions earnings reached over 40% of the gross earnings in the same period²⁸. In sum, the CCA not only helped small farmers through inexpensive loans, but also by selling inputs at lower prices.

28. *Memoria anual de la Caja de Crédito Agrario*, 1944: 78-9.

4. GEOGRAPHIC AND SOCIAL DISTRIBUTION OF CCA CREDIT

The geographic distribution of CCA operations among Chile's different agrarian regions and provinces is a relevant aspect to assess its role in the agricultural credit market²⁹. Initially, from 1928 to 1933, the CCA adopted a quota system to allocate the available credit according to the needs of each province, which were estimated considering agricultural and economics factors as the area under cultivation, livestock density, and crop productivity, among other variables. In practical terms, the CCA Board's made a proposal that determined quotas for each province, which then had to be approved by the government through the Superintendency of Banks (CCA, 1928: 40, 92). As a result, credit concentrated in Central Chile, by far the most important agricultural region, the 11 provinces of which received over 60% of the available funds. In turn, the provinces in La Frontera, Llanquihue and Sur Austral regions received approximately 30% of the total funds, while less than 10% went to Norte Chico. Norte Grande, a predominantly mining region, was allocated a negligible share. Credit balances show that farmers did not make use of all the available credit, and that Chile Central and Llanquihue were the agrarian regions with the highest levels of borrowing (Table 1). Some provinces in Central Chile, such as Santiago and Aconcagua, significantly exceeded their assigned quotas in four and three years, respectively; and in 1930 all the provinces of Central Chile exceeded their quotas, most likely as farmers were seeking credit to cope with the effects of the Great Depression.

The unbalanced distribution of CCA credit among regions and provinces persisted until the late 1930s. Thus, between 1928 and 1938 Central Chile concentrated 64.3% of the total credit, that is, much more than La Frontera (15.5), Llanquihue (10.6) Norte Chico (6.9) (Fig. 5). The provinces that received the most CCA credit were Santiago (22.3%), Valdivia (10.3%), Talca (10.2%), Colchagua (9%) and Cautín (8%). This credit concentration was related to economic differences among Chile's agricultural regions and provinces. The CCA, it appears, allocated more credit to provinces with larger areas under cultivation, higher land productivity, and a higher number of tenant farmers. That was clearly the case of Santiago province, which had the highest average yields for barley, potatoes, beans and corn, and the third-highest of wheat. Likewise, Valdivia province had the second highest productivity in wheat. Another factor related to credit concentration was CCA's emphasis on livestock raising; provinces with the highest livestock density were among those that received more credit from the CCA. By 1935, that was the case for

29. Chile's agrarian regions and the provinces they comprised are as follows: Norte Grande (provinces of Tarapacá and Antofagasta); Norte Chico (Atacama and Coquimbo); Central Chile (Aconcagua, Valparaíso, Santiago, O'Higgins, Colchagua, Curicó, Talca, Maule, Linares, Ñuble and Concepción); La Frontera (Arauco, Bio Bío, Malleco and Cautín); Llanquihue (Valdivia, Osorno and Llanquihue); and Sur Austral (Chiloé, Aysén and Magallanes).

Valdivia (20.7 head per km² of cultivated land), Colchagua (18.9), Concepción (16.3), Santiago (15.8) and Cautín (15.6) (DGE, 1931, vol. III: 40; DGE, 1933: 8-16; DGE, 1936: XIX)³⁰. Therefore, geographic concentration of CCA credit seems more related to economic reality than being the result of discrimination against any region or province, as Matthei (1939) suggested with reference to agricultural provinces in southern Chile.

TABLE 1
Effective use of Credit Allocated by CCA, 1928-1933

Agrarian Region	1928	1929	1930	1931	1932	1933
Norte Grande	—	—	33%	31%	31%	43%
Norte Chico	86%	79%	95%	89%	86%	67%
Chile Central	89%	75%	98%	97%	91%	89%
Frontera	85%	74%	92%	85%	76%	59%
Llanquihue	79%	70%	83%	89%	86%	67%
Sur Austral	88%	63%	68%	74%	73%	53%

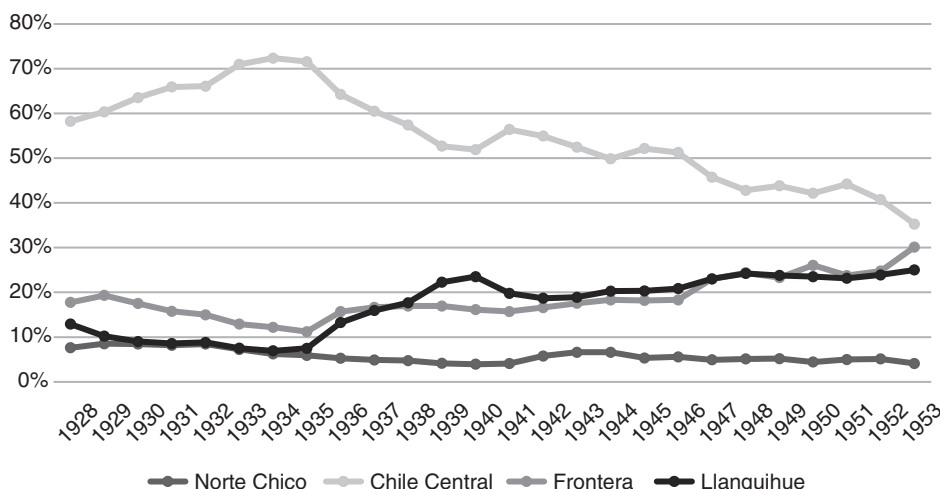
Source: Estimated with data from Anuario Estadístico de la República de Chile. Finanzas, bancos y cajas sociales (1929-1934).

Shortly after the CCA was reorganized, the geographic distribution of its operations began to change. Starting in 1935, a trend towards decentralization began developing, which resulted in a convergence in the credit allocated to, on the one hand, Central Chile and, on the other hand, La Frontera and Llanquihue regions. From 1936 to 1953, Central Chile lost the same credit market share that both southern regions gained (Fig. 5). A critical point in that process of convergence was reached in 1948, when the provinces comprising both La Frontera and Llanquihue started to receive more credit than the 11 provinces comprising Central Chile. By 1953, when the CCA ceased to operate, there was a fairly balanced distribution of agricultural credit in Chile. Between 1928 and 1953, Santiago province still received the largest share of CCA credit (15.6%), but it was followed by Valdivia (9.8%) and Cautín (8%), the main agricultural provinces in southern Chile, while Bío-Bío came close (6.8%) (Fig. 6). The decentralization of the CCA credit business is better shown by looking at the average credit share *per* province in the whole period from 1928 to 1953. Contrary to estimates presented in previous works, Llanquihue, in southern Chile, was allocated more average credit per province than any agrarian region: 5.9% per province, meanwhile, Chile Central obtained 4.9%, La Frontera 4.7%, Norte Chico 2.9%, Sur Austral 1% and Norte Grande 0.1%. In sum, there is evidence of credit decentralization due to the significant participation of Llanquihue and La Frontera regions in the last years of the enterprise and its high average credit by province.

30. Coquimbo was the first province with the largest number of hectares operated by tenants.

FIGURE 5

Evolution of the geographical distribution of the CCA Credit (real value), 1928-1953



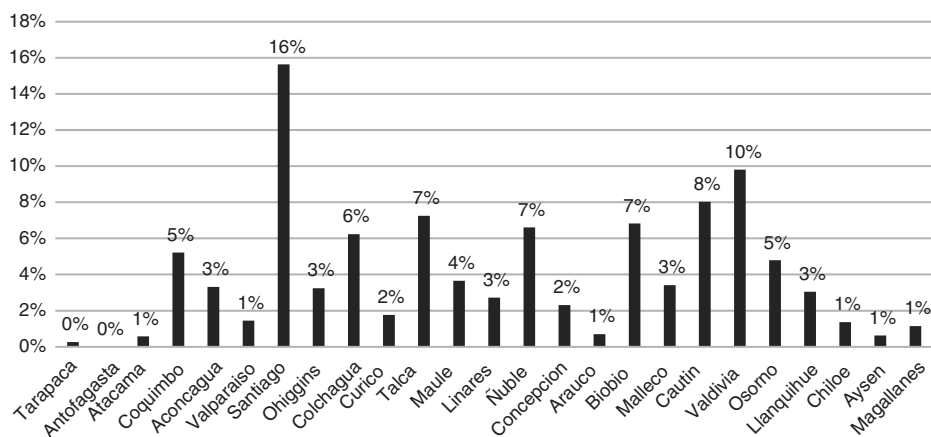
Source: Estimated with data from *Anuario Estadístico de la República de Chile. Finanzas, bancos y cajas sociales (1929-1954)* and Díaz et al (2016). *Chile 1810-2010. La república en cifras. Historical Statistics*.

Interestingly, the increasing share of credit received by the southern provinces was related not only to the opening of more branch offices, but also to political developments that changed the CCA's Board and policies. In the late 1930s, southern landowners affiliated with the Radical Party, the main government party under the three Popular Front administrations (1938-52), were appointed to the CCA Board of Directors. At the same time, southern landowners who were members of the Radical Party gained importance in the National Agricultural Society (SNA), especially those from La Frontera and Llanquihue (Wright, 1982: 81-2). That was the case of the four Möller Bordeu brothers and the Buschmann family, which were influential large landowners in Concepción and Llanquihue, respectively. Julio Buschmann, for instance, senator for Llanquihue province, was a member of the SNA, but also one of the founders of the Sociedad Agrícola y Ganadera de Osorno (SAGO), a new association of large landowners in the south. Edmundo Möller became a member of the CCA Board from 1941 to 1943, while his brother Fernando was minister of Agriculture in 1942, the same year that the geographical distribution of CCA credit shifted towards the southern provinces³¹.

31. *Memoria anual de la Caja de Crédito Agrario*, 1951: 88.

FIGURE 6

Geographical distribution of the CCA Credit (real value) per province, 1928-1953



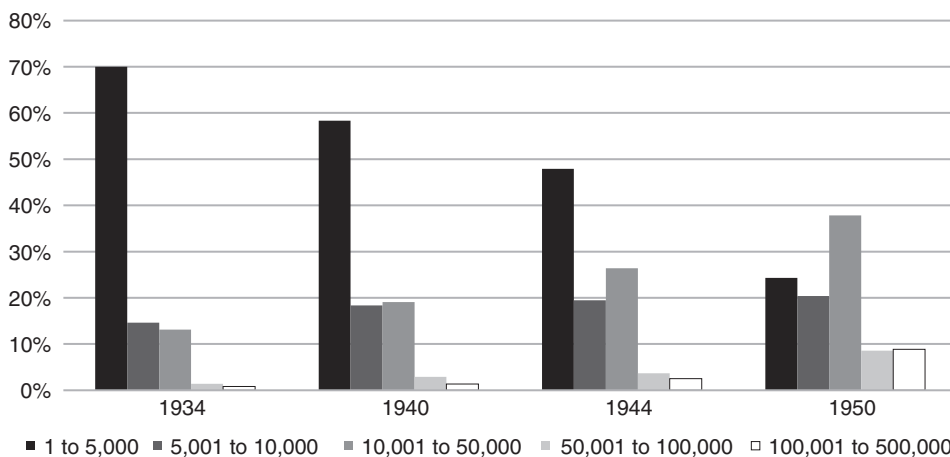
Source: Estimated with data from *Anuario Estadístico de la República de Chile. Finanzas, bancos y cajas sociales (1929-1954)* and Diaz et al (2016). *Chile 1810-2010. La república en cifras. Historical Statistics*.

Along with moving towards an increasing decentralization of its operations, the CCA definitely became the Chilean small farmer's fundamental source of credit. Most of the small farmers who borrowed from it had previously no access to the formal capital market, and many did not even own the land they farmed, so most of them could borrow only modest amounts of money in loans from the CCA. In 1933, Law No. 5185 defined "small farmers" as those who received loans for amounts not exceeding \$20,000, but in the early fifties the CCA Board defined the small farmer as "low-income peasants who are ordinarily outside the bank credit," had no other economic activity than "agricultural exploitation" and whose capital, according to CCA estimate, "does not exceed \$500,000 pesos". Based on that definition, the CCA determined that "the maximum individual loan to small farmers is \$50,000"³². Therefore, in our estimates of trends through the 1934-52 period we considered all loans for up to that sum as indicative of credit allocated to small farmers. Since the CCA was a microcredit institution, to better examine the social distribution of its credit, we divided all the loans in the same categories used in its annual reports and in Chile's main statistical. The data we have collected conclusively demonstrate that the CCA's main beneficiaries were small farmers: between 1934 and 1952, 89% of credit operations were for amounts equal to or less than \$50,000, while the number of operations for the largest category (\$100,001-\$500,000) were negligible, only 3% (Fig. 7). In addition, the reduction in the number of operations in the lowest category was almost equal to the increase in the number of loans for amounts in the second and third

32. *Memoria anual de la Caja de Crédito Agrario*, 1952: 20.

categories, that is, loans still lower than \$50,000³³. Further, the number of operations in 1953 would have been sufficient to reach 70% of the 55,761 owners of small properties of less than 5 hectares recorded in the 1955 agricultural census³⁴.

FIGURE 7
Social distribution of the number of credit operations, selected years



Source: Estimated with data from *Anuario Estadístico de la República de Chile. Finanzas, bancos y cajas sociales (1934-1945)* and *Memoria Anual CCA (1946-1951)*.

But what could small farmers afford with a loan for \$50,000? It is very difficult to know the answer, because in this period there were price controls of many agricultural products, multiple exchange rates for those products, and agricultural prices increased (Valdés, 1972). However, some prices can be indicated to have a notion of the possible uses of CCA credit geared for small farmers. In 1934 the CCA sold metal plows for \$220 pesos³⁵; at the beginning of the 1940s, through the Agricultural Export Board (Junta de Exportación

33. However, it is necessary to point out that keeping the tranches fixed during years of inflationary outbreaks implies that the participation of the lower tranches will tend to decrease over time because rational agriculturalists will increasingly get larger nominal amount of credits in order to maintain purchasing power of the loans. For instance, following the CPI from DÍAZ, LÜDERS and WAGNER (2016), we estimate that \$48,834 pesos from year 1951 are equivalent to \$5,000 pesos from year 1934 (in purchasing power terms), therefore, a farmer in 1951 would need a \$48,834 pesos loan to purchase the same things that the farmer did back in 1934. In other words, a loan of \$5,000 pesos taken in 1934 could only buy a tenth of its value in 1951.

34. This is assuming that each operation is a loan, and that each small farmer received one loan only per year. In fact, the ratio of loans outstanding to new loans in 1950 was 1.07, which is a measure of the average term of the loans (IBRD/FAO, 1952: 119).

35. *Memoria anual de la Caja de Crédito Agrario*, 1935: 115.

Agrícola) the government set the wholesale price of wheat at \$85 per 100 kilograms (Millar & Fernández, 2008: 422); in 1945 the CCA Board granted loans for \$100,000 specifically for the acquisition of breeding bulls, to be allocated in individual loans each of which could not exceed \$16,000, while the value of each animal could not exceed \$6,000³⁶. In sum, the distribution of the number of credit operations, the average amount per operation, and prices for relevant items demonstrate that the CCA was a microcredit institution.

After 1930, Chilean governments, from Arturo Alessandri's second term (1932-38) to the González Videla administration (1946-52), sought to increase agricultural production. These administrations resorted to a variety of strategies, including propaganda campaigns appealing to farmers' patriotism, inexpensive credit programs, special purchase prices, the purchase of surplus production, and price controls set by the Junta de Exportación Agrícola (Millar & Fernández, 2008). Following such policies, through loans at low interest rates, the CCA encouraged farmers to produce goods for domestic consumption that were important components of the urban population's diet, namely, meat, milk, and cereals, especially wheat (Bernedo, 1989). Thus, for instance, in 1935 Law No. 5157 allowed the CCA to provide special credits for farmers that needed to purchase seeds and fertilizers for wheat cultivation³⁷. These policies clearly were reflected in the purposes of the loans that the CCA made through the 1927-51 period. In fact, 55% of the total credit was directed to the production of cereals, meat and dairy; in addition, other important purposes declared in CCA loans were livestock raising and dairy production (31%) (Fig. 8). Indeed, between 1927-51, livestock and dairy received 31% of the total credit, while crop seeds and final processing of cereals obtained 24% of the credit, 4.5% of the credit was used for vineyards and wine-making, and 8.5% was for vegetables. Moreover, in terms of inputs, 21% of the funds from the CCA was used for fertilizers, disinfectants, machinery and work tools.

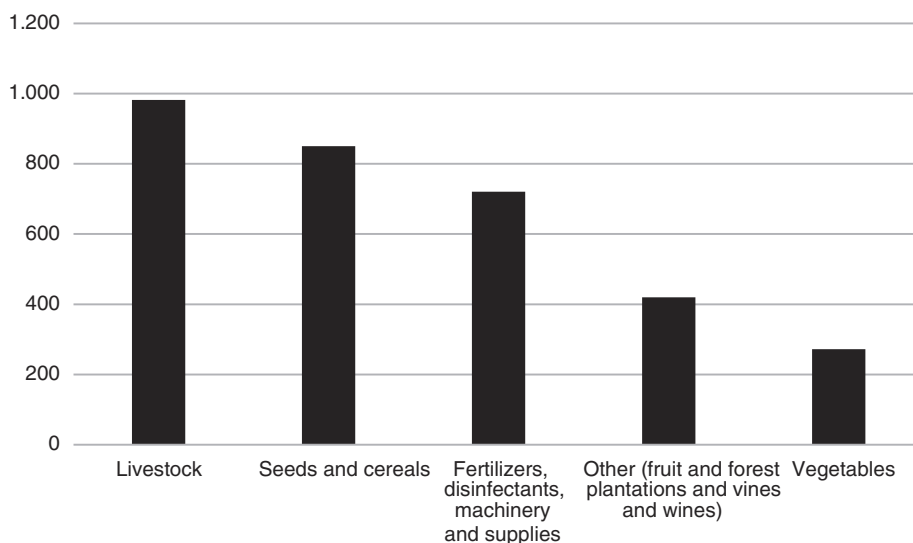
Given the limitations of the statistical sources, the impact of credit on the agricultural sector can be estimated by looking at general trends in those crops that were primarily the business of small farmers, namely, legumes and potatoes. The area under cultivation saw a modest increase from 82,144 ha in 1909-10 to 111,479 ha in 1925-26; thereafter it grew significantly, reaching 275,000 ha in 1934-35, that is, it more than doubled in the ten years following the creation of the CCA. From the thirties to fifties, there was an increase in vegetable production compared to that of other crops. While cereals, legumes, and wines, saw a decrease, fruit crops and vegetables increased (Díaz, 2006). Despite the

36. *Memoria anual de la Caja de Crédito Agrario*, 1946: 39.

37. *Memoria anual de la Caja de Crédito Agrario*, 1935: 61.

drop in the five-year period between 1935-39, in the long term (25-years period) the share of vegetables increased by 50%, from a 6.3% share in 1930-34 to 9.6% in 1955-59 (Díaz, 2006: 60). Even though the outcomes of agricultural production are multifactorial (climate, prices, availability of labor, use of fertilizers, capital and credit, machinery, etc.), it is reasonable to assume that a part of this growth was due to agricultural credit from the CCA given to small farmers.

FIGURE 8
Purpose of CCA Loans (real value in million pesos), 1927-1951



Source: Estimated with data from *Memoria 25 años: 1927-1951: Caja de Crédito Agrario. Memoria 1950-1951 y de sus 25 años de labor* (1952: 50) and Díaz et al (2016). *Chile 1810-2010. La república en cifras. Historical Statistics*.

5. CONCLUSIONS

Our findings dispute long-held views on the apparent neglect of agriculture in the economic policies that Chilean governments implemented during the period of “inward-oriented growth”. The CCA’s leading role in the expansion of the agricultural credit market in Chile from 1926 to 1953 attest to the developmentalist state’s interest in stimulating agriculture’s recovery after the Great Depression. Indeed, the industrialization-promoting state did foster agricultural growth by means of inexpensive, public credit primarily geared for small farmers located in all agricultural provinces. The series of CCA credit operations from 1927 to 1953, that we constructed with data from virtually untapped sources, demonstrate that this public institution became the main formal source of agri-

cultural credit just prior to its integration into the State Bank of Chile (1953), which is still in business as one of the major banks in the country. Although large commercial banks, the state's economic development agency (CORFO), the National Savings Bank, several commercial houses, and a number of small agricultural credit cooperatives participated in the formal agricultural credit market, due to the magnitude of its operations, the CCA was the main institution responsible for the maturation of agricultural credit market.

We also found relevant information that is not regularly available for private banks, such as the geographic, social, and productive allocation of CCA credit. The main beneficiaries of CCA loans were small farmers who received almost the entire funds that this institution put into the agricultural credit market. Initially, its operations concentrated in Central Chile, but starting in 1936 a process of convergence led to a fairly balanced distribution of CCA credits among the agricultural provinces of La Frontera, Llanquihue and Central Chile regions. Consequently, the CCA evolved into a decentralized credit-supplying institution. The CCA also became an organization with an extensive geographic coverage, despite the obstacles posed by Chile's longitudinal extension, and it remained an entirely public institution.

The CCA became a leading institution in Chile's credit market because its particular type of agricultural credit was substantially different from other forms of credit. First, the CCA extended loans for longer terms than those offered by the banking system, which enabled farmers to meet the agricultural production cycles. Second, the CCA had offices in rural locations that had no access to other financial institutions. Third, its lower requirements for collaterals allowed small farmers to obtain loans in the formal credit market, and made it possible for the CCA to reach farmers without financial records outside Central Chile provinces, where information asymmetries prevailed. Fourth, the CCA offered loans at lower interest rates than private banks.

Considering the CCA's leading position in the agricultural credit market by 1952, the fact that this institution has been neglected in the specialized literature is a surprising lacuna in the study of the state's role in promoting economic recovery in post-depression Chile. This omission is related to the persistence of conventional notions uncritically adopted to explain the so-called "agricultural stagnation" that Chile witnessed in the 1940s and 1950s, such as the supposed lack of public policies to promote agriculture. Insufficient research on the CCA is related to its over-simplification, supposedly as a mere extension of the ill-famed Caja de Crédito Hipotecario. Another notion held to illustrate the lack of state support to the agricultural sector, namely, the fact that CORFO provided scant credit to farmers, is also highly questionable. That function was performed by the CCA, while CORFO focused on other activities, especially manufacturing. The increas-

ing agricultural credit provided by CCA may thus be one of the explanations for the low amount of credit that CORFO allocated to agriculture. In light of this, the findings in this paper invite further research on public policies aimed at promoting agriculture under the industrializing state and their impact on agricultural productivity.

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APPENDIX

TABLE 2
Chilean Inflation (%), 1927-1953

Year	Inflation	Year	Inflation	Year	Inflation	Year	Inflation
1927	-1,0	1934	4,2	1941	23,1	1948	16,8
1928	0	1935	-1,4	1942	25,5	1949	20,6
1929	7,4	1936	12,3	1943	7,8	1950	16,5
1930	-5,2	1937	9,8	1944	15,0	1951	23,4
1931	0	1938	2,2	1945	7,7	1952	12,0
1932	23,6	1939	7,6	1946	30,1	1953	56,2
1933	4,4	1940	9,1	1947	23,1		

Source: Díaz et al (2016: 358-360). Chile 1810-2010. La república en cifras. Historical Statistics. Data available: <http://cliolab.economia.uc.cl/BD.html>

TABLE 3
Number and Amount of Credit Operations of the CCA, 1927-1953

Year	Number of Operations	Nominal amount of credit	Real value amount of credit	Year	Number of Operations	Nominal amount of credit	Real value amount of credit
1927	922	41,768,525	41,768,525	1941	15,152	240,999,979	97,852,248
1928	1,443	49,155,040	49,155,040	1942	19,226	312,615,791	101,123,926
1929	1,936	79,457,826	73,985,138	1943	23,27	397,340,843	119,202,462
1930	1,832	86,461,269	84,901,178	1944	21,184	352,082,206	91,844,892
1931	1,057	28,028,854	27,523,106	1945	21,608	448,728,748	108,680,919
1932	3,559	20,229,812	16,066,504	1946	24,316	534,990,264	99,606,994
1933	11,228	49,721,346	37,818,836	1947	29,994	700,119,175	105,904,842
1934	7,54	67,476,537	49,241,477	1948	28,048	748,063,803	96,865,349
1935	7,285	89,012,250	65,851,722	1949	30,078	1,010,435,633	108,488,210
1936	8,527	113,691,035	74,871,041	1950	36,141	1,354,689,46	124,840,685
1937	8,836	114,302,375	68,581,545	1951	41,605	2,332,991,049	174,244,954
1938	10,521	142,212,814	83,475,322	1952	44,392	2,623,294,000	174,900,054
1939	14,954	170,257,871	92,873,883	1953	45,702	2,875,256,000	122,748,177
1940	15,932	192,558,907	96,279,664	Total	476,288	15,175,941,414	2,388,696,690

Source: Estimated with data from Memoria 25 años: 1927-1951: Caja de Crédito Agrario. Memoria 1950-1951 y de sus 25 años de labor (1952: 52), Anuario Estadístico de la República de Chile. Finanzas, bancos y cajas sociales (1954: 27) and Díaz et al (2016). Chile 1810-2010. La república en cifras. Historical Statistics. Memoria anual de la Superintendencia de Bancos, 1929-1954. Biblioteca del Congreso Nacional. Chilean laws: www.leychile.cl

The Impact of the Rise of Modern Maize Production in Brazil and Argentina

HERBERT S. KLEIN AND FRANCISCO VIDAL LUNA

KEYWORDS: Brazil, Argentina, commercial agriculture, maize.

JEL CODES: Q12, Q13, Q15, Q17.

***B**razil and Argentina have emerged as leading maize producers and exporters in the past two decades. In both cases the modern maize industry is associated with the expansion of soybean production and has also had an impact on national meat production. We examine how this transformation of maize production occurred, how it evolved in different ways in these two countries and how it relates to changes in their general agricultural development.*

O Impacto do Aumento da Produção Moderna de Milho no Brasil e na Argentina

PALAVRAS-CHAVE: Brasil, Argentina, agricultura comercial, milho.

CÓDIGOS JEL: Q12, Q13, Q15, Q17.

O Brasil e a Argentina emergiram como principais produtores e exportadores de milho nas últimas duas décadas. Em ambos os casos, a moderna indústria do milho está associada à expansão da produção de soja e também impactou a produção nacional de carne. Examinamos como ocorreu essa transformação, a diferença dessa evolução nos dois países e como se relaciona com as mudanças gerais no desenvolvimento da atividade agropecuária.

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Herbert S. Klein [orcid.org/0000-0002-2239-2784] is Gouverneur Morris Emeritus Professor of History Columbia University, and Research Fellow at the Hoover Institute at Stanford University. Address, Hoover Institution, 434 Galvez Mall, Stanford, California 94305, E-mail address is hklein@stanford.edu

Francisco Vidal Luna [orcid.org/0000-0002-7694-7159] is professor in the Faculdade de Economia e Administração (FEA) of the Universidade de São Paulo. Address, FEA-USP, Avenida Professor Luciano Gualberto, 908 - Butantã - São Paulo/SP - 05508-010 E-mail: foluna@usp.br

1. INTRODUCTION

In the past two decades the spectacular growth of maize exports by Brazil combined with continued exports of maize by Argentina has turned the South American countries into the primary zone for maize exports in the world market. In both cases corn has expanded with soy production and in both cases, it has been tied to major changes in meat production. In Brazil the availability of abundant supplies of soy and maize enabled the underpinnings of the extraordinary surge in meat exports in this very same period. In the case of Argentina, soybeans have replaced natural pasture and the increase in maize production allowed Argentina to shift from pasture feeding to stockyard feeding as never before in Argentine history. In this essay we examine how this transformation of maize production occurred, how it evolved in these two countries of Brazil and Argentina, and how it relates to their auxiliary agricultural production, both of soybeans and meat. We first analyze the maize production and exports in the recent period in these two leading South American producers, then we examine in detail how the two crops system of corn production in Brazil develops in association with the soybean crop and its impact on the pastoral industry. In the next section on Argentina, we show how the growth of maize production was also associated with soybean crops, but in a pattern different from Brazil in terms of the timing of the crop, its production by corporations renting land, and its impact on cattle and wheat production. In our conclusion we explore how these two highly productive maize systems evolved and the major factors which influenced their different patterns of growth.

2. RELEVANCE OF MAIZE PRODUCTION IN THE PAST DECADES

Maize is the largest cereal produced in the world, surpassing such other cereals of world importance as wheat, rice, and soybeans. America, the continent where maize was domesticated, accounts for half of world production. In recent years South America has emerged as the leading source of maize exports for the world market, when Argentina was joined by Brazil as a major world exporter. In the harvest of 2019-20, Argentina and Brazil together produced some 153 million tons of maize and exported 74,000 tons which represented respectively 14% of world production and 43% of world exports (USDA, 2021b: 28, 29). While Argentina has a long history of exporting maize and other grains into the world market, this is a new development for Brazil. In both cases the revolution in genetically modified seeds, the adoption of no-till farming and the association of maize with the new South American crop of soybeans, led to major change in the yield and importance of maize within their agricultural economies. It also fostered significant change in their respective cattle and chicken industries due to the increasing abundance of maize.

Although Argentina had been exporting its maize production from the end of the 19th century, in Brazil maize was a largely small farming product with a limited internal market, mostly going to animal feed. But the dramatic expansion of soybean production which began in the late 20th century soon turned to maize as the major rotating crop to be used in the soybean fields to balance soil nutrients. This led to an explosion of maize production and its association with commercial large-scale agriculture, especially of soybeans. This sudden expansion of maize, which only occurred in the past two decades, allowed Brazil for the first time to export a substantial amount of the maize it produced. It also provided the nation with an ever increasing amount of maize for animal feed, the primary domestic use of maize. This in turn permitted Brazil not only to supply the domestic market, but it allowed for the sudden growth of cattle and chicken production in this same period. By the second decade of the 21st century Brazil's maize exports finally equaled or surpassed those of Argentina. At the same time this newly abundant maize and soybean production allowed Brazil for the first time to become a major exporter of bovine and chicken meats, which grew so rapidly that Brazil became the world's largest meat and chicken exporter in this same period as the expansion of maize production (USDA, 2021a).

Brazil was thus able to develop both a modern pastoral industry based on a steady supply of animal feed made from soybeans and maize increasing its stock of bovine and swine herds but also to create industrial commercial chicken farms at the same time. Like Argentina, the feeding of cattle previously had been based on pasturing the animals on grasses. But in the case of Brazil, most ranchers had not developed the grasses and cultivated pastures that made Argentina famous in the world as an exporter of meat from the late 19th century. Instead, they relied far more on natural pastures on mostly lands unsuitable for cropping. The availability of a steady and increasingly abundant source of both soybeans and maize are fundamental in explaining the rise of Brazil as the world's largest exporter of beef and chicken in this most recent period.

In view of its enormous adaptability to physical conditions and easy planting, maize is produced by 170 different countries. Among the twenty largest producers there are countries with totally different climate and geographical characteristics, such as India, South Africa, Canada, France and Egypt. Currently the largest producers are the United States, China, Brazil, Argentina, and India in that order. What is impressive is that since 1980 the two South American countries have increased their production at a higher rate than all the other major producers, with the most recent period from 2000 to 2020 showing Brazil growing at almost twice the rate of the world increase in maize production (see Table 1).

TABLE 1
World production of maize in selected countries, 1980-2020 (1000 tons)

Country	1980	2000	2020/2021	% Annual Growth	
				1980-2020	2000-2020
United States	168,647	251,854	373,949	2.0%	2.0%
China	62,715	106,178	260,000	3.6%	4.6%
Brazil	20,372	32,321	110,000	4.3%	6.3%
Argentina	6,400	16,781	50,000	5.3%	5.6%
India	6,957	12,043	28,000	3.5%	4.3%
Mexico	12,374	17,557	28,000	2.1%	2.4%
Canada	5,753	6,954	14,000	2.2%	3.6%
South Africa	11,040	11,431	14,000	0.6%	1.0%
Others	102,365	136,920	640,867	4.7%	8.0%
World	396,623	592,039	1,518,816	3.4%	4.8%
% Argentina+Brazil	7%	8%	11%		

Notes: the European Union is a major producer, but is not listed as such in Faostat.

Source: Faostat (www.fao.org/faostat/en/#data/QA) and USDA (2020: 29).

TABLE 2
Corn: world supply and distribution, 2019-20 (1000 tons)

Countries/regions	Production	Consumption	Imports	Exports	Ending Stoks
United States	345,962	309,506	959	46,923	48,757
China	260,779	278,000	7,596		200,526
Brazil	102,000	68,500	2,003	34,187	4,792
European Union	66,718	81,000	18,607	4,807	7,177
Argentina	51,000	13,500		39,917	3,672
India	28,766	27,200		1,125	
Mexico	26,658	43,800	16,526		3,515
Canada	13,563	13,960	1,867		2,559
Others	221,084	299,153	127,476	48,075	32,127
Total	1,116,530	1,134,619	175,034	175,034	303,125
Brazil+Argentina	153,000	82,000	2,003	74,104	8,464
%Brasil+Argentina	14%	7%	1%	42%	3%

Source: USDA (2021b: 28-9).

Since maize can be grown in the most varied climates most countries are self-sufficient or produce a significant portion of domestic demand (Paliwal, 2001: 18). Thus, only 15% of world production enters international trade. In the harvest of 2020-21 the largest importers, those importing 10,000 tons or more, are the European Union, Mexico, and sev-

eral Asian and Middle Eastern countries. The United States, Brazil and Argentina are the leading exporters. Two of the largest exporters, the United States and Brazil are also the largest consumers, along with China and the European Union (see Table 2).

These two South American nations are unusual among world maize producers in the high percentage of national production which they exported and the high ratio of domestic supplies which went into animal feed. Whereas Argentina exported on average just over half their national production in the quinquennium of 2014-18, and Brazil almost a third, the world as a whole managed to export an average 15% of its production in this same period, as did the United States which remains the world's largest maize exporter. These two Latin American producers also devoted an extraordinarily high ratio of their domestic supply to animal feed—in both cases averaging three quarters of that national consumption. In contrast the United States used just 43% on average in this five-year period for its domestic consumption for feed and the world in general applied just 56% of corn production to this end (see Table 3).

3. MAIZE PRODUCTION IN BRAZIL

The recent evolution of maize production and productivity in Brazil is the result of the profound transformation and modernization of Brazilian agriculture which began in the 1960s (Klein & Luna, 2019). The government at the time was promoting import substitution industrialization and as a complement to this policy also promoted modern government management of agricultural activity. This involved a minimum price policy, the creation of regulatory stocks, the promotion of an abundant and subsidized credit system, and major government sponsored research in agriculture with the creation of Embrapa. Embrapa scientists helped revolutionize Brazilian agriculture through new seeds and new soil preparation adapted to tropical conditions (Alves, Souza & Gomes, 2013). This research permitted farmers to occupy the Cerrado region in the Center-West of the country.

From the 1960s to the early 1980s the government's system of subsidies was costly both in terms of credit and the support of wheat (Fernandes Filho, 1995: 443-74; Cole, 1998). The foreign debt crisis of the 1980s and the accompanying national fiscal crisis led to an end to subsidies in the agricultural area. But agriculture, unlike industry, was able to integrate with the main international agribusiness value chains, create domestic and foreign markets to finance its operations and persistently increase productivity, allowing the country to become an active agent in the international products market in the last twenty years. It has become a leading world producer and exporter of numerous products from soybeans to boiler chickens. It was in relationship to the growth of soybean pro-

TABLE 3
Usage of corn in the domestic market of Argentina, Brazil,
and the United States, 2014-18 (1000 tons)

Element	2014	2015	2016	2017	2018
Brazil					
Production	85,283	85,283	64,188	97,911	82,288
Import Quantity	388	388	2,910	1,340	941
Stock Variation	-6,130	-6,130	-1,073	7,250	-4,704
Export Quantity	29,159	29,159	22,077	29,555	23,760
Domestic supply	62,642	62,642	46,095	62,445	64,173
Feed	47,806	47,806	33,279	45,949	49,378
Seed	486	486	366	558	469
Losses	8,565	8,565	6,709	9,924	8,321
Processing	49	49	51	51	45
Other uses (non-food)	0	0	0	0	0
Food	5,736	5,736	5,690	5,964	5,960
Argentina					
Production	33,087	33,818	39,793	49,476	43,462
Import Quantity	0	3	3	14	9
Stock Variation	0	0	0	2,000	1,000
Export Quantity	15,965	16,800	24,582	23,785	23,234
Domestic supply	17,124	17,020	15,213	23,704	19,237
Feed	12,600	12,660	10,703	18,040	14,203
Seed	280	332	391	486	427
Losses	482	492	579	720	633
Processing	901	809	754	828	811
Other uses (non-food)	2,337	2,220	2,279	3,114	2,647
Food	524	507	506	516	517
USA					
Production	361,091	345,486	412,262	371,096	364,262
Import Quantity	950	1,446	1,982	1,756	1,193
Stock Variation	12,682	149	14,130	-3,886	2,043
Export Quantity	50,163	45,089	56,463	53,507	70,534
Domestic Supply	299,196	301,694	343,651	323,231	292,878
Feed	135,019	129,999	138,935	134,735	133,991
Seed	796	832	798	807	838
Losses	17,048	16,163	19,111	18,264	17,864
Processing	23,640	22,401	24,788	23,925	25,310
Other uses (non-food)	118,821	128,419	156,118	141,583	110,955
Food	3,871	3,882	3,901	3,918	3,920

Source: Faostat (www.fao.org/faostat/en/#data/FBS).

duction that maize finally became a major commercial product and was produced in such abundance that it became a major export crop for Brazil.

Maize is a traditional product of the Brazilian farmer since early colonial times and was cultivated with low productivity. For example, in one of the first agricultural censuses carried out in Brazil, that of São Paulo in 1905, some 77% of the farms produced maize, though they used only 27% of their cultivated lands to do so. Coffee of course was the major crop and accounted for 64% of total agricultural production, but maize was second valued at 16% of total output (Luna, Klein & Summerhill, 2016: table 1). In the 1920 national agricultural census some 37% of the cultivated lands were dedicated to maize production. This made it the largest single crop in terms of land usage, with coffee second and it was grown on a third of the cultivated lands. It accounted for 24% of the value of agricultural production, just behind coffee which represented 25% of total crop value in that year (DGE, 1920: XIX, table 6.). From 1919 to 1959 maize production went from 5 million tons to 9 million tons, for a growth of 2% per annum, with the greatest production coming from the Southeast and Southern Regions, with the states of Minas Gerais, São Paulo, Paraná and Rio Grande do Sul each producing well over a million tons (IBGE, 1960: 124, table XII).

TABLE 4
Yield per hectare of maize in selected American countries, 1961 (in tons)

	Countries in 1961				
	Canada	USA	Argentina	Brazil	Mexico
1961	4.6	3.9	1.8	1.3	1.0
1971	5.2	5.5	2.4	1.3	1.3
1981	5.9	6.8	3.8	1.8	1.8
1991	6.7	6.8	4.0	1.8	2.1
2001	6.6	8.7	5.5	3.4	2.6
2011	9.5	9.2	6.4	4.2	2.9
2018	9.7	11.9	6.1	5.1	3.8

Source: Faostat (www.fao.org/faostat/en/#data/QC).

But for all its importance in national consumption, Brazilian productivity in maize was quite low. In 1961 the yields per hectare of maize in Brazil were only 29% of the yields obtained in Canada and only a third of what farmers in the United States obtained. While the leading American producers continued to improve productivity throughout the last half of the 20th century, Brazil remained at a relatively stagnant level of maize production. It did not pass the 2 tons per hectare level until 2000 whereas Argentina passed that yield thirty years earlier and even Mexico reached that level by 1991. As late as 1991 it was only 27% of Canadian and US productivity in maize output (see Table 4).

Although average productivity was low, the universality of its planting meant that production was usually sufficient to cover national needs, with imports needed to meet production crises or supply imbalances in the off-season. Productivity varied by region with traditional southern Brazilian small farm producers having low yields, while new planting areas with their large farms in the Center-West had yields close to those of Canada and the United States. This can be seen in the agricultural census of 2017 which showed high variation in yield, in contrast to soybeans which was a commercial crop with the same yields no matter what the size of the farm might be (see Table 5).

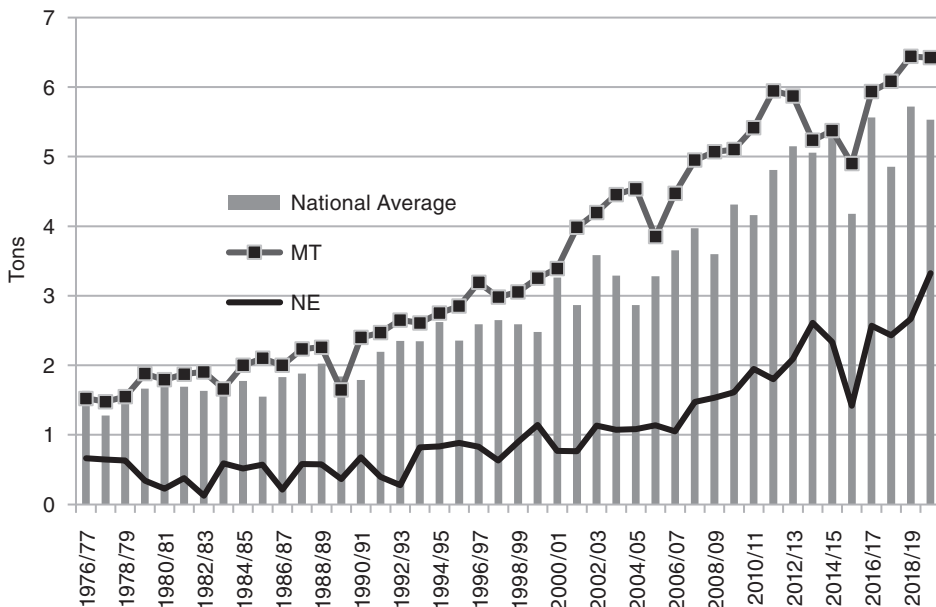
TABLE 5
Production, area planted and yield of maize and soybeans by size of farms.
Agricultural census, 2017

Size of Farm	Production (tons)	Area Planted	ton/hectare
Soybeans			
Total	103,156,255	30,722,657	3.36
>0 and <1 ha	2,322	710	3.27
1 - 2 ha	20,496	6,248	3.28
2 - 5 ha	361,499	109,544	3.30
5 - 10 ha	1,029,836	309,271	3.33
10 - 20 ha	2,178,765	643,994	3.38
20 - 50 ha	4,690,006	1,372,136	3.42
50 - 100 ha	5,313,670	1,559,798	3.41
100 - 200 ha	7,196,659	2,121,796	3.39
200 - 500 ha	15,111,610	4,491,662	3.36
500+	67,251,391	20,107,499	3.34
Maize			
Total	88,099,622	15,783,895	5.58
>0 and <1 ha	473,738	356,386	1.33
1 - 2 ha	800,730	407,054	1.97
2 - 5 ha	2,180,154	678,662	3.21
5 - 10 ha	2,014,870	425,316	4.74
10 - 20 ha	2,643,354	474,249	5.57
20 - 50 ha	4,511,532	777,258	5.80
50 - 100 ha	4,743,957	815,335	5.82
100 - 200 ha	6,621,814	1,110,688	5.96
200 - 500 ha	13,536,620	2,265,094	5.98
500+	50,572,854	8,473,852	5.97

Source: IBGE, *censo agro 2017* (<https://censos.ibge.gov.br/agro/2017>).

This is well reflected as well in the geographically diverse patterns in yields over time. Comparing the best performing state of Mato Grosso with all the states which made up the Northeastern region, the differences were profound. Of the 103 million tons produced in the harvest of 2019-20, Mato Grosso was the largest producing state with 35 million tons, while all the Northeast states produced just 9 million tons of maize. Mato Grosso already had reached a yield of 2 tons per hectare by the harvest of 1984-85 whereas the Northeastern region did not reach that level until 1991-92. By the late 1990s Mato Grosso was up to 3 tons per hectare and reached 6.4 tons per hectare by 2019/20 or double what was achieved by the Northeastern region in that crop year (see Graph 1).

GRAPH 1
Maize yields by hectare for Mato Grosso (MT)
and the Northeastern States (NE), 1976-2020 (in tons)



Source: Conab (1976-2020).

Although this huge regional difference persists, over time there has been a slow but steady tendency to reduce this gap between regions. Some formerly marginal areas in the North and Northeast are now highly productive, such as the area called Matopiba¹. In general,

1. Matopiba is a region that comprises the Cerrado biome in the states of Maranhão, Tocantins, Piauí, and Bahia, and accounts for a large part of the Brazilian production of grains and fiber.

TABLE 6

Cultivated area, production and productivity of maize by states and regions, 2019-20

Region/States	Area (1000 há)	Production (1000 tons)	Productivity (kg/há)
NORTE	804.8	3,518.7	4,372
Roraima	15.0	90.0	6,000
Rondonia	197.9	1,004.1	5,074
Acre	32.4	80.2	2,476
Amazonas	11.2	28.4	2,535
Amapá	1.4	1.4	972
Pará	264.6	834.8	3,155
Tocantins	282.3	1,479.8	5,242
NORDESTE	2,627.3	8,736.9	3,325
Maranhão	452.4	2,196.3	4,855
Piauí	467.6	2,195.2	4,695
Ceará	519.5	640.0	1,232
Rio Grande do Norte	59.7	34.3	574
Paraíba	107.6	89.0	827
Pernambuco	235.8	188.2	798
Alagoas	38.4	61.4	1,600
Sergipe	153.7	849.7	5,528
Bahia	592.6	2,482.8	4,190
CENTRO-OESTE	9,283.5	56,836.0	6,122
Mato Grosso	5,455.6	34,954.5	6,407
Mato Grosso do Sul	1,855.0	8,783.0	4,735
Goiás	1,911.7	12,616.9	6,600
Distrito Federal	61.20	481.60	7,869
SUDESTE	2,054.5	11,764.0	5,726
Minas Gerais	1,171.2	7,524.3	6,424
Espirito Santo	11.5	33.2	2,891
Rio de Janeiro	1.1	3.6	3,295
São Paulo	870.7	4,202.9	4,827
SUL	3,757.2	21,663.1	5,766
Paraná	2,629.8	14,947.8	5,684
Santa Catarina	336.0	2,779.7	8,273
Rio Grande do Sul	791.4	3,935.6	4,973
NORTE/NORDESTE	3,432.1	12,255.6	3,571
CENTRO-SUL	15,095.2	90,263.1	5,980
BRASIL	18,527.3	102,518.7	5,533

Source: Conab (1976-2020: Milho 1ª Safra, Milho 2ª Safra, Milho 3ª Safra).

among all farmers, even family farms producing for the national market, there is a slow but steady increase in yields in such basic crops as rice and beans as well as maize. Thus, most states producing over 500,000 tons per annum of maize were now achieving between 4 and 6 tons per hectare. Only the insignificant producing states are still at minimally productive levels (see Table 6).

From 9 million tons in 1991 Brazilian maize production reached 102 million in 2020. This massive growth of output permitted Brazil to satisfy all its necessities and begin to export maize by the 21st century. This very recent emergence of Brazil as a world class exporter is due to several major developments. There was since the 1960s major improvements in Brazilian agriculture in general, including the improvement of crop treatments, new seeds, both hybrid or genetically modified ones, and the ability to occupy new territories, such as Cerrado thanks to the work of Embrapa which played a fundamental role in how to treat these previously unproductive soils. Finally, the expansion of soybean crops into the tropical Center-West region was fundamental. Maize was now used as the major alternative crop to soybeans. Alternate cropping was fundamental in the tropical agriculture of the Center-West region to prevent plagues, as the repetition of the same crop increases the chances of crop infestation. Thus, as the Center-West become the world's largest producer of soybeans, maize production expanded there as well on highly commercial large size farms, especially as Brazil was able to develop two crops a year.

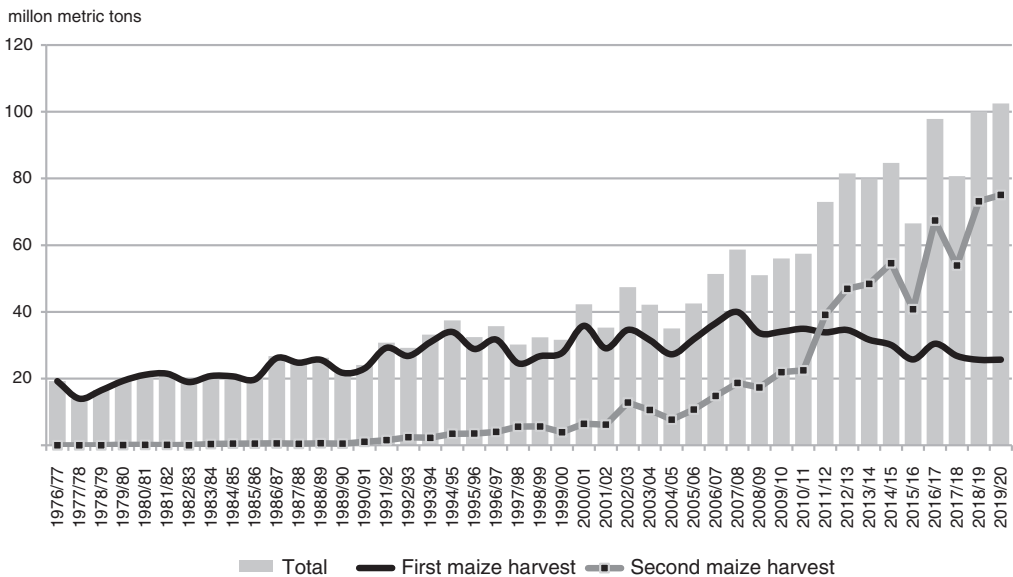
The second major change was the adoption of no-till, or Direct Planting Agriculture, especially as it applied to maize in these new regions (Oliveira *et al.*, 2015: 41). Brazil was one of the pioneering countries in the adoption of this technology, and today the United States, Brazil and Argentina respectively are the leading countries in the world in terms of area cultivated using this cultivation process, which in addition to direct benefits in the sustainability of agriculture, presents economic results that justified its wide adoption in Brazil (Motter & Almeida, 2015; Oliveira *et al.*, 2015: 40-4; Camargo, Angelo & Oliveira, 2016; Kassam *et al.*, 2015: 3). By the 2017 agricultural census 32.8 million hectares were planted through this process, involving 557 agricultural establishments². It was this technology which contributed to the extraordinary expansion of a second crop in the dry season. The no till system is faster, reducing the risk of water deficit, in addition, it maintains the coverage of the soil surface and allows greater water infiltration into the soil and reduces evaporation (Cruz *et al.*, 2006: 42-53; Cruz *et al.*, 2002: 7; Cruz *et al.*, 2010).

The third change was the wholesale adoption what has been called double cropping or tropical soybean-maize succession cropping generically called the *safrinha*, or the lit-

2. IBGE, *Sidra*, table 6640 (<https://sidra.ibge.gov.br/tabela/6640>).

the harvest in which this no-till planting was crucial (Simão, 2016: 4). The traditional maize harvest was produced in the wet season from October to December. This new second harvest was planted directly over the harvested crop of the wet season in the dry season and without irrigation from January to March or April using the no till planting technique (*plantio direto*). The first crop was most often quick growing soybeans (or *soja precoce*). Although there were early experiments of this type of double planting in the Southern states in the 1980s and 1990s, they were less viable for this production than zones closer to the equator. The serious adoption of this system on a large scale came after 2000 and was most fully developed in the hotter Center West region (Montesdeoca, 2014; Cruz, Pereira Filho & Pereira, 2020). Suddenly Brazil was producing two harvests of maize every year, with the *safrinha*, or second harvest, becoming ever more important over time and finally dominating national production. In 2000 only 15% of the maize came from the *safrinha*. By 2011-12 it was over half the total production and by harvest of 2019-20 this second harvest accounted for 73% of the crop (see Graph 2).

GRAPH 2
Total output of first and second maize harvest, 1976-77 to 2019-20



Source: Conab (1976-2020).

A final significant factor that was crucial was the use of new hybrid seeds. Both in family farms and in non-family farms, these certified or transgenic GM seeds were fundamental in maize production. Although the majority of farms producing maize were family farms, in the case of seeds used, there was little difference between the two types of

farms. Both family farms and non-family farms used certified or transgenic seeds in approximately a quarter of both these two types of establishments. Moreover in both cases those using these seeds produced the bulk of maize harvested. In the case of family farms, those using these seeds accounted for 81% of family farm maize production and among the non-family farms the ratio was 90%. Thus certified or transgenic seeds were another key factor in the expansion of maize production in this period (see Table 7). As of 2017 GM seeds were planted on 50.2 million hectares of cultivated land, of which GM maize was planted on 15.6 million hectares and GM soybeans on 33.7 million hectares. By this year Brazil was the world's second largest consumer of GM seeds in the world after the United States (ISAAA, 2017: 6, 15).

TABLE 7

Types of seeds used in maize production in Brazil by type of farming unit, 2017

Seeds Used	All Farms	Non-Family Farm	Family Farm
Total	1,655,450	312,495	1,342,955
Common, self-produced	910,449	159,178	751,271
Common, aquired	336,735	67,285	269,450
Certified	195,334	41,281	154,053
Transgenic	212,932	44,751	168,181
Cultivated Area			
Total	15,783,895	13,038,855	2,745,039
Common, self-produced	1,026,910	368,506	658,403
Common, aquired	1,715,398	1,275,764	439,634
Certified	5,019,183	4,441,876	577,307
Transgenic	8,022,405	6,952,709	1,069,695
Quantity Produced (tons)			
Total	88,099,622	77,127,610	10,972,012
Common, self-produced	2,157,531	1,350,772	806,759
Common, aquired	7,977,022	6,685,691	1,291,330
Certified	28,633,312	25,960,236	2,673,076
Transgenic	49,331,758	43,130,912	6,200,846

Source: IBGE, *Sidra*, table 6958 (<https://sidra.ibge.gov.br/tabela/6958>).

This recent growth of a second maize harvest has enabled Brazil to become a significant exporter of maize in the world market, becoming the second largest exporter after the United States only recently. Brazil exported a small amount and in most years imported a small amount through most of the 20th century. Even as recently as the 1980s and 1990s there was a recurring deficit in the maize trade with national production insufficient for domestic needs and with the country taking in imports of corn usually on an annual ba-

sis. It was only in the harvest of 2000-01 that Brazil produced enough corn to begin to seriously export its surplus and supply the internal market. Thereafter both internal consumption and production began to expand at an ever-rapid place. In the quinquennium of 1996-97 both consumption and production averaged 34.2 million tons and by the quinquennium of 2016-17 to 2020-21 average consumption had almost doubled to 65.9 million tons, but national production had more than tripled to 98.4 million tons (USDA, 2001-2021).

This growth of production provided for an ever-increasing usage of maize in the internal market. Given the small consumption of maize as a human food, most of the growing demand came from the animal feed market. In the case of Brazil, in the seven years period from 2001-07 animal feed accounted for over two thirds of domestic demand, and of this animal feed, 58% went for poultry feed, some 15% for swine feed and 7% for feeding cattle (Cruz, 2010: 21, table 2). Over time this pattern slowly changed as exports and production increased. Thus in the period from 2010-11 to 2019-20 period, exports increased from 18% to 35% of annual production, production almost doubled and animal feed declined from 72% of that production to just 56% of total production. Consumption of animal feed actually increased from 39 million tons to 51 million tons in the same period, but exports and production increased even faster. There was however little change in the share of animal feed as poultry in this ten year period averaged 58% of the total feed consumed, swine increased to 28% and the cattle feed to 8%. Of the poultry consumed feed, most (on average 85%) went to feed boiler or meat chickens and 15% for egg laying hens (see Table 8). It is estimated that 60% of the cost of producing chicken and pigs is made up of the cost of feed, which is essentially composed of soybeans and maize (Copetti, 2021). This consumption of feed for chickens and for a lesser extent for cattle, led to an explosion of the stock of these animals. Brazil's chicken stocks went from 690 million in the decade of the 1990s to 1.3 billion in the decade of the 2010s. In the same period the stock of cattle went from 141 million head to 213 million head³. This growth of stocks permitted Brazil to greatly expand chicken and beef exports. Total meat exports went from 1.2 million tons to 6.1 million tons from 2000 to 2019, with chicken export volume going from 900 thousand tons to almost 4 million tons. These meat exports took off in the new century thanks to the availability of national soybean and maize production. This explains the high correlations between maize production and the chicken meat exports in the period 2000-19, while production of these two crops fundamental for animal feeding were very strongly correlated with each other (see Graph 3)⁴.

3. <http://www.fao.org/faostat/en/#data/QA>

4. In the period 2000-19 the correlation of maize production with chicken meat production was .91, and with chicken meat exports was .80, and .92 with soybean production.

TABLE 8

Categories of consumption of total maize available in Brazil, 2010-19 (in tons)

Category	2010/11	2011	2012	2013	2014	2015	2016	2017	2018	2019
Initial Stock	11,547	9,212	11,223	14,078	17,881	14,201	8,074	8,074	17,017	16,961
Total Production	53,749	70,907	83,462	82,760	87,153	73,887	100,687	100,687	94,529	91,241
Production 1 st safra	33,023	35,208	37,126	33,417	30,948	28,851	33,782	33,782	27,682	27,682
Production 2 nd safra	20,725	35,699	46,336	49,343	56,205	45,037	66,905	66,905	66,847	63,559
Imports	656	830	911	791	370	2,903	1,400	1,325	600	600
Substitute consumption	2,400	2,500	2,000	2,000	2,000	1,000	700	700	300	300
TOTAL OFFER	68,352	83,450	97,597	99,628	107,403	91,990	110,861	110,786	112,446	109,102
Total Demand										
Animal Consumption	38,828	40,298	43,453	47,177	49,454	48,067	49,720	49,720	50,680	50,680
Boiler Chickens	19,127	19,796	21,479	23,520	24,578	24,086	24,617	24,617	25,165	25,165
Egg Chickens	3,275	3,390	3,661	3,917	4,074	3,992	4,377	4,377	4,536	4,536
Pigs	10,670	10,937	11,648	12,556	13,247	12,584	13,141	13,141	13,267	13,267
Cattle	3,188	3,427	3,684	3,979	4,158	4,075	4,189	4,189	4,231	4,231
Outros animais	2,568	2,748	2,981	3,205	3,397	3,329	3,396	3,396	3,481	3,481
Industrial Consumption	4,636	4,868	5,209	5,990	6,589	6,523	6,653	6,653	6,786	6,786
Human Consumption	1,873	1,892	1,882	1,873	1,863	1,845	1,882	1,882	1,919	1,919
Other Uses	2,849	3,545	4,257	4,014	4,227	3,584	3,876	3,876	3,914	3,914
Losses	1,075	1,418	1,669	1,655	1,743	1,582	2,014	2,014	1,891	1,825
Seeds	393	404	425	381	403	443	439	419	451	429
EXPORTS	9,486	19,802	26,625	20,655	28,924	21,873	29,261	29,261	32,000	32,000
Total Demand	59,139	72,226	83,519	81,744	93,203	83,917	93,844	93,825	97,642	97,554
Final Stock	9,212	11,223	14,077	17,884	14,201	8,074	17,017	16,961	14,804	11,548

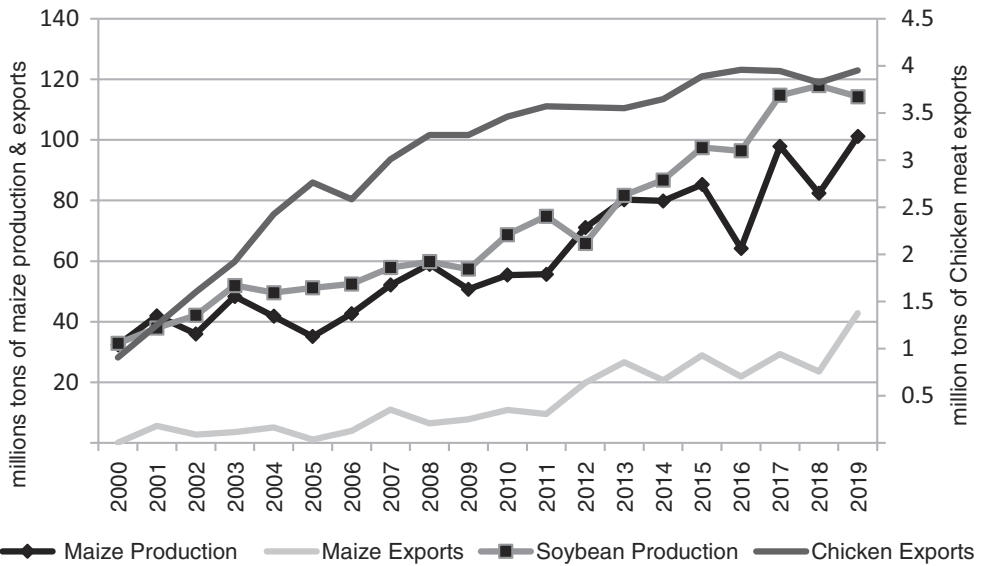
Source: Associação Brasileira das Industrias do Milho, "Estatística" (www.abimilho.com.br/estatistica).

These meat and chicken exports only began to be significant after 2000 when production finally outpaced the growth of national corn consumption. Once started these exports have been on a secular trend of growth, reaching 29 million tons in 2017 and 39 million tons in 2020, second to the United States and just ahead of the 34 million tons which Argentina will export –both of them together producing 15 million tons more than the United States (USDA, 2020: 30-1). In turn the estimate of Brazilian maize production for the harvest year 2020-21 is expected to produce 110 million tons of maize, and the national market will now consume an estimated 70 million tons, up from just 30 million tons in 2000.

This exceptional increase in production occurred with relative stability of the planted area, thanks to the extraordinary growth in productivity, which doubled in the 21st cen-

tury, from 2.7 tons/hectare to 5.6 tons, doubling in the period of 17 years. This type of stability was found in all grains, including soybeans (Klein & Luna, 2021). Thus increasing productivity led to higher output with little expansion in land use (see Graph 4).

GRAPH 3
Brazilian production and exportation of maize, and total exports of beef and chicken meat, 2000-19

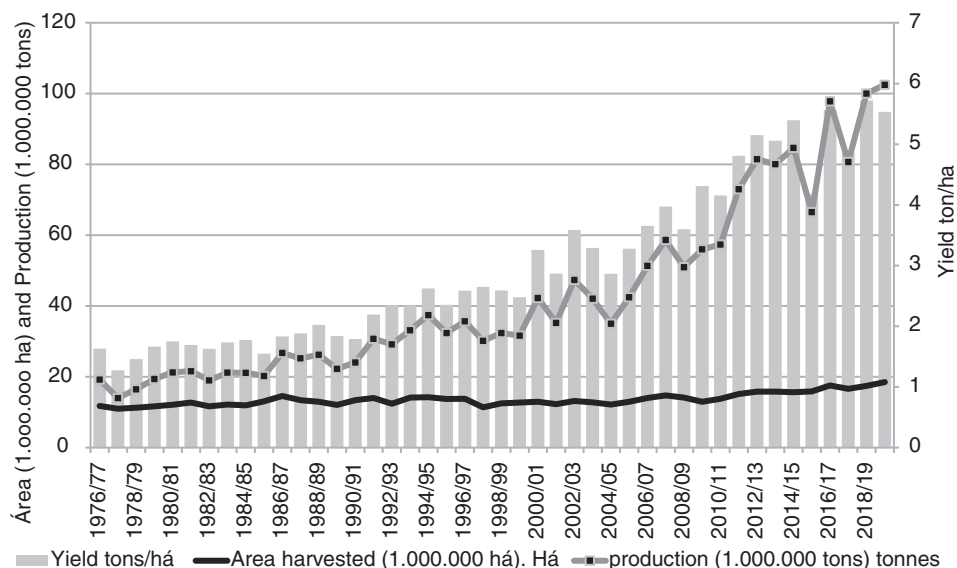


Source: Faostat (<http://www.fao.org/faostat/en/#data/QA>).

The structure of maize production is rather complex. According to the agricultural census of 2017, a total of 1.3 million family farms planted maize using 2.7 million hectares, and produced 11 million tons in the harvest. These family farms represent 81% of all farming units producing maize, accounted for 17% of the total land planted in maize crops and produced 12% of total maize production. In other words, maize was spread throughout Brazilian agriculture, but its production was concentrated in the 312 thousand non-family producers, who occupied 83% of the land dedicated to corn production and accounted for 88% of maize produced⁵.

5. IBGE, *Sidra*, table 6959 (<https://sidra.ibge.gov.br/tabela/6959>).

GRAPH 4
Maize in Brazil. Area, production and yield, 1976-2019



Source: Conab (1976-2020).

In other words, maize represents a crop open to all types of agricultural producers, unrelated to the size of the property, or whether it was a family or non-family farming unit. The vast majority of producers in fact are made up of small farmers, but today maize production is overwhelmingly produced by large farms with extensive cultivated areas. These productive farms are modern and competitive, explaining Brazil's ability to participate aggressively in the world maize market. Except for the production of soybeans, in which even small family farms achieve close to international levels of productivity (Klein & Luna, 2021: table 6), this pattern of large, middle and marginal farms is the norm in much of Brazilian agriculture. In general it is the middle and larger farms which are using modern agricultural technology, the latest in modified seeds and are fully integrated with international value chains, competing on equal terms with the major participants in world agribusiness. It is the small units, the majority of the farms, which in most cases are subsistence units only marginally producing for the domestic market.

It is these large commercial producers, now mostly producing soybeans as well as corn, who are the primary movers in this market. Their extraordinary increase in maize output has led to profound changes in both national and international markets for Brazilian meat production as maize has been, along with soybeans, the primary input into animal feed. This has allowed Brazil to become a leading world exporter of both beef and boiler chicken

meat as well as satisfying a national population that was growing at over 2% per annum through most of this period (Klein & Luna, 2019: chap. 3).

4. THE CASE OF ARGENTINA

Argentina, like Brazil, is one of the world's largest producers and exporters of grains, but the agricultural history of the two countries differs profoundly. At the beginning of the 20th century, Brazil had a significant production of some products such as coffee, rubber, sugar, and cocoa, but it also had a rudimentary food agriculture which had low productivity and offered the nation low food security. In contrast, Argentina represented one of the most important world producers of grains and meat in the world and maintained a secure national food supply (Barsky & Gelman, 2001; Scobie, 1964; Arriaga, 1999; Cortés, 1979; Gallo, 1983; Adelman, 1994; Hora, 2001; Giberti, 1981). In 1929 Argentina exported more than 13 million tons of grain, 6.6 million tons of wheat, 5 million tons of maize, 1.2 million tons of flax and about one million tons of other winter cereals. Argentina was considered the "Granary of the World", accounting for about half of the world market for cereals and flax. Availability of high-quality land, the massive influx of immigrants to agricultural work, an adequate network of railways and storage, as well as the improvement of maritime transport, were the essential elements explaining Argentina's position in the world grain market (Arriaga, 1999: 11; Ferreres, 2011: 4).

Like all countries, Argentina was strongly affected by the 1929 crisis, international market prices fell dramatically, causing a 40 to 50% drop in the value of the country's exports. In response, the government intervened in the market for the first time (Hora, 2012: 146-65; Cadenazzi, 2002; Barsky, 1988: 32). In 1933 it created a Regulatory Agency for Grains (Junta Reguladora de Granos) which was to act in support of market prices. To make the system operational, the government started to operate a national storage system to hold grains off the market. In 1935 the intervention process was deepened by the creation of the National Commission for Grains and Elevators, which involved the government in the whole process of production and commercialization of grains and seeds (Arriaga, 1999: 14). This direct intervention in the production and commercialization of grains continued until the 1950s. During this period there was relative stability in the productivity of the main grains produced in Argentina (Campos & Sanches Júnior, 2017: 124). From then on, the government started to operate with less interventionist mechanisms. In 1956, the National Institute of Agricultural Technology (INTA) was created to provide basic agricultural research and it proved to be of fundamental importance in the modernization of Argentine agriculture, playing a role similar to Embrapa in Brazil. Initially it incorporated all existing experimental stations which had been in existence from the be-

ginning of the century, and its funding was based on the collection of a 1.5% tax on agricultural exports (Pellegrini, 2014; Campos & Sanches Júnior, 2017: 125).

While government intervention in the agricultural market has waxed and waned over time, this dynamic has been a fundamental part of the national agricultural scene for some time. Since the middle of the twentieth century Argentine agricultural development has been influenced by these continuous periods of intervention followed by commercial liberation. Thus in 1973 the government again introduced a broad system of state intervention in the production and commercialization of grains. The State fixed prices and even established quotas on exports. This system lasted until 1977, when it returned to the free market. The decades of the 1970s and 1980s were a period of profound political and economic crisis in Argentina. Inflation reached levels of hyperinflation; orthodox and heterodox measures were tried and failed. There was great instability in the gross domestic product, which between 1971 and 1990 increased by only 0.6% on average. The agricultural sector fell by 4.7 points between 1983 and 1989, declining to a share of 10.7% of GDP (Souza, 2007: 113; Lavarello, Gutman & Rios, 2010; World Bank, 1989).

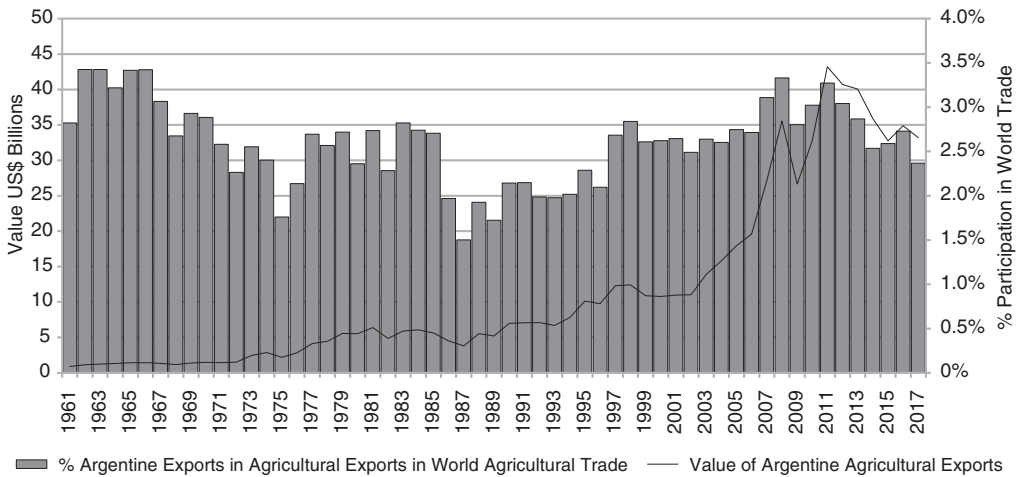
The 1970s and 1980s also represented the oil crisis and the debt crisis, in which most countries in Latin America were forced to turn to the International Monetary Fund and adopted the “Washington Consensus” which included a de-regulation of the local market. In the case of Argentina, this process took place under the Menem government, which took office in July 1989. The government passed an Economic Emergency Law which suspended all subsidies, privileges and special regimes. It adjusted tariffs and devalued the national currency. During the 1990s successive agreements were signed with the IMF, but at the end of the 1990s Argentina was still facing a deep crisis (Cunha & Ferrari, 2006; Souza, 2007; Vianini, 2012).

This type of interventionism in agriculture, particularly taxes or quotas on exports, as well as the low performance of the Argentine economy in general, and the successive external crises, affected the performance of the country’s agriculture both in terms of production and productivity. The most affected segment would be meat, since its export was continually restricted by the government in order to keep national prices low by cutting off exports and forcing sales to be turned toward the internal market. All these constant interventions had an impact on the productivity of the factors of production in Argentine agriculture which showed little change from 1980-90 and 2001-09, especially when compared with Brazil (Fuglie, 2012; Lema, 2015; Lema, n.d.; Feitosa, Silva & Abreu, 2010; Ferreira *et al.*, 2016; Morais *et al.*, 2016). In these three decades Brazil had an average annual TFP (Total Factor Productivity) growth of 3%, while Argentina declined in the 1980s and only achieved a modest growth in the next two decades. This low perfor-

mance of Argentine agriculture especially compared to most developing countries in the period is explained in particular by the performance of livestock, which has had a TFP indicator since 1961 far below agricultural production, harming the results of agriculture as a whole (Fuglie, 2012: tabela A 16.2).

At the beginning of the 21st century, the world economic scenario changed, with significant growth in international trade and rapid expansion of international commodity prices, caused in large part by Asian performance, in particular by China's extraordinary growth. But at the same time the election of an anti-liberal and state developmental government brought a resumption of interventionist policies (Frenkel & Rapetti, 2011; Colombini, 2016). After a period of strong growth in the international market, the 2008 crisis and the dampening of international commodity prices, created new problems for several Latin American countries, especially for Argentina, which again showed extreme external weakness. Even the supposedly liberal Macri government was forced to promote wide intervention of the economy, including price freezes.

GRAPH 5
Total value of Argentine agricultural exports (in US\$) and its participation
in total world agricultural trade, 1961-2017



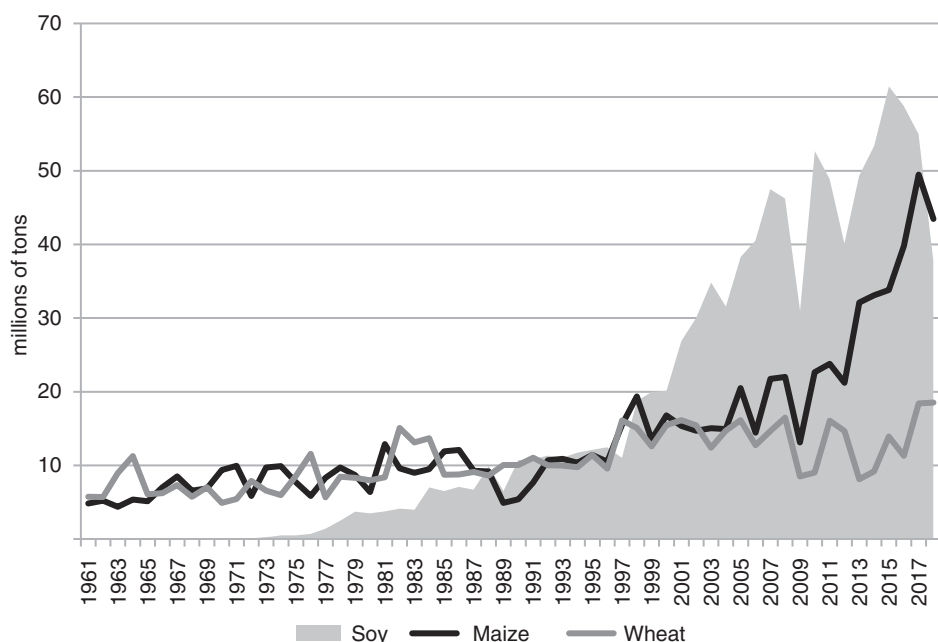
Source: Faostat (<http://www.fao.org/faostat/en/#data/QA>).

Argentine exports thus suffered the impacts of the world economic crises as well as the successive domestic crises. After a long period of relative stagnation in the 1970s and 1980s, there was both significant growth and abrupt declines throughout the last decade of the century. Finally in the first years of the 21st century Argentine agricultural pro-

duction and exports grew impressively due to the growth of international trade and the commodities price boom of the first two decades in the new century. Agricultural exports growth went from 10 billion dollars in 2000 to 31 billion dollars in 2018, but this expansion paralleled the expansion in world agricultural trade so that Argentina position fell to just 2% of world agricultural trade (see Graph 5). In the same period, Brazil increased its exports from 12 billion to 83 billion, reaching, and doubled its share in world exports to almost 6% in 2018.

GRAPH 6

Volume of maize, soy and wheat production in Argentina, 1961-2018 (in tons)

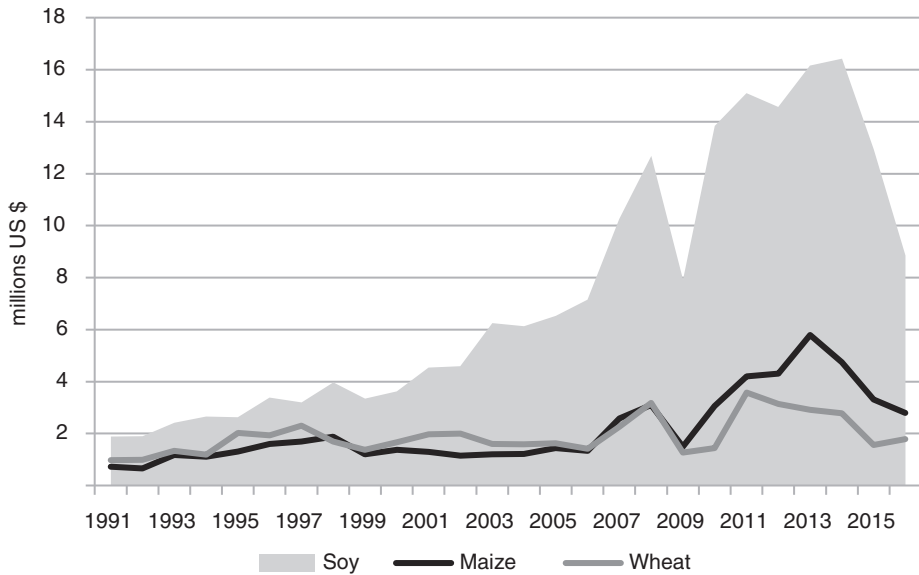


Source: Faostat (<http://www.fao.org/faostat/en/#data/QA>).

For most of its history agriculture remained both the predominant industry of Argentina and its primary export sector. But there have been important changes in the mix of these export crops with soybeans and their products and maize displacing wheat and meat in importance in the most recent period. In this period soybean production expanded greatly, but so did maize with output of the two highly correlated (.93). In contrast soybean growth was only moderately correlated with wheat expansion (see Graph 6). This growth was reflected in the value of these three crops which showed even more impressive differences. By 2017 the value of soybeans alone was five times that of wheat and three times larger than maize (see Graph 7).

GRAPH 7

Value of soy, wheat and maize crops in Argentina, 1991-2016 (in current US\$)



Source: Faostat (<http://www.fao.org/faostat/en/#data/QA>).

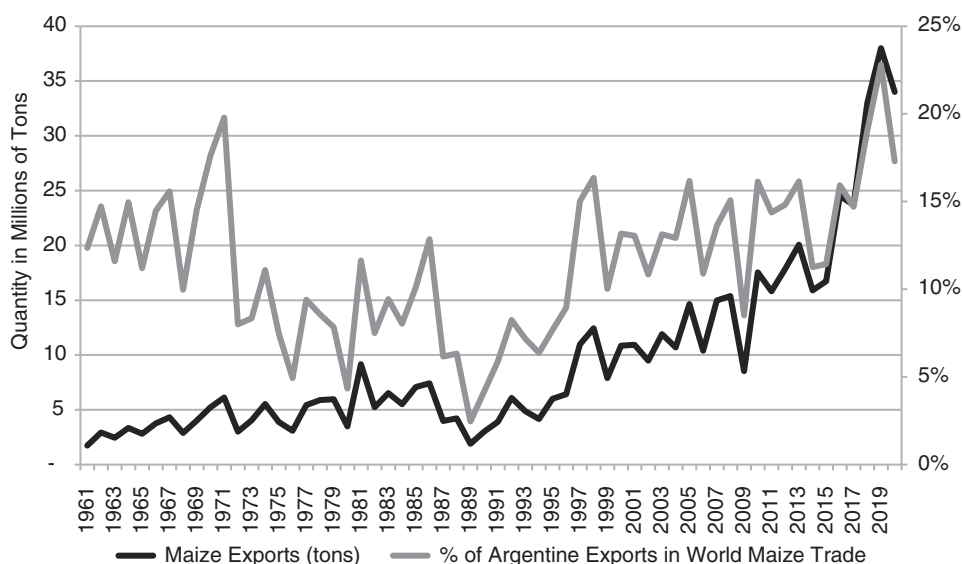
Although this growth has been propelled by the soy complex (meal, oil and beans) which reached 14 billion dollars (2018), maize was the second most important Argentine agricultural export in value. In that year it reached 4.4 billion dollars which was double the value of wheat exports and represented 7% of the value of total goods exported⁶. By the harvest of 2019-20 maize production reached 51 million tons, of which some 40 million tons was exported. This represented 23% of world exports of maize in that year (see Graphs 8). By this time, depending on the harvest, Argentina had become the world's second or third largest exporter of maize along with Brazil, and the world's fourth largest producer of this crop after the United States, China and Brazil. In that year the US share was just 27%, while together Brazil and Argentina accounted for 43% of the world maize export market (USDA, 2021b: 30).

Maize has been grown in Argentina since pre-Columbian times, historically adopting traditional methods of production. Although advances in seed development began in the 1930s, particularly in the United States, and Argentina played a predominant role in the international market, little was done in the latter country until the middle of the last cen-

6. Observatory of Economic Complexity (OEC), <https://oec.world/en/profile/country/arg?redirect=btrue>

tury (Vessuri, 2003). Thus, in the 1950s when in the United States more than two thirds of the maize planted came from hybrid seeds, in Argentina, this percentage did not exceed a tenth of planted maize (Rossi, 2007). This would be one of the factors explaining the extraordinary difference in maize productivity between the two countries with Argentina only obtaining a third of the yield obtained in the United States in the early 1960s. Today Argentine yields are up to 70% of the United States maize farmers.

GRAPH 8
Exports of Argentine maize and their importance
in the world maize trade, 1961-2020

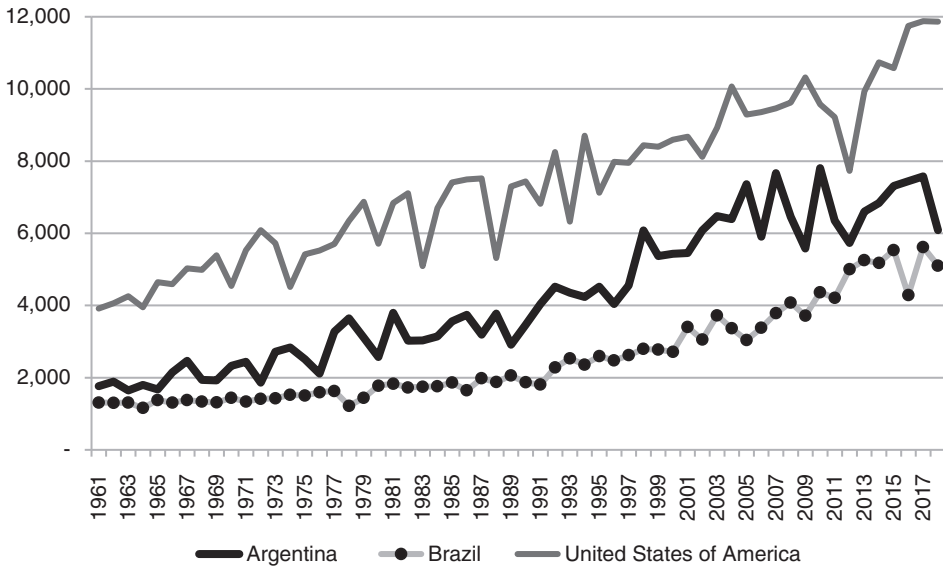


Source: Faostat (<http://www.fao.org/faostat/en/#data/QA>) and USDA (2021b: 30).

Since the 1950s, studies in Argentina on the development of hybrids have intensified, in processes led initially by the Ministry of Agriculture and later by INTA. The research then developed and the people trained in this field were subsequently used by private companies that dedicated themselves to the production of hybrids in the country (Rossi, 2007). Gradually the hybrid seed market was consolidated, with the growing participation of multinationals in the sector and new varieties emerged, but until the eighties simple hybrids predominated and Argentina produced most of these seeds (MAGyP, 2016; ASA, 2017; Agrozoz, 2020). From the 1990s, hybrids with tolerance to herbicides also appeared and in 1998 the commercialization of genetically modified organisms (GMOs) was approved. Although there was significant growth in maize productivity, particularly since the 1990s, the levels reached by Argentina have always been well below the levels of productivity in

the United States, but they have narrowed over time. Moreover, Argentine yields have consistently been better than those obtained by Brazil (see Graph 9).

GRAPH 9
Maize yield in Argentina, Brazil and USA, 1961-2017 (kg/ha)



Source: Faostat (<http://www.fao.org/faostat/en/#data/QA>).

Until the end of the 1980s, Argentine agriculture still had the traditional characteristics of production. Although technological improvements had occurred, they were predominantly concentrated in processes, such as mechanization, but still with little use of fertilizers. In livestock, natural pastures still predominated. There were some timid advances, but with little impact on agricultural productivity, making Argentina less competitive on the international market. On the other hand, the low intensity of the crops, in many ways largely preserved the quality of the soils (Reboratti, 2010: 64; Balsa, 2004). The great transformation occurred with the introduction of genetically modified seeds in soybean cultivation. In 1996, a genetically modified soybean called RR soy, produced by Monsanto, was launched in the United States and in the same year it was approved by the Argentine authorities. This seed was glyphosate-resistant, which was the active ingredient in Herbicide Roundup, which could now be used to control weeds. Since then, the use of this gm seed has had an explosive expansion. At the same time in 1998 two transgenic maize seeds were approved, one resistant to lepidopteran insects and the other resistant to the herbicide glufosinate. In 2004, glyphosate-tolerant maize, the so-called RR maize, was launched, which was as successful with maize production as it had been with soybean pro-

duction. With the launch of RR maize, hybrid use became almost universal, reaching over 95% of farm producers (Rossi, 2007).

Thus from the final years of the 20th century until the middle of the second decade of this century, there was also an important growth in the area planted with maize and increasing yields per hectare⁷. Comparing the yields obtained by maize, wheat and soybeans in the average of the last three years (2017-19), with the average yields obtained in the 1999-2001 trienniums, maize multiplied by 3.3, soy by 2.2 and wheat by 1.3 (Barsky & Gelman, 2001: 37, graph 2; MAGyP, 2020a) This was clearly due to the introduction of genetically modified seed.

According to data from ArgenBio, there are currently 61 genetically modified organisms in Argentina, of which 34 are for maize (ArgenBio, 2020). Although there was a slower penetration of genetically modified maize crops, when compared to soybeans, growth has been continuous and accelerated in the 2017-18 crop. Genetically modified Hidrido Bt2 RR maize represented 25% of hybrids in the 2012-13 crop, 36% in the following crop, reached 57% in the 2016-17 crop and increased to 77% in the 2017-18 crop. The use of RR products, both in soybeans and in maize, is directly associated with no-tillage, which reached practically the totality of maize planting in Argentina by 2020 (Cap, 2012). No-till planting evolved gradually from the late 1980s and reached 38% of all corn grown being under no-till farming system by the end of that century. Two years later it was used on two thirds of the corn harvest and by 2010-12 it was over 90% (Nocelli, 2018: 8).

Given the large agricultural research establishment, the nation was able to develop its own management techniques to adapt this technological advance to the specific conditions of the country (Alapin, 2009; *Siembra Directa*, 2011; Nocelli, 2018). The planting was widely accepted because it gave positive results in output, reduced time of planting and improved soil quality. In addition, the use of no-tillage planting led to crop rotation and increased use of fertilizers (*Siembra Directa*, 2011: 4). As in Brazil, the no tillage planting (called *siembra directa* in Argentina) and new seeds led to the growth of the first and second harvest maize plantings. The first was called the *siembra temprana* and the second the *siembra tardía*. Throughout the harvests of the 2010s, we see a relative balance between the two harvests. In 2017-18 for example, the early harvest produced 54% of to-

7. Studies that seek to demonstrate the relative profitability of the various crops, present very unstable results in Argentina, due to the strong fluctuations in the exchange rate, the variation in land rental prices, and the erratic policy of confiscation in exports, which affect various products differently. For the 2017-18 harvest, see EMILIO (2019) and AGROSITIO (2020).

tal maize production and the second harvest 46%, little different from earlier years or later years. In that same year 99% of the maize produced was from hybrids and 55% of the farms were considered to be operating at a high technical level and another 41% at a medium technical level (Gago, Gianatiempo & López, 2018).

In Argentina maize matures in different ecological zones at different rates. In the south-eastern region of the province of Buenos Aires it grows in 110-115 days. It takes between 113-125 days in the central Pampa region and in the subtropical areas 125-130 days (Gear, 2006: 5). In Argentina the key problem was declining fertility of soils from single cropping. Maize turns out to be an excellent crop for maintaining soil quality and thus double cropping was developed with maize being the first crop and soybeans the second –the reverse of the double cropping in Brazil (Gear, 2006: 7).

In the 2019-20 harvest, 9.5 million hectares of maize were planted, of which 7.7 million were harvested, from which total production of 58 million tons was obtained, with a yield of 7.6 tons per hectare harvested. Córdoba accounted for 33% of production and Buenos Aires for 27%. If we include Santa Fe, these three provinces accounted for 72% of the national production. The highest productivity occurred in four provinces –the three largest producers and Entre Ríos. These same provinces, but with Buenos Aires in the lead, are also the areas with the highest production of soybeans, as well as wheat (see Table 9).

Another basic difference in maize production is that in Argentina corporations rent land to produce maize, contracting out to specialized firms to plant, maintain and harvest the crop. The owner of the land is thus not the producer of the crop. This unusual renting system is of minor importance in Brazil where almost all producers are farm land owners, although contracting services are sometimes used for planting and harvesting. The growing of soybeans, especially in the Pampa region, has led to a very rapid rise in land prices. Because of this price inflation, producers have increasingly turned to renting or leasing land, a long tradition in Argentina which was a well-established practice in traditional grain production (Flichman, 1977: 89). By the agricultural census of 1969, the larger the farm size, the greater was the importance of renters, and by the end of the 20th century renter-producer produced half the crops in the province of Buenos Aires (Llovet, 1988). It is estimated that in the census of 2002 some 70% of the farmland in the rich Pampa region was rented, and then usually for just one planting season (Piñeiro & Villarreal, 2005: 34). This was both a response to increasing land costs and the uncertainties of government policies. Beginning in the 1990s appeared a new type of renter, which was unique to Argentina, of *pooles de siembra* or planting pools established primarily for soybean and maize production which gathers together small amounts of capital of diverse origin in an in-

vestment fund and during a fixed period of one or more seasons it rents lands and then contracts with third party services to plant, maintain and then harvest the crop⁸.

TABLE 9
Area planted and production of maize by province in Argentina, 2019-20

Province	Area Planted hectares	Area Harvested hectares	Producción in tons	Yield tons/hectare
Córdoba	2,924,573	2,467,227	19,196,764	7.8
Buenos Aires	2,472,520	1,923,178	15,595,357	8.1
Santa Fe	1,120,960	872,060	7,370,856	8.5
Santiago Del Estero	811,060	760,760	5,653,025	7.4
Entre Ríos	488,300	421,370	2,872,233	6.8
La Pampa	529,500	290,832	2,364,777	8.1
Salta	303,655	280,759	1,878,683	6.7
San Luis	375,500	328,600	1,327,270	4.0
Chaco	279,602	227,236	1,306,732	5.8
Tucumán	89,110	83,960	429,564	5.1
Misiones	31,150	30,130	149,809	5.0
Catamarca	16,200	14,950	91,326	6.1
Corrientes	12,099	11,000	69,301	6.3
Formosa	45,000	13,700	61,650	4.5
Jujuy	5,244	4,744	28,464	6.0
Total	9,504,473	7,730,506	58,395,811	7.6

Source: MAGyP (2020b).

These service companies emerged because of the high cost of the ever more complex machinery and the need for specialized workers. This led to the full development of planting, irrigating and harvesting companies, called *contratistas de cosecha* independent of the producer (Bisang, Anlló & Campi, 2008: 176). In maize production these companies provide three basic services. The first is preparing the soil and sowing the seeds (*siembra*), the second is spraying (*pulverización*) the fields with water as well as pesticides, herbicides and whatever nutrients are needed, and finally harvesting (*cosecha*). Of these three tasks, the most expensive is the harvest followed by the sowing of the seeds. For technical reasons the costs per hectare of harvesting maize is 1.4 times more costly than harvesting soybeans. Also the larger the maize farm, the higher the returns in servicing the maize crop (Moltoni, Duro & Masia, 2015: 2, 4). For all their fixed machine

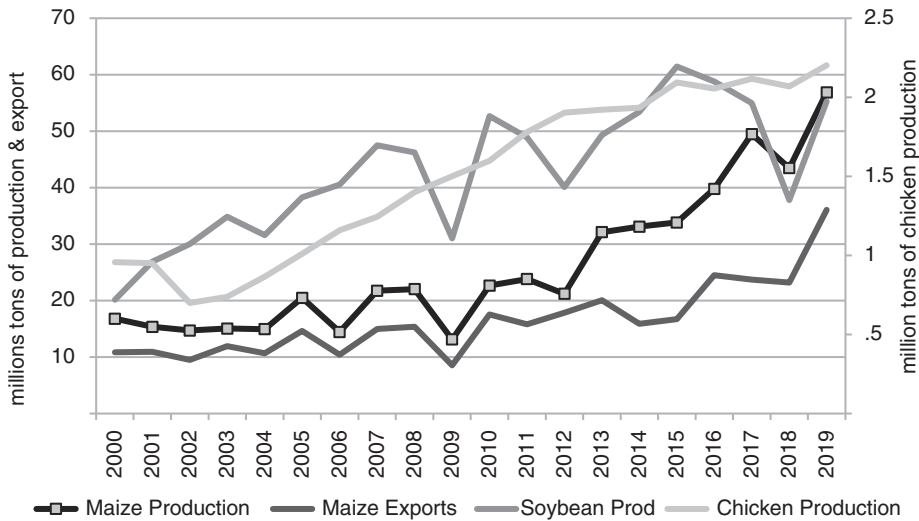
8. On the origins of this system (LÓDOLA & FOSSATI, 2003: 7). For a detailed analysis of these pool arrangements, see CALIGARIS (2015), MURMIS and MURMIS (2012), ORTEGA (2017), and DAGOTTO (2008).

and labor costs, *contratistas* are estimated to account for less than 14% of the total costs of production to the renter or landowner who contracts their services (Villulla & Chen, 2015: 112-13). Moreover, it is the *contratistas* who provide most of the labor with the renters usually employing just a professional agronomist and a head peon. Sometimes one company does all three services, but most often there are three separate companies providing the services. A great many of these are family run companies with almost all the workers coming from the owner's family. Even so the costs of owning and running the required machinery are substantial and their usage requires constant renovation of machines (Muzlera, 2010). Given these costs, it is these *contratistas* who purchases most of the farm machinery sold in Argentina (Garavello, 2017). By 2002 it was estimated that two thirds of all grain farms used these services and by 2012-13 they worked on 23.5 million hectares (Moltoni, Duro & Masia, 2015: 1). As of the census of 2002 some 47% of the 134,000 agricultural enterprises (known as EAP or farms) of the Pampa region used such firms (Piñeiro & Villarreal, 2005: 34). This *contratista* system accounts for about a quarter of Argentine GDP and over half of the value of all exports in the second decade of the 21st century (Bisang, Anlló & Campi, 2008: 172). For the small farmers who are also producers of maize, an alternative has been their incorporation into complex value chains with processing companies providing inputs for payments in maize after harvesting, a system not that dissimilar from what some producers do in Brazil (Gutman, 2008).

Finally, this growth in maize production permitted Argentine meat producers to shift a growing share of cattle production from pastures to feedlots (Arelovich, Bravo & Martínez, 2011: 39), so as to free pasture lands for soybean and maize production (Klein & Luna, 2021). The breeding of livestock in confined areas has greatly expanded throughout Argentina and usually comes at a negative cost of local environmental conditions with the abandonment of good pastures lands to agricultural production (Horak, Assef & Miserendino, 2019). Also, the transition from pasture to crops and the shift of animals to feedlots has led to the increased the emission of environmentally negative gases into the atmosphere (Castesana *et al.*, 2018). While maize and soy meal animal feed permitted a shift in the system of beef feeding in Argentina, it had little impact on beef exports which from 1980 were small in volume and quite erratic. This long decline is due both to the massive shift to soybean production and the reduction of herds, as much as to negative government policies hostile to beef exports (Graziani, 2018). But this growth of maize production led to a major increase in maize exports, and it also had an impact on chicken production in the same period. Chickens, the primary consumers of animal feed, of which maize was a basic ingredient, experienced an extraordinary growth in numbers which went from a stock of 109 million to 120 million birds in the period 2000-19 and was correlated with the growth of maize output (see Graph 10). By the harvest of

2019-20 some three quarters of internally consumed corn went for animal feed (Bolsa de Comercio de Rosario, 2020)⁹.

GRAPH 10
Argentine production, and exportation of maize
and exports of chicken meat, 2000-19



Source: Faostat (<http://www.fao.org/faostat/en/#data/QA>).

5. CONCLUSION

By the beginning of the third decade of the 21st century the evolution of these two maize producers had reached the point that together they now exported more maize than the United States, the world leader in maize exports. This major growth of modern maize was based in both countries on similar developments. Both quickly and massively adopted GMO maize seeds, both associated maize with the booming soybean expansion, and both adopted direct or no-till planting and double cropping. But the structure of production was different in both nations, with Brazil evolving through traditional land ownership and production, and Argentina developing a high capitalism system of pooled capital producers, rented land and service providers to do the planting, maintenance and harvesting of crops. In both cases maize went from being a traditional crop of low yield production

9. For the two decades 2000-19 the correlation in Argentina between maize and soybean production was .69 and .83 for the relation between maize output and chicken meat production. Both significant but lower correlations than in Brazil.

to a highly commercialized product capable of competition in the world market. Moreover, in both nations, more rapidly in terms of Brazil and more delayed in terms of Argentina, this boom in maize production would have a major impact internally. In the case of Brazil it led to a brand new export product, that of meat. In the case of Argentina it permitted farmers and cattlemen to shift from cattle to the more profitable and less state controlled soybean production and permitted a steady shift toward stockyard feeding on an ever larger scale, which potentially could lead to greater exports of meat, at least as trends in the last five years have indicated. That of course could change with the changing government policies toward Argentine beef exports, one of the more sensitive exports of the country.

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