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Theme Overview: The Agricultural Production Potential of Latin America: Implications for Global Food Supply and Trade

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JEL Classifications: N56, Q13, Q17, Q18

Keywords: Agriculture, Infrastructure, Investment, Latin America, Policy, Production, Trade

The Latin American region is an important U.S. trade partner. Historically, the region has been a significant supplier of fruit and vegetables during the winter months in the United States. High-value specialty crops, which are generally labor-intensive and highly perishable, have gained prominence in Latin America due to increased demand and improvements in production efficiency, infrastructure, and transportation (Palma, Ribera, and Bessler, 2013). This trend is expected to continue, particularly for functional foods (Kotilainen et al., 2006; Liu, 2013; Palma, Ribera, and Knutson, 2016). However, countries like Brazil and Argentina, are large producers of oilseeds and meat and compete directly with U.S. agricultural products in international markets (Muhammad and Valdes, 2019).

Articles in this Theme:

The articles in this theme seek to provide an understanding of the agricultural potential of different Latin American subregions—Brazil, Mexico, the Southern Cone region (Argentina, Paraguay, and Uruguay), the Andean region (Chile, Peru, Colombia, Ecuador and Bolivia), and Central America and the Caribbean—and the challenges and opportunities they face. The articles focus on commodities of economic importance for these countries with a comparative advantage in international markets, particularly because of their proximity and relationship to U.S. trade.

The articles discuss agricultural production growth as a result of crop area expansion and productivity gains, reviewing agricultural policies that have propelled or limited agricultural production and trade in the region. They also reference the state of the infrastructure and its capacity to sustain growth, trading relationships, and the role of domestic and foreign direct investment. One element of this theme is how different countries in the region have positioned themselves to address emerging trade opportunities to meet global food demand—specifically to address changes in dietary intake due to shifts in consumer preferences of an increasing population with higher purchasing power (growing global middle class) (Regmi and Gehlhar, 2001; Ferrier and Zhen, 2017; O'Hara, Narayanan, and Mulik, 2018). We hope that interested readers will find this information useful, particularly as changes in food cultures and world demand will likely be followed by changes in the production and distribution of food across the globe.

First, Calil and Ribera discuss the importance of Brazil as one of the top exporters of agricultural products, including coffee, sugar, meat, poultry, soybeans, and corn. The article analyzes Brazil's main drivers of growth and trade competitiveness, which include the mechanization of the agricultural sector and the adoption of efficient and more sustainable production systems that boosted agricultural productivity. Brazil has expanded its agricultural frontier over the last few decades. Calil and Ribera argue that additional growth potential resides in Brazil's capacity to increase productivity in new agricultural production geographical areas. One market factor discussed in this article that fuels growth in the agricultural sector is the increase in demand for agricultural products in China, Brazil's leading trade partner. An advantage Brazil has in grain crop production over the United States is its capacity to obtain two grain crops per season (for example, soybean–corn) and the integration of crop–livestock production systems. The authors conclude by discussing the challenges of inadequate transportation infrastructure and how current investment in constructing new ports and railroads is expected to address this challenge.

Second, Durand-Morat explores production potential and hurdles in the agricultural sectors of Argentina, Uruguay, and Paraguay, which are important producers and exporters of oilseeds, cereals, and meat. Production growth in this region is attributable to area expansion and productivity gains due to the widespread use of improved seed varieties and adoption of conservation tillage. In Argentina, agricultural growth has been driven mainly by an expansion of the agricultural frontier, but political and economic instability in the last several years has stifled Argentina's growth potential. In contrast, political stability, investment, and openness to trade have stimulated growth in the agricultural sectors of Paraguay and Uruguay. The production of soybeans and rice in this region is expected to continue to increase over the next decade, consolidating the countries as important world suppliers of these commodities. Oilseed production yields in some areas of Paraguay and Uruguay remain lower than those in Argentina and Brazil, an area for potential improvement. Durand-Morat also discusses the latencies of Argentina, Uruguay, and Paraguay and the conditions needed for them to realize their full potential. Some of the challenges discussed in the paper include high export taxes (Argentina) and the need to invest in infrastructure to facilitate transportation logistics and reduce the cost of doing business in the region.

Third, Canales, Andrango, and Williams review the agricultural and trade sector in Mexico, emphasizing products with high trade flows to the United States. They explore the growth in the specialty crop sector, which has been mainly driven by an increase in crop area and yield improvements. Within the specialty crop sector, the authors first elaborate on the increase in protected production structures (greenhouses, hoop houses, and shade structures), which are partly subsidized by the Mexican government and private investment. Production under protected agriculture is predominantly shipped to export markets. Second, they explore Mexico's capacity to increase their relevance in the organic sector. The authors argue that production and exports of high-value crops, such as avocados, tomatoes, and berries are expected to increase. Further, Mexico is expected to retain its place as one of the top world suppliers of specialty crops. Export diversification into other Asian and European markets is a possibility given the emergence of new trade agreements. Finally, the authors analyze some of the challenges for the Mexican agricultural sector. Their most recent challenge relates to the uncertainty regarding the new Mexican administration policies, which could hold back investment in the most productive agricultural subsectors of the country.

Fourth, Malaga, Avila-Santamaria, and Carpio assess the agricultural output growth and trade flows in Ecuador, Colombia, Peru, Bolivia, and Chile. Climate heterogeneity in this region has allowed these countries to produce a variety of temperate and tropical crops for export markets (e.g., grapes, blueberries, flowers, avocados, cacao). Quinoa, which has gained considerable popularity in the United States over the last decade, is grown in the Andean region. The authors note the significant expansion of irrigated land planted and exports of avocado in the region, primarily from Peru. Peru and Chile have taken advantage of the counter-seasonal production patterns for crops such as grapes, apples, and berries and currently have a strong presence in U.S. markets. The authors conclude by discussing new opportunities for trade relationships and the need for infrastructure improvements, especially in the northern countries of the region.

Finally, Peguero, Sandoval, and Zapata review the agricultural sector in Central America and the Caribbean (CAC). While smaller in size compared to other South American regions, CAC is important in the production and exports of high-value crops, including fresh fruits and vegetables, cocoa, and coffee. Due to its proximity, the United States is the main destination market to CAC exports. As world demand for tropical fruit continues to increase, the region will continue to experience significant growth in tropical crops such as mango, pineapple, papaya, melon, and cocoa. Agricultural growth in the region has been driven by large productivity gains for many fruit and vegetables. However, traditional export crops such as coffee, bananas, sugarcane, and melons have experienced only limited growth. The authors conclude that research and extension, access to credit, crop insurance, and infrastructure investments are greatly needed to propel growth in the agricultural sector of CAC.

For More Information

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Brazil's Agricultural Production and Its Potential as Global Food Supplier

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JEL Classifications: N56, Q13, Q16, Q17, Q18

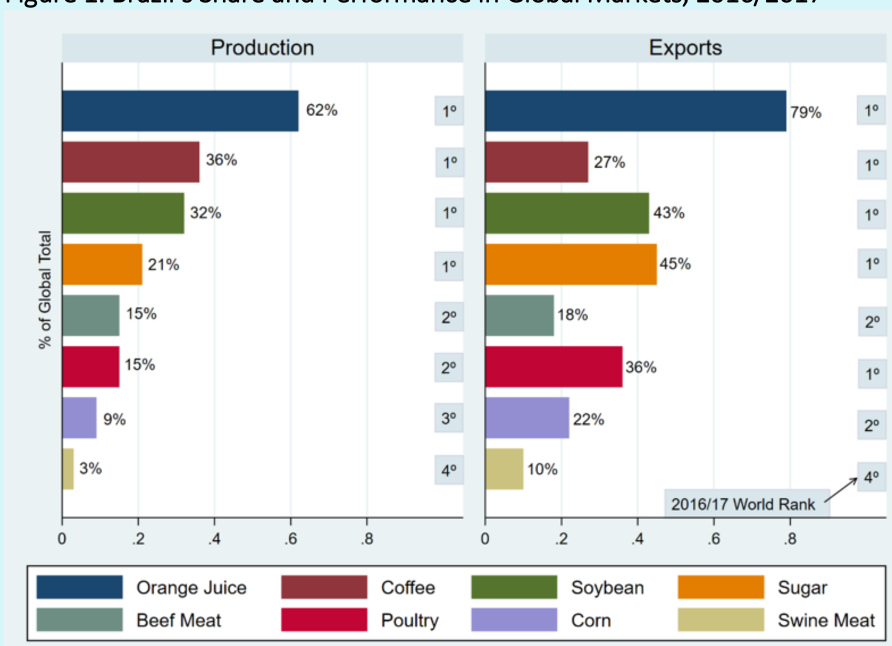
Keywords: Agricultural Policy, Brazil, Crop-Livestock-Integration, Matopiba, Production, Technology

Introduction

We explore Brazilian potential as a global food supplier. Brazil's performance in the production and export of agricultural commodities has been excellent, as shown in Figure 1; its market share of both global production and exports indicates that the country is a major player among the world's food suppliers.

Technological advances, combined with the expansion of the agricultural frontier, have driven Brazil's growth. But will Brazil continue to expand agricultural production to meet ever-increasing global demand for food? To shed light on Brazil's potential as a food supplier, we discuss some of the main drivers of the country's success, including productivity gains, land and water availability, research and technology, and domestic policies.

Figure 1. Brazil's Share and Performance in Global Markets, 2016/2017



Source: USDA (2018).

Productivity

Productivity has been the primary driving force in the growth of Brazil's agricultural sector. According to Gasques, Bachi, and Bastos (2018), higher productivity was responsible for 80.6% of agricultural production growth from 1975 to 2016. To reach this conclusion, the authors estimated Brazil's total factor productivity (TFP), the ratio of aggregate agricultural outputs and inputs (land, labor, and capital) used in agricultural production. From 1975 to 2016, the TFP increased, on average, by 3.08% per year. In the same period, land and labor stood out, with annual growth rates of 3.84% and 3.74%, respectively (Figure 2A).

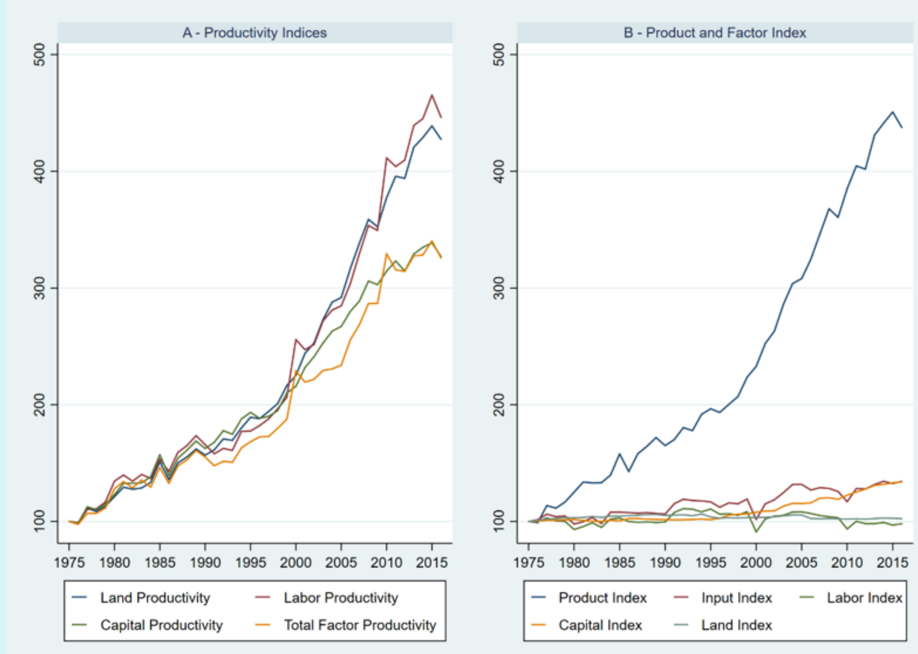
Efficiency in input use allowed Brazil to more than quadruple its agricultural production in the last 40 years (Figure 2B, blue line). Brazil's agricultural production grew at rates (3.82% per year) much higher than the growth (0.72% per year) in the use of inputs such as land, labor, and capital (Figure 2B, red line).

Since the 1990s, capital inputs such as fertilizers, pesticides, and agricultural machinery have been the main drivers of agricultural growth. Figure 2 shows a growing trend in the capital productivity factor over the last 20 years (Figure 2B, orange line). For example, the use of fertilizers increased from 6.5 million tons in 2000 to 15 million tons in 2016 (Gasques, Bachi, and Bastos, 2018). At the same time, land and labor have trended downward (Figure 2B). For instance, by the 2000s, the sector employed about 16 million people. Today, that number has fallen to 13 million people working on farms (Gasques, Bachi, and Bastos, 2018), which explains the negative labor index values.

Brazilian agriculture has benefited from the development and adoption of technologies resulting from domestic research and innovations based on the peculiarities of the country. For example, universities and the Brazilian Agricultural Research Corporation (Embrapa) developed new technologies that made the agricultural production viable in the Cerrado region. These technologies also generated gains in economies of scale. Producers in southern Brazil, where farms were small and land prices high, moved to the Midwest (Cerrado region), where farms were large and land was affordable.

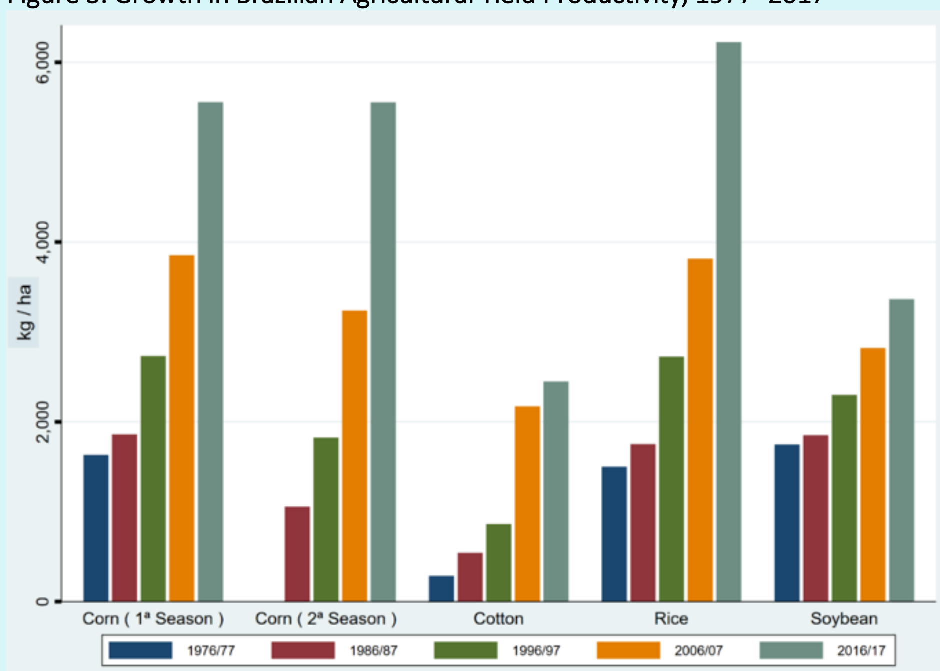
The effectiveness of Brazilian technological development is also expressed in crop productivity gains. Crop yield performance in Brazil has increased over the past 40 years. Figure 3 illustrates steady growth in cotton, corn,

Figure 2. Product, Inputs, and Total Factor Productivity in Brazil, 1975–2016



Source: Gasques, Bachi, and Bastos (2018).

Figure 3. Growth in Brazilian Agricultural Yield Productivity, 1977–2017



Source: CONAB (2019).

rice, and soybean yields. The production technology used in the Cerrado region allows for two crops per growing season. Since the 1980s, the country has produced soybeans in the winter and corn in the fall (called second-season corn). Figure 3 shows that the first- and second-season corn reached the same level of productivity this decade. Second-season corn demonstrates Brazil's ability to generate technology to produce under adverse conditions. Also, second-season cornallows Brazil to increase its production of corn-fed meat and its export potential. However, Brazil still has room to improve both its corn and meat productivity. For example, in 2017, the United States averaged 176.7 bushels/acre of corn, while Brazil averaged 81.1 bushels/acre (Adcock et al. 2018). At the same time, the United States, with 92.7 million head of cattle, produced 12.1 tons of carcass weight equivalent (CWE), while Brazil, with more than double the number of head (223.2 million), produced only 9 million tons of CWE (USDA, 2018).[1]

A small part of the productivity growth in Brazil is uniform across farmers in the industry. According to Filho (2019), about 20% of producers benefited from the tropicalization of grain production, signaling that economic churning (new entrants and efficient farms buying/renting inefficient farms) will still occur, leading to a substantial increase in productivity.

Land Use and Water

Among the top five countries with the largest agricultural areas, Brazil had the most significant agricultural land expansion (66%) over the last five decades, while the United States reduced its agricultural land by 7% (Table 1). However, Brazil's agricultural land is still smaller than Australia (−23%), the United States (−30%), and China (−46%). Arable land shows similar behavior. Even with agricultural expansion, almost 60% of the country remains forested.

Table 1. Major Agricultural Land Countries (10^6 km^2)

	Land Area		Agricultural Land[a]			Arable Land[b]			Forest Area		
Country	1965	2015	1965	2015	Δ%	1965	2015	Δ%	1990	2015	Δ%
China	9.39	9.39	3.55	5.28	49%	1.01	1.19	18%	1.57	2.08	33%
United States	9.16	9.15	4.36	4.06	−7%	1.77	1.52	−14%	3.02	3.10	3%
Australia	7.68	7.68	4.73	3.66	−23%	0.37	0.46	25%	1.28	1.24	−3%
Brazil	8.36	8.36	1.71	2.83	66%	0.28	0.80	182%	5.47	4.93	−10%
Russia	16.39	16.38	–	2.18	–	–	1.23	-	8.10	8.16	1%

Note: Contiguous U.S. land is 7.65 10^6 km^2.
[a]The World Bank defines agricultural land as the share of land area that is arable, under permanent crops, or under permanent pastures.
[b]The World Bank defines arable land as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, or land temporarily fallow.
Source: World Bank (2018).

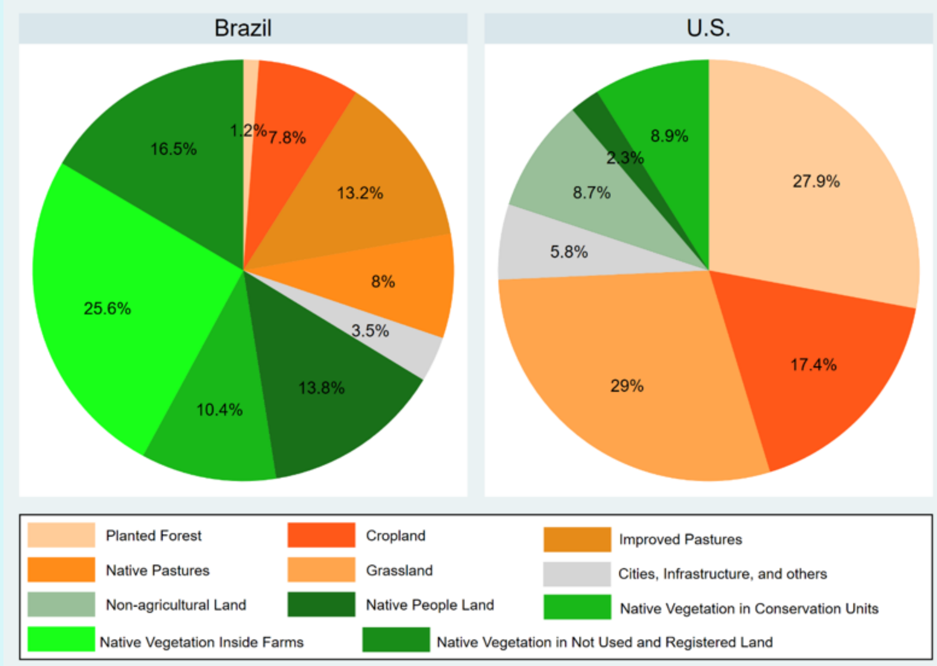
Brazil uses a small portion of its land for agriculture. Embrapa (2019) contrasts the land use in Brazil and the United States, as shown in Figure 4. Brazil allocates 21% of its land for farming (7.8% for crops and 13.2% for livestock). The United States uses 17.4% of its land for grain production. The corresponding number of hectares (ha) is greater than the combined area under crops and improved pastureland in Brazil. The amount of native vegetation inside

[1] Unlike in the United States, the majority of cattle are fattened in pasture and the use of hormones is forbidden.

Brazilian farms (25.6%) and native pasture (8%) is striking. Although Brazil plows less than 10% of its area, according to OECD (2018), 28% of its land is arable.

Figure 4 reflects Brazil's strict environmental laws. The Forest Code (Law N. 12,651 of 2012) states that in the Amazon biome (Figure 5A), 80% of the private property must be kept under natural vegetation (legal reserve); in the Cerrado biome (Figure 5A), 35% of private property must remain under natural vegetation. To help law enforcement, the government established the Rural Environmental Registry (CAR) in 2012.[2] CAR collects georeferenced information of each rural property with detailed environmental data to combat deforestation and assist with economic planning.

Figure 4. Land Use: Brazil vs. the United States



Source: Embrapa (2019a).

In addition to the government's efforts to prevent deforestation, the private sector and non-governmental organizations (NGOs) signed an agreement (soybean[3] and meat[4] moratorium) to not trade or finance commodities from deforested areas of the Amazon region (Figure 5A). Access to large markets, such as the European market, stimulates the industry to follow strict environmental requirements. Hence, the Forest Code and the CAR can facilitate Brazil's access to new markets.

Since Brazil is not expected to add a substantial amount of new land to production because of the Forest Code, Brazil's potential as a food supplier relies on strategic land use and technological development. Embrapa created a unit—Embrapa Territorial—dedicated exclusively to strategic land use. Embrapa Territorial monitors agricultural activity and deforestation on farms using satellite images. Another governmental strategic tool is the Agricultural Zoning Program (ZARC), which indicates the best crop for a given region as well as the technical procedures to increase productivity, reduce risks, and protect the environment. ZARC supports some major agricultural policies, such as insurance and rural credit. Farmers who wish to access such programs must follow ZARC prescriptions, which helps increase farm efficiency.

Although the Cerrado biome (Figure 5A) is regarded as unfit for grain production (Figure 5B), Brazil developed the technology to grow grains in acid and nutrient-poor soils. Also, Brazil can harvest two crops per year (discussed in

[2] As of June 2019, CAR has 5.9 million registered properties. See http://www.car.gov.br/publico/imoveis/index.

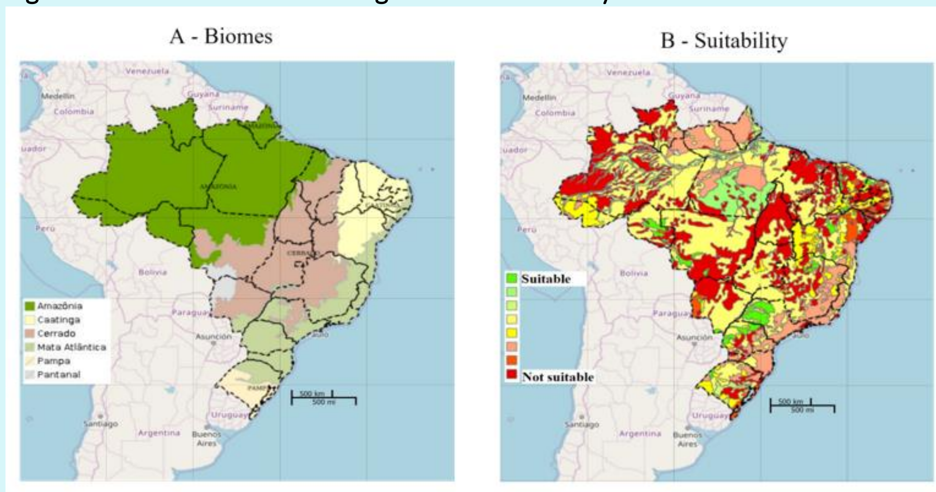
[3] According to ABIOVE (http://abiove.org.br/en/sustainability/), "The Soy Moratorium is a trade agreement, signed in July 2006, between the Brazilian Association of Vegetable Oil Industries (ABIOVE), the National Grain Exporters Association (ANEC), the government and civil society. This agreement is a commitment not to trade, nor finance, soy produced in areas in the Amazon Biome deforested after 22 July 2008, the reference date of the Forest Code."

[4] Like the soybean industry, the meat industry has also signed an agreement not to market meat from regions of illegal deforestation (https://amazoniareal.com.br/empresas-fazem-acordos-da-moratoria-da-carne/)

the previous section) under these conditions in the Midwest. In the 1980s, Brazil expanded production to the Midwest (Figure 5A). Today, production is expanding toward the northeast Cerrado and some northern regions (Adcock et al., 2018).

Midwest expansion caused a substantial increase in Brazil's grain production (Figure 7A). The new frontier, a region known as MATOPIBA, in the northeast Cerrado has 73 million hectares to strengthen agricultural production (Embrapa, 2019). Given the agricultural potential of the MATOPIBA, the national congress created an agency (Agência MATOPIBA) in 2017 just for the development of the region. Figure 6 highlights the Midwest and the MATOPIBA region.

Figure 5. Brazilian Biomes and Agricultural Suitability

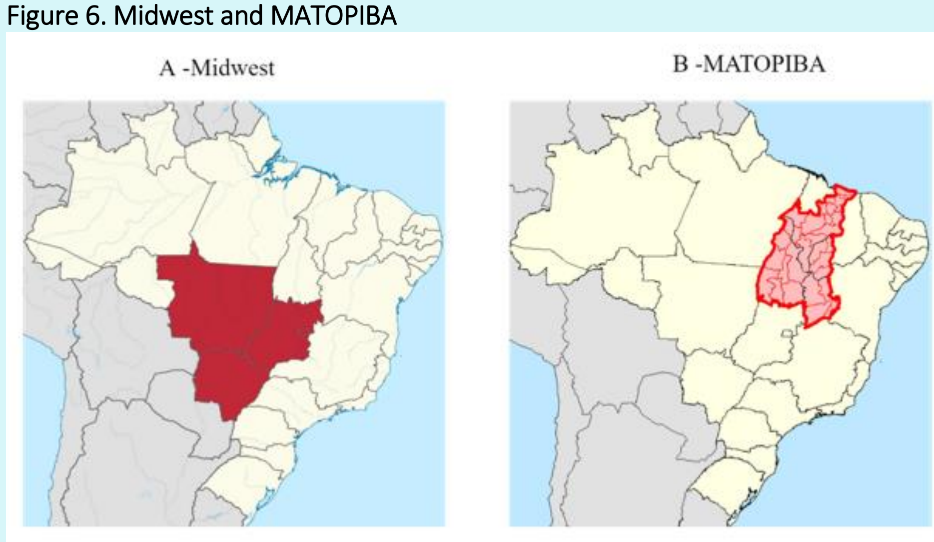


Note: Embrapa/IBGE classifies agricultural potentiality according to soil characteristics (physical, morphological, and topographical).
Source: Soma Brasil (2019).

The northern states of Pará (PA) and Rondônia (RR) are also regarded as agricultural frontier, especially the green highlighted area in the north of Figure 5B. Because this area is in the Amazon biome (Figure 5A), there are many restrictions on economic activities (for example, the Forest Code). However, the region has 20.6 million hectares of grassland and 2.21 million hectares of crops (IBGE, 2017).

The MATOPIBA region is not well-suited for agriculture (Figure 5B), but neither was the Midwest at one time. If Brazil shows similar ability to adapt crops to new environments and increase productivity in MATOPIBA, as it did in the Midwest, the country will be able to increase its food production (Figure 7) significantly in years to come. The competitive advantage of the MATOPIBA region over the Midwest is its proximity to foreign markets.

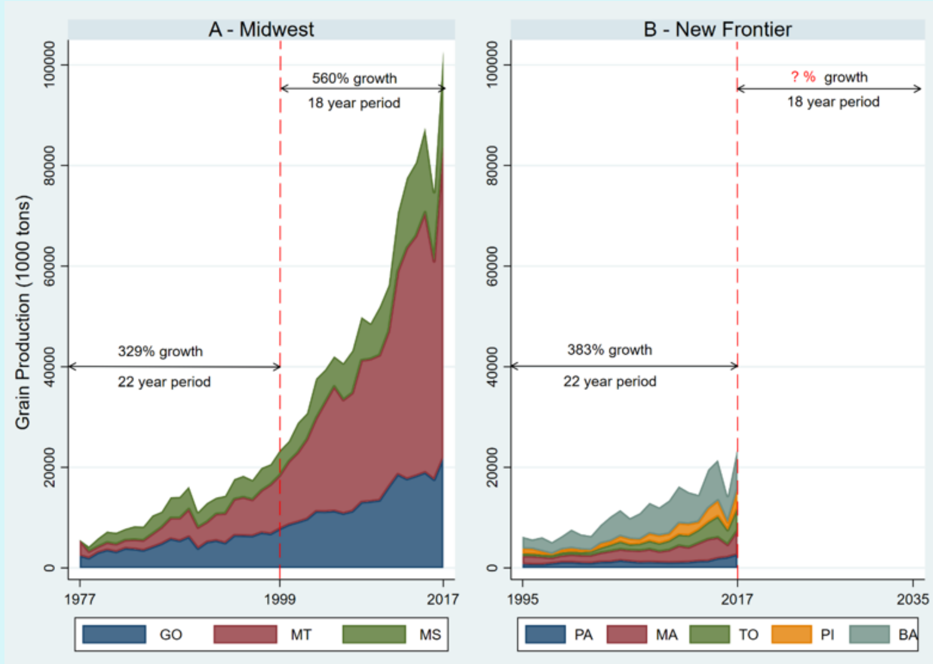
Figure 6. Midwest and MATOPIBA



Note: Midwest includes Goiás (GO), Mato Grosso (MT), and Mato Grosso do Sul (MS) states. MATOPIBA includes Maranhão (MA), Tocantins (TO), Piauí (PI), and Bahia (BA) states.
Source: Mattos (2019).

Adcock et al. (2017) discuss how infrastructure bottlenecks affect agricultural exports in Brazil. Grain flows from the Midwest states (Figure 6A) to the southern ports mostly on poorly maintained highways for over 1,000 miles. However, the North–South railroad (operated in a private–public partnership) crosses the MATOPIBA region toward the northern port of Itaqui (Maranhão).[5] This logistical advantage can boost the region's agribusiness.

Figure 7. The Growth of Brazilian Grain Production in the Midwest and the New Frontier



Note: Goiás (GO), Mato Grosso (MT), Mato Grosso do Sul (MS), Pará (PA), Maranhão (MA), Tocantins (TO), Piauí (PI), and Bahia (BA).
Source: CONAB (2019).

The Brazilian Ministry of Agriculture (Ministério da Agricultura, Pecuária e Abastecimento, MAPA, 2019) forecasts growth of 9.5 million ha (+ 15.3%) and 63.4 million tons (+26.8%) of grain over the next ten years (2028/29).[6] MAPA also foresees poultry, beef, and pork production increasing by 3.88 (+28.6%), 2.07 (+24.6%), and 1.12 (+28.2%) million tons over the next ten years (2028/2029), respectively. During this period, MAPA expects the major grain expansion to occur in the Midwest (+ 35.7 million tons and + 7.7 million ha) and MATOPIBA (+6.5 million tons and + 1.1 million ha). MAPA projections were made using times series models (auto regressive integrated moving average [ARIMA]), so the forecasts do not include the structural and technological changes underway in the country.

Since Brazilian water resources are abundant and widespread (Figure 8), incorporating irrigation into production systems can increase production. The nation has 8,647 billion m^3/year of total renewable surface water(FAO, 2014). Piauí, one of Brazil's driest states, receives a third more water than the U.S. Corn Belt (*The Economist*, 2010). According to the Brazilian National Water Agency (2017), Brazil has the potential to expand to over 76 million ha of irrigated crop area, in addition to the 6.95 million ha currently under irrigation (Figure 8C).

Most of Brazil's agricultural expansion will likely come from approximately 145 million hectares of underutilized or degraded pastureland (Cunha, Ribeiro, and Guarenghi, 2019). Annual crops have been taking over the pasture area in Brazil for the last 40 years. From 1975 to 2016, annual crops expanded from 36.8 million ha to 69.5 million ha

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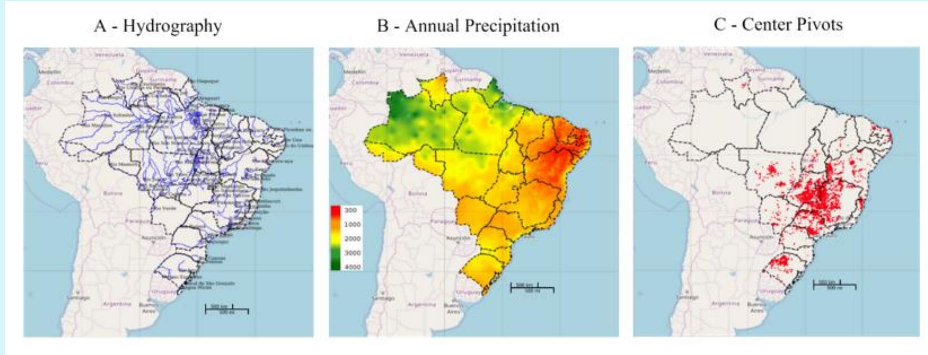
[5] The North–South railroad private public partnership was signed on July 31, 2019. For more information: http://agenciabrasil.ebc.com.br/politica/noticia/2019-07/contrato-de-concessao-da-ferrovia-norte-sul-e-assinado-em-anapolis

[6] Detailed forecast for each commodity can be found at http://www.agricultura.gov.br/assuntos/politica-agricola/todas-publicacoes-de-politica-agricola/projecoes-do-agronegocio/projecoes-do-agronegocio-2018-2019-2028-2029

while pasture was reduced from 165 million ha to 145 million ha (Gasques, Bachi, and Bastos, 2018). Brazil has been developing and adopting new pasture recovery technologies, as we discuss in the next section.

Figure 8. Brazilian Water Resources

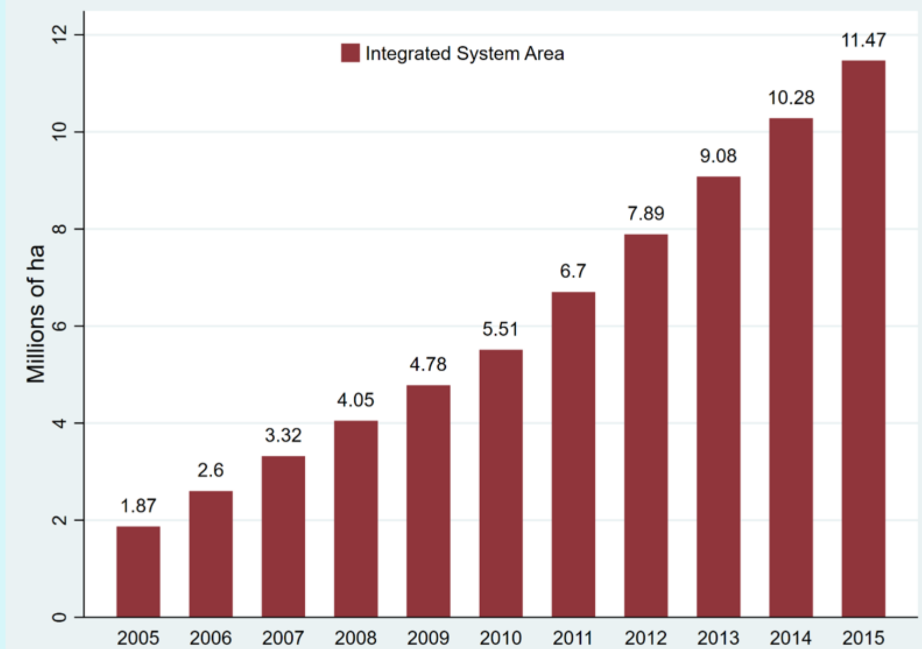


Source: Soma Brasil (2019).

Research and Technology

In 1992, the government created the National Agricultural Research System (Sistema Nacional de Pesquisa Agropecuária, SNPA): Strategically associated research centers—such as Embrapa, state research organizations, research institutes, universities and private organizations—address various, regionally specific research topics . According to Embrapa (2019),[7] the research agenda of public and private organizations will prioritize and encourage more resilient and sustainable production systems. Some examples of their research priorities are: crop-livestock-forest integration, agroforestry, organic agriculture, no-till production, biological nitrogen fixation, recovery of degraded pastures, management of native forests and planted forests, irrigation optimization, biological control of pests and diseases, and waste recycling and protected production. Integrated systems are a promising solution not only to increase production but also to recover degraded and degrading land. The most common integration system in Brazil involves soybeans, corn, grass, and cattle. After soybeans are harvested, farmers plant corn mixed with grass (*brachiaria*). When the corn is harvested, the grass is ready for grazing. The cattle are fattened in the pasture. After the cattle are removed for slaughter, the area is dried out, and soybeans are planted on the straw using no-till practices. The system occurs within one crop year without irrigation. Another possible configuration is to introduce tree planting (for example, eucalyptus) into the system.

Figure 9. Growth of Brazilian Area Occupied by Integrated System, 2005–2015



Source: Embrapa (2019).

Given that Brazil has developed the technology to produce three commodities rather than just one over a single year on the same amount of land, the prospects for increased production are bright. Moreover, the integrated system is economically feasible, as over 11 million ha, an area roughly the size of Germany's total agricultural land, are already under this production system (Figure 9).

From 2000 to 2017, Embrapa's budget increased from R$ 2.1 billion ($0.63 billion) to R$3.4

[7] For more details of Embrapa's study on the future of Brazilian agriculture: https://www.embrapa.br/en/visao/o-papel-da-ciencia-tecnologia-e-inovacao.

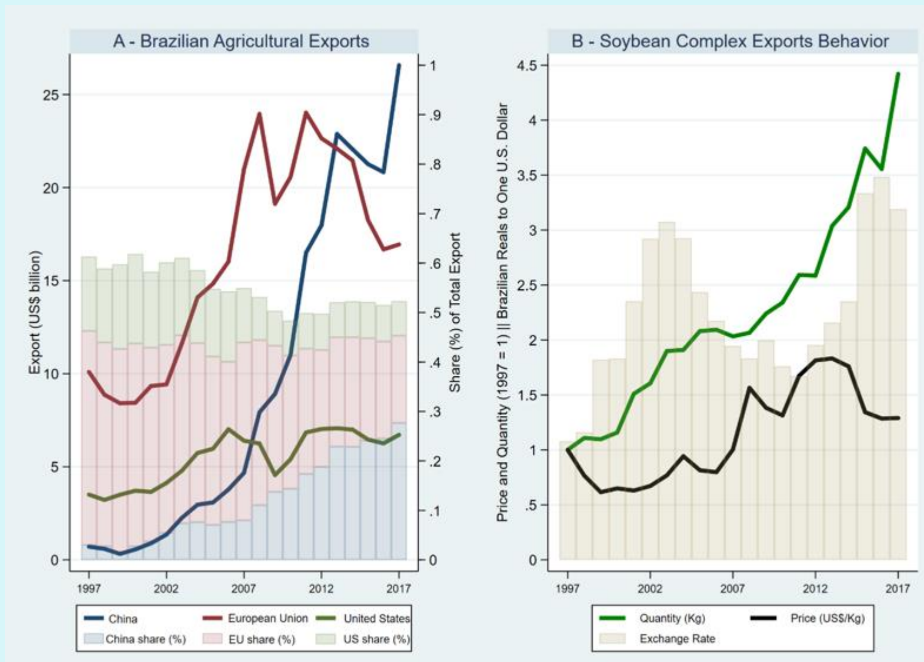
billion ($1.02 billion) (Santana and Gasques, 2019).[8] Within this budget in 2013, Embrapa launched a new intelligence center, Agropensa,[9] which evaluates the major factors that will shape demand for food such as population growth in developing countries, longevity, purchasing power, urbanization, and new consumption patterns to strategically identify future research areas or to provide resources for current research.

According to Agropensa, seven trends provide insight into the future of Brazilian agriculture: (i) socioeconomics and spatial changes in agriculture; (ii) intensification and sustainability of agricultural production systems; (iii) climate change; (iv) agricultural risks; (v) added value in agricultural supply chains; (vi) consumer roles; and (vii) technological and knowledge convergence in agriculture. Guided by these topics,SNPA will develop new production processes, methods, and systems to address growing demands for water, food, and fiber worldwide.

Agricultural Policy and Trade

In the 1990s, the European Union (EU) purchased almost half of all Brazilian agricultural exports. However, in the last decade, Brazil has reduced its exports to the continent by more than 30% (Figure 10A). The free trade agreement between Mercosur[10] and the EU signed last June may lead Brazil to reverse the downward trend in agricultural exports to the EU. Today, China is the leading export market for Brazil, having acquired about 30% (~US$26 billion in 2017) of agricultural exports in recent years (Figure 10A), experiencing a 37-fold increase from 1997 to 2017. The U.S.–China trade war may further strengthen the growth of Brazilian agricultural exports to China. Additionally, Brazil and the United States began negotiations for a free trade agreement in August 2019. It is premature to predict the effects of Brazil–U.S. negotiations.

Figure 10. Brazilian Agricultural Exports and the Role of Exchange Rate, 1997–2017



Source: MAPA (2018a).

Aside from the vital role of Chinese imports to Brazilian agribusiness growth, the exchange rate also favored Brazil's competitiveness in foreign markets. For example, Figure 10B shows the steady growth in soybean exports, even in the face of price reductions (in dollars) since 2011, given the advantageous exchange rate. The soybean

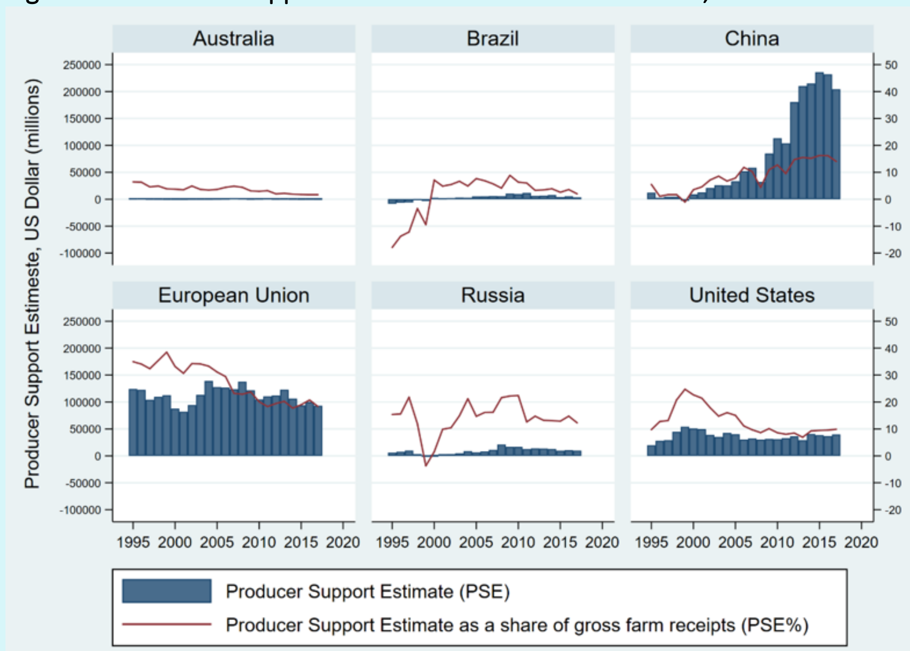
[8] Values expressed in reales (Brazilian currency) of 2017. 2017 yearly average of exchange rate: $1 = R$ 3.332.
[9] More details on Agropensa: https://www.embrapa.br/en/agropensa and https://www.embrapa.br/en/busca-de-noticias/-/noticia/25240884/agropensa-vence-premio-internacional-por-inovacao-institucional
[10] Southern Common Market (Mercosur) member countries are Argentina, Brazil, Paraguay, and Uruguay. The EU–Mercosur free trade agreement has been signed but not yet ratified by the congresses of the agreement's countries.

complex was responsible for 40.23% of Brazilian agricultural exports in 2018, followed by meat (14.51%), forest products (13.80%), sugar and alcohol complex (7.35%), and coffee (4.90 %) (MAPA, 2018a).

Although Brazil's exports are concentrated in a few products, Brazilian agriculture has recently incorporated value-added products such as cotton, fruits, and vegetables (Homma, Lima and Vieira., 2019). The new productive arrangements (required by these cultures) embody Brazil's potential as a food provider. The MATOPIBA region has both cotton (i.e., Barreiras) and fruit (i.e., Vale do São Francisco) production clusters.

In recent years, Brazil has performed well in agricultural production and exports with little government support (Figure 11). The majority of Brazilian support is based on variable inputs, mainly concessional credit (farm marketing and working capital). Since 2008, such credit has depended on producers' compliance with environmental criteria (Forest Code). Santana and Gasques (2019) reported that Brazilian agricultural policy has been reducing market intervention and standing out more as a normative agent and market regulator. The authors foresee greater private-sector participation in public policies such as rural credit, storage, and public–private partnerships.

Figure 11. Producer Support Estimate for Selected Countries, 1995–2017



Notes: Producer Support Estimate (PSE) refers to the annual monetary value of gross transfers from consumers and taxpayers to agricultural producers, measured at the farm-gate level, arising from policy measures that support agriculture regardless of their nature, objectives or impacts on farm production or income. PSE is the sum of two elements: market price interventions and direct payments to producers. PSE %: PSE as a share of gross farm receipts (including support). PSE = 20%. Without PSE, producers would be receiving 20% less than they receive now.
Source: OECD (2018).

Public–private partnerships are crucial to solving some logistical barriers. For example, the Northern Arc Ports (Porto Velho, Itacoatiara, Miritituba, Santarém, Barcarena, São Luís) and the Ferrogrão railroad projects are sponsored and funded by some major grain companies such as Amaggi, ADM, Bunge, Cargill, and Dreyfuss. Ferrogrão will take production from the Midwest to the northern waterways and then to the Northern Arc Ports for export, creating more distribution channels and lower transportation costs to help Brazil meet global food demand.

Moreover, the new Brazilian biofuels policy, RenovaBio, establishes the strategic role of biofuels in both the energy matrix and in reducing greenhouse gases. For the Ministry of Mines and Energy (Ministério de Minas e Energia, MME, 2018), this policy will increase ethanol production from 30 billion liters in 2017 to 50 billion liters in 2030. Sugarcane-planted area is expected to expand by 3 million hectares, from 10.2 to 13.2 million ha by 2030. Concurrently, biodiesel production will expand from 4 billion liters in 2017 to 13 billion liters in 2030. Then, only for biodiesel production, soybean planted area is expected to expand 7 million hectares by 2030. Another implication of this policy is the proliferation of corn ethanol plants. There are five currently corn-based ethanol mills, with six more under construction (UNEM, 2019). Corn consumption by mills is expected to reach 17 million tons by 2030, an increase of 12 million tons. (UNEM, 2019).

Conclusion

Brazil has abundant resources, including land, water, and technology to ensure production growth. New agricultural frontiers, new technologies, limited political intervention, private-sector investment in transportation infrastructure, and a diversified agriculture in both productive arrangements and traded varieties (biofuels, cotton, fruits, and vegetables) are all factors that boost the country's ability to continue as one of the leading producers of agricultural commodities worldwide.

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Agricultural Production Potential in Southern Cone: Argentina, Paraguay and Uruguay

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JEL Classifications: N56, P47, Q10, Q17

Keywords: Export taxes, Infrastructure, Production prospects

The Mercosur bloc—which includes Argentina, Brazil, Paraguay, Uruguay, and Venezuela (currently suspended) as permanent members—is a major player in agricultural markets. While Brazil represents the largest share of agricultural production in the region, Argentina, Uruguay, and Paraguay are well-established producers and exporters of agricultural products and increasing competitors in the global market for oilseeds, cereals, and meats. Their abundance of natural resources and relatively small and slow-growing population lead us to infer that these countries will have a growing role in the global market in the coming decades, conditional on addressing particular challenges that may dampen their production potentials. This article discusses the opportunities and challenges facing agriculture in the southern cone countries of Argentina, Paraguay, and Uruguay and provides market insights about the future role of this region in the global agricultural market. While we intentionally leave Brazil out for the sake of brevity, we recognize that much of the economic and agricultural development in the three countries of interest depends on the performance of the Brazilian economy.

Agriculture: A Key Engine of Economic Growth

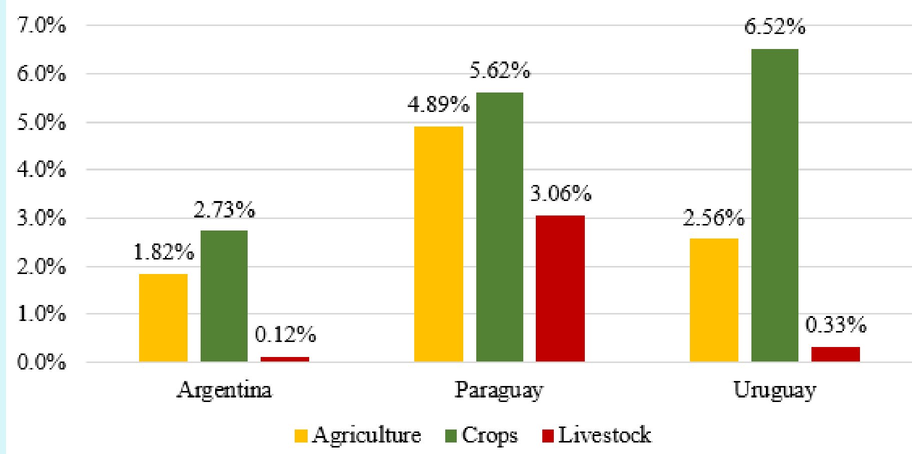
Agriculture remains an important economic sector in the three countries: According to FAOSTAT, agriculture accounted for 5.7% of the gross domestic product in Argentina and Uruguay and 10.2% in Paraguay for 2015–2017, compared to 1.4% for the group of developed OECD countries and 1.0% for the United States during the same period. Argentina is the 20th largest agricultural producer in the world, while Paraguay and Uruguay rank 67th and 73th, respectively. These countries play a key role in specific agricultural markets: summing their production, they are the 3rd-largest producer of soybeans, 7th-largest producer of feed grains (corn and sorghum), and 7th-largest producer of beef in the world.

That these countries are more prominent agricultural exporters than would be suggested given their production capacity is largely due to their low population densities. According to FAOSTAT, Argentina is the 12th-largest exporter of agricultural products and ranks among the top five exporters of soybeans, soybean oil and meal, and corn. It was a top three exporter of beef before the imposition of export constraints in 2007 to keep beef domestic prices and inflation low and has regained part of its market share since 2015 after the removal of most of those export restrictions. Paraguay ranks as the 43th exporter of agricultural products and is among the top 5 exporters of soybeans and the top 10 exporters of beef. Likewise, Uruguay ranks 45th among all agricultural exporters and is among the top 10 exporters of soybeans, rice, and beef.

Agriculture Growth Patterns in the Last Decade

The expansion of socialism in Latin America in the past decade—most notoriously in Venezuela, but also in Argentina, Uruguay, and Paraguay—resulted in policies that favored urban constituents more and taxed agriculture. Aside from that regional pattern, the agricultural sector has faced distinct challenges across the three countries of interest. (Figure 1). Paraguay experienced the fastest growth in crop production, led by an impressive growth in soybeans and corn, the two largest field crops, and in livestock production. On the other hand, Argentina grew the least across all categories, largely due to the rise of export taxes that disproportionally affected agriculture.

Figure 1. Average Annual Growth Rate in Agricultural Production, 2007–2016.



The growth in Paraguay resulted from a combination of area expansion and productivity gains. For example, the production of soybeans, the main agricultural sector in Paraguay, almost doubled in the last decade thanks to a 48% increase in yields and 33% increase in area. The soybean boom of the 2000s explains the fast growth in crop production in Uruguay, which went from planting around 12,000 hectares in 2001 to 1,000,000 in 2010. Most of the growth in agricultural production in Argentina came from changes in land use: The area with annual crops increased by 26%, primarily at the expense of forestland as the agricultural frontier advanced north into more subtropical areas. Average yields increased during the same period, most notably those of soybeans (18%) and corn (10%).

Producers across the region have access to the latest technologies and management practices. According to International Service for the Acquisition of Agri-biotech Applications (ISAAA), Argentina and Paraguay rank 3rd and 7th in the adoption of biotech crops, with close to 24 and 3 million hectares planted in 2017, respectively, while Uruguay ranks 11th, with 1.3 million hectares of biotech crops. Moreover, sustainable management practices are widespread in the region, with over 90% of the cropping area in Argentina and Uruguay and 80% in Paraguay under direct (no-till) drilling.

Table 1. Selected Market and Endowment Indicators

	Argentina	Paraguay	Uruguay
Crop land† (millions ha)	40.2	4.9	2.5
Permanent grassland (million has)	108.5	17.0	12.0
Population (millions, 2016)	43.5	6.6	3.4
Crop land per capita	0.92	0.74	0.74
Total renewable water resources (billion m^3/year)	876.2	387.8	172.2
Total renewable water resources per capita (m^3)	19,792	56,937	49,812
Average 2012–2016 value agricultural production (in million constant 2004–2006 USD)	35,610	4,485	3,859
Average 2012–2016 value agricultural exports (in million constant 2004–2006 USD)	17,778	1,408	1,739
R&D intensity ratio (R&D spending as a percentage of agricultural gross domestic product)	1.3%	0.25%	1.4%
Number of trade agreements in force	15	15	15
Doing Business ranking	119	113	95

†Includes arable land and land under permanent crops.
Sources: FAO, 2016, 2019; World Bank, 2019; Organization of American States, 2019.

Agricultural research has been a key factor in increasing agricultural productivity in the region over the past decades. The latest data available show that agricultural research and development (R&D) spending in Argentina has grown significantly since the mid-2000s, representing around 1.3% of the agricultural gross domestic product in 2013, higher than the regional average and above the minimum R&D investment targets of at least 1% suggested by the United Nations. One major concern is the high dependence on the public budget (which accounts for 95% of the R&D investment) and the large share spent on salaries (80%). The nonprofit sector plays a crucial role in agricultural extension among leading crop and livestock producers, with programs such as the Regional Consortium of Agricultural Research (CREA) and the Direct Seeding Producer Association (AAPRESID), but extension services are otherwise in dire need of improvements.

Agricultural R&D in Paraguay is incipient and mainly conducted by the Paraguayan Institute for Agricultural Technology (IPTA), created in 2010. Total spending on agricultural R&D in Paraguay is very low by regional standards (around 0.25% of the agricultural gross domestic product in 2013), and the country relies strongly on technologies generated elsewhere, mainly in Brazil and Argentina, a strategy that has served it well in the last decade.

Uruguay spent 1.4% of its agricultural gross domestic product on agricultural R&D in 2013, half of which comes from the public budget. On the spending side, only around half of the budget covers wages, and the rest is available for capital investments and operating costs. As in Argentina, nonprofit organizations play a vital role, mainly in agricultural extension.

Production Growth: Potential Opportunities and Challenges

Agricultural production in the region is expected to continue growing in the next decade, fostered by the availability of untapped natural resources in western Paraguay, the availability of fallow arable land in Argentina, the conversion of grassland into more productive crop and livestock uses in Uruguay, and overall an increase in productivity, primarily in Paraguay. Production projections from the Organization for Economic Co-operation and Development and the UN Food and Agriculture Organization (OECD/FAO, 2018) and the U.S. Department of Agriculture (USDA) point to an increase in agricultural production and agricultural exports from the region, supported primarily by the further dismantling of agricultural taxes in Argentina and continuing agricultural investment in Paraguay. OECD/FAO estimates that soybean production in Argentina and Paraguay will reach 66 million metric tons and 12 million metric tons by 2027, or 33% and 21% more than the 2017–2018 average. Likewise, the USDA estimates that rice production and exports from the three countries will increase in the coming decade, which will consolidate the region as the 6th-largest global exporter of rice.

Agriculture faces quite different sets of opportunities and challenges across countries. Arguably, the main challenge for agriculture in Argentina is the overall economic and political instability prevalent during most of the last two decades. To illustrate, the economy shrank by 2.8% in 2018 despite a US$56 billion aid package granted by the International Monetary Fund to help cope with the economic crisis, and the inflation rate was 48% in 2018 (over 10 times the Latin American average) and estimated to reach 55%–60% in 2019. Argentina devaluated its currency over 100% (in nominal terms) in 2018, which resulted in a real devaluation of the currency. However, the lack of export financing and high indebtedness in the sector, along with the continuing high inflation, limit the export opportunities generated by the real devaluation of the currency. Export taxes continue to be prevalent (e.g., soybean exports are currently taxed 28%), although they have receded from the spike observed from the mid-2000s until 2015. Despite these challenges, the agricultural sector grew, albeit moderately, in the last decade (Figure 1). However, the sector will need more stable economic conditions and lower tax burdens to achieve higher growth and take advantage of the large endowment of natural resources readily available to increase production (for example, arable fallow land in the fertile Pampas region). Argentina experienced significantly higher growth in the 1990s, prior to the spike of taxes on agriculture.

Paraguay has abundant natural resources, including land and water, and has intensified the use of land for agriculture in the last decade. Arable land area increased 39% in the last decade, but around 17 million hectares or 78% of agricultural land still remains under permanent grassland. Moreover, there are vast areas of tropical and subtropical forest in the least developed Chaco region (west of the Paraguay River), which offers the most opportunities to expand the agricultural frontier, but development in that region is slow and faced with numerous challenges, including opposition from environmental organizations due to the potential impact on the rainforest. Deforestation has been particularly widespread in Paraguay since the 1970s, mainly because of the expansion of cattle farms in the western part of the country. Law 422/73, better known as the Forest Law, requires the approval of a soil management plan and the preservation of around half of the area within each farm as a condition for land clearing, but illegal land clearing is still widespread, despite government efforts. The development of the Chaco region also implies significant investments in infrastructure to supply the region with the services needed to compete in the international market. The major producing departments of the south and southeast (Itapúa, Alto Parana, Canindeyú, and Caaguazú) provide little room for area growth but some opportunities for yield improvements. For example, average soybean yields in the last five years are 10% below the yields obtained in Brazil and 15% the yields obtained in the United States.

A stable macroeconomic situation, austere government policies, market openness, and low tax burden have helped Paraguay achieve impressive economic growth in the last decade. Agriculture received a windfall of investment and was subject to very low tax rates, which helped improve profitability and encouraged investment in the sector, but there is mounting pressure to increase taxes on agriculture, primarily soybeans. The government approved an increase in the agricultural value-added tax in 2018, but the proposal to implement a 10%–15% export tax on soybeans and other raw crops such as corn and wheat is still under consideration in Congress. Stakeholders are familiar with the impact of export tax policies in neighboring Argentina and worry about their possible impact on the agricultural sector in Paraguay, which already faces shrinking profit margins due to high transportation costs and depressed commodity prices. The support to agriculture is marginal and related mainly to the provision of general services such as agricultural research and extension and pest and disease control.

For the most part, Uruguay already exhibits high productivity levels in many agricultural sectors, including cattle and rice, but still lags behind on soybeans, whose yields remain 30%–40% below those of Argentina, Brazil, and the United States. Aside from soybeans, it seems that Uruguay can support further production growth based on land use changes into more productive activities. To give some context, the area with annual crops in Uruguay doubled while the area with temporary pastures grew by 80% in the last decade, primarily at the expense of permanent grasslands and fallow arable land. Yet around 12 million hectares or 83% of agricultural land remains under permanent grassland, potentially available to be converted into more intensive uses. Irrigation remains limited mostly to rice; investment in irrigation infrastructure offers opportunities to increase productivity and resiliency to the challenges generated by climate change. Uruguay is a leader in agriculture sustainability, with a strict regulatory framework that governs the use of key natural resources such as soil and water, and a leader in the implementation of traceability policies in sectors such as cattle and forestry. Innovative measures such as these can help Uruguay continue being a reliable supplier of agricultural products with increasing value-added attributes.

Uruguay offers a stable political and economic environment that has favored the growth of agricultural production in the last decade. The economy has grown steadily since 2003 at 4% a year, and the inflation rate has been under control and mostly within the target range of 3%–7% in the last two years. The Uruguayan peso has depreciated significantly, by 21% since early 2018, far outpacing the inflation rate and thus benefiting agricultural exports. Although economic growth and the implementation of more inclusive social policies led to increases in food demand, they also increase pressure on the cost of production. Increasing costs of production are the main threat to the agricultural sector in Uruguay. For example, the mean wage index, a measure of labor costs, increased over 8% annually since 2017, and the price of gasoline averaged US$1.7/liter, more than twice the price in the United States. The high export dependency of the agricultural sector makes Uruguay very sensitive to shocks in the international markets, but the government has no countercyclical measures in place, which may undermine the future growth of the sector. While some agricultural sectors benefit from tax exemptions (for instance, a partial value-added tax rebate on diesel fuel for the rice and livestock sectors), farmer organizations are demanding a more widespread adoption of such mechanisms.

The situation of the rice sector in Uruguay is a good example of the challenges and opportunities facing the Uruguayan agricultural sector as a whole. Uruguay is the 9th-largest exporter of rice and has an established reputation as a supplier of high-quality long-grain rice that is reflected in the high prices received in the international market. Most of the acreage is planted following best management practices, resulting in average yields over 8 metric tons per hectare, one of the highest in the world. The efficiency in water use is high by international standards due to the low water use (less than 9,000 m^3/hectare) and high yields. Surface water provides more than 90% of the irrigation needs, and the energy needed for pumping is low in part because around 50% of the area is irrigated by gravity. The efficiency downstream is also high, with four modern rice-milling companies processing and exporting over 80% of the rice. Land transportation is short (most rice produced within

400 km from the exporting port) and the port infrastructure is adequate. Despite the high efficiency throughout the rice supply chain and the premium received in the international market, the economic results over the last several years have been dire and led to a significant reduction in acreage, number of farmers, and overall level of activity.

Export Taxes: A Significant Burden for Argentinean Agriculture

As part of Mercosur, these three nations have embraced intra- and extra-regional integration as a cornerstone of economic development. To illustrate, these countries currently participate in 15 trade agreements, including the World Trade Organization (WTO), and are negotiating 10 other agreements with developed and developing countries such as the European Union, Singapore, South Korea, and Central America. As part of Mercosur, extra-regional imports are subject to a common external tariff scheme, while trade within the region is for the most part free. Unlike agricultural export subsidies, which are regulated/limited under the WTO, countries have much more freedom to implement export taxes, although these are rarely used. Paraguay and Uruguay maintain a free export policy with minimal interference, but pressure is mounting in Paraguay to implement export taxes on raw agricultural exports. In Uruguay, Law 17.780/2004 prohibits export taxes altogether. On the other hand, Argentina has frequently imposed export taxes as an intrinsic part of the national economic policy since the mid-1940s. The changes in economic strategies and agricultural trade policies of the last several decades greatly affected the performance of the Argentinean agricultural sector. After a period of economic and trade liberalization in the 1990s, which helped the agricultural sector achieve an average annual growth of 4%, the 2001 economic crisis led to a shift back to economic protectionism, high government intervention, the reintroduction of agricultural export controls in the form of export taxes on most agricultural products, and ad hoc export quotas and outright export bans, which particularly targeted selected sensitive products such as beef and wheat. By the mid- to late 2000s, agricultural growth was down to 1.5%, even when the international market for most agricultural commodities remained strong. The current administration has lowered the economic pressure on agriculture (for example, removed export permits and lowered most export taxes), but still taxes on agriculture remain high. As the history of the last 30 years shows, eliminating export barriers can have a great positive impact on Argentina's agricultural production and exports.

Modernizing the Transportation Infrastructure: Potential Game Changer for Argentina and Paraguay

The lack of investment in transportation infrastructure is a major bottleneck affecting the competitiveness of agriculture in Argentina, and the problem is worse for other products more geographically dispersed than soybeans, or regional productions outside the Pampas that have longer inland distances to the main exporting ports of Rosario and Buenos Aires. Due to lack of investment, the rail network in Argentina decreased from 47,000 km by the mid-1900s to 18,000 km currently. Further, inland truck transportation, which accounts for over half of the logistical cost of moving soybeans from the farm to the crushing and exporting hub of Rosario, is expensive and inefficient relative to competing industries such as the U.S. soybean and Australian wheat sectors. Improving the efficiency in the trucking and rail sectors has the potential to make agriculture profitable even in areas with great potential outside the Pampas. Most of the agricultural production in Argentina is moved inland via trucks, and only a marginal portion (less than 10%) uses less costly means such as rail or barges. For example, 87% of the soybeans are transported to Rosario, the main crushing and exporting hub, by truck, and the remaining by rail, compared to the United States where half of the soybean crop is moved by barges, 30% by rail, and only 20% by truck. The government is taking actions in this regard and currently implementing a plan to modernize and expand the capacity of the rail system by 2023 based on public and private investments. To that end, the government is investing in the main rail network that connects the production region in the northwest to the exporting ports, and the China Railway Construction Corporation is investing over $1 billion to reactivate the rail system connecting the western Cuyo region, known for its wine, olive, and nut industries, with the main export ports on the Atlantic coast. Investments in the barge industry are limited, although Argentina has a good network of rivers to transport most of the production in the eastern region. Finally, Argentina has a modern and efficient port infrastructure tailored to exporting its main agricultural commodities, but there are concerns about rising administrative costs and the lack of investment in new ports closer to production regions upriver.

Despite its landlocked position, Paraguay is an increasing player in the numerous international markets. Paraguay has developed a modern fluvial logistics sector that moves most of the domestic production via barges through the Paraná and Paraguay rivers. Around 80% of Paraguay's exports are via barges down the Paraguay–Paraná waterway, which are then consolidated into ocean freights at ports downriver, primarily in Rosario, Argentina, and Palmira, Uruguay. The port export capacity increased 10 times since the mid-2000s with the construction of 22 new ports to attend the growing agricultural exports. However, transportation costs for exports in Paraguay remain high. To illustrate, the transportation cost of soybeans from Caazapá (Paraguay) to Shanghai (China) is 260% higher than from Davenport, Iowa, 90% higher than from Trinidad, Uruguay, and 53% higher than from Rafaela, Argentina. Such a high transportation cost limits the profitability of agriculture and threatens its growth and sustainability. It is worth noticing that Brazil is a major export market for many Paraguay products such as rice (60% of production goes to Brazil), which helps circumvent in part the high export logistics costs.

Conclusion

Argentina, Paraguay, and Uruguay have plenty of resources to expand agricultural production in the coming decade, but achieving growth depends on addressing some key challenges that lay ahead. Argentina presents the greatest potential for growth in nominal terms given its availability of natural resources, but this growth will depend on improving economic and political stability, reducing or dismantling export tax schemes, and investing in transportation infrastructure to lower logistics costs while sustaining investment in agricultural R&D. Paraguay must prioritize investment in infrastructure to lower its logistics costs, keep agricultural taxes low, increase investment in agricultural R&D, and strike a balance between agricultural development and the environment in the western region. Finally, Uruguay must find ways to reduce the high and rising production costs that result from increasing labor costs and the high tax burden on services and energy and sustain its investment in agricultural R&D.

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Mexico's Agricultural Sector: Production Potential and Implications for Trade

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Keywords: Agriculture, Investment, Mexico, Specialty crops, Trade

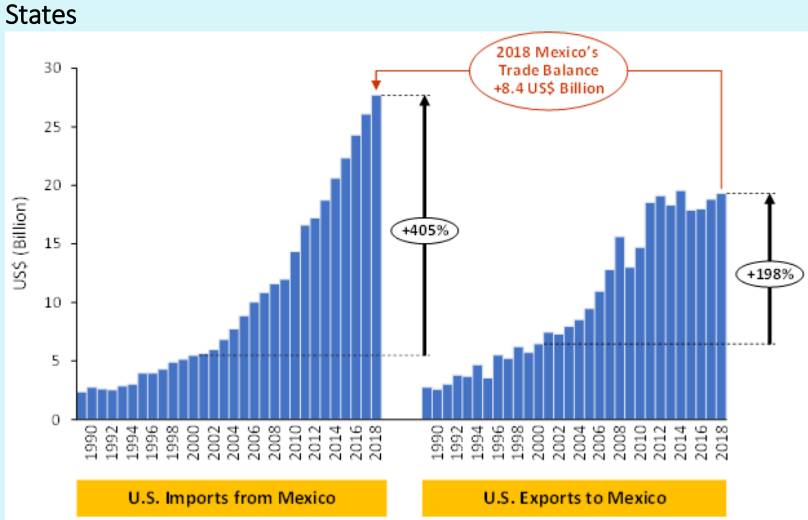
Overview of Mexico's Agricultural Sector

Mexico is a major global producer and exporter of agricultural products, capturing a significant share of the total world exports of citrus and melons (31%), tomatoes (24%), cucumbers (19%), and tropical fruit (22%), including pineapples, mangoes, avocados, and guavas (ITC, 2019). The agriculture and food sector is one of the main engines of Mexico's rural economy, representing 3.3% of its national gross domestic product (GDP) (World Bank, 2019). The sector has experienced significant growth during the last few years: Production value of crops and livestock increased by 21% and 12%, respectively, between 2012 and 2017 (SIAP, 2018b). Mexico's exports and share in total world exports of agricultural products also increased during the same period.

Trade

International trade has become more important for the Mexican economy in the last 30 years. Mexico currently has 12 free trade agreements with 46 countries (Secretaría de Economía, 2015). The North American Free Trade Agreement (NAFTA), which has facilitated trade among the United States, Mexico, and Canada since 1994, has become the most important trade platform for Mexico. In September 2018, the three countries reached an agreement to replace NAFTA with the United States–Mexico–Canada Agreement (USMCA), but NAFTA remains in force pending full ratification of the USMCA. In 2018, Mexico also signed the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and ratified a modernized Global Agreement with the European Union (EU) (Secretaría de Economía, 2018), which will likely increase diversification into European markets. Other major markets

Figure 1. Bilateral Agricultural Trade between Mexico and the United States



Data Source: U.S. Department of Agriculture (2019c).
Note: Total World Trade Organization (WTO) agricultural imports and exports.

with potential for Mexico include China, which has 1.3 billion consumers and a rapidly growing middle class, and Central America, with which it shares consumption habits and tastes.

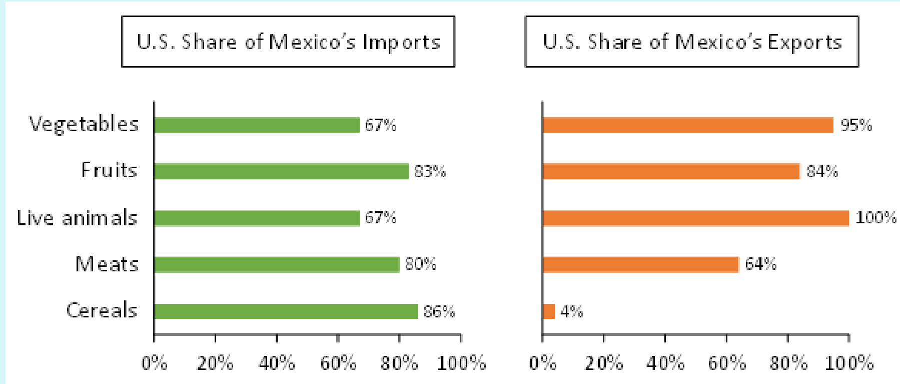
Trade with the United States

Mexico's favorable climate allows for year-round fruit and vegetable production, which are exported primarily to the United States. Between 2000 and 2018, Mexico's exports of agricultural products to the United States increased by 405%, twice as fast as Mexico's imports from the United States (Figure 1). Mexico's trade balance with the United States reached a record high of US$8 billion in 2018 (Figure 1). Exports of fruit and vegetables have been important drivers of this trade surplus.

The United States buys nearly 78% of Mexico's total agricultural exports, most of which are predominantly labor-intensive crops. Similarly, the United States supplies more than 80% of Mexico's total imports of meat and cereal grains, including corn,[1] soybean, and wheat (Figure 2). Mexico's current agricultural trade flows are largely reliant on the United States, which increases Mexico's susceptibility to changes in the U.S. economy and—more specifically—changes in U.S. trade and foreign policies.

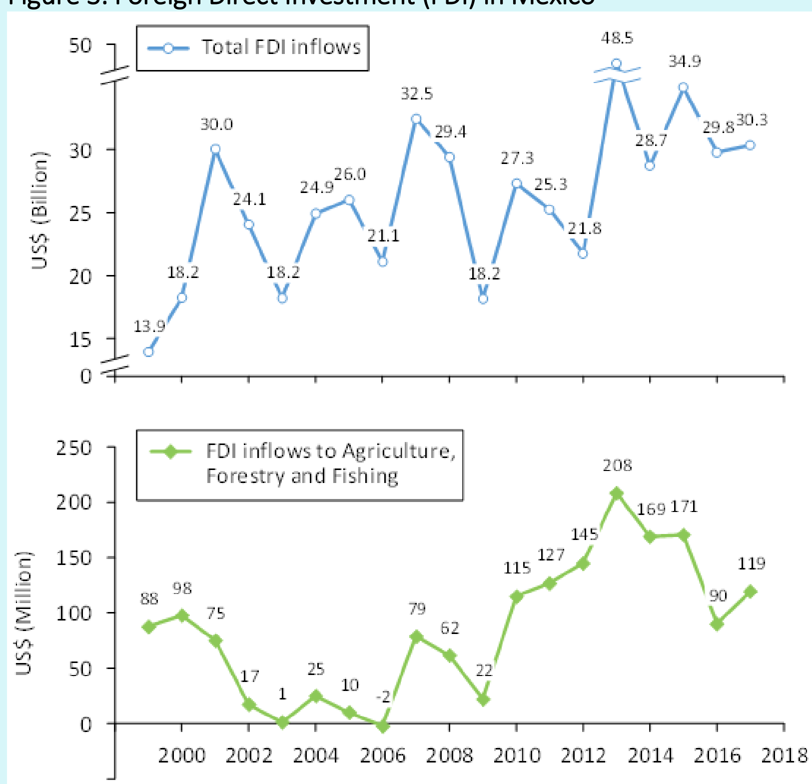
Mexico, however, could also benefit from changes in U.S. trade policies targeting other countries. For example, the U.S. trade war with China resulted in lower U.S. agricultural imports from China during the first quarter of 2019.[2] During the same period, imports from Mexico increased. If higher tariffs continue to be imposed on selected

Figure 2. U.S. Share of Mexico's Exports and Imports



Data Source: UN Comtrade Database (2018). U.S. and Mexico bilateral trade. Note: Authors' own calculations from total export and import value data in 2018: vegetables (HS 07), fruit (HS 08), live animals (HS 01), meat (HS 02), and cereals (HS 10).

Figure 3. Foreign Direct Investment (FDI) in Mexico



Data Source: CNIE (2018).

[1] Ahmed (2018) argues that U.S. exports of white corn (mostly for human consumption) to Mexico have negatively affected Mexican producers, while U.S. exports of yellow corn have benefited the development of the livestock sector.

[2] Monthly imports of agricultural products from China and Mexico from U.S. Department of Agriculture, Foreign Agricultural Service, Global Agricultural Trade System: https://apps.fas.usda.gov/gats/ExpressQuery1.aspx.

Chinese agricultural products, Mexico could potentially benefit through trade and investment diversion (Gantz, 2019).

Investment

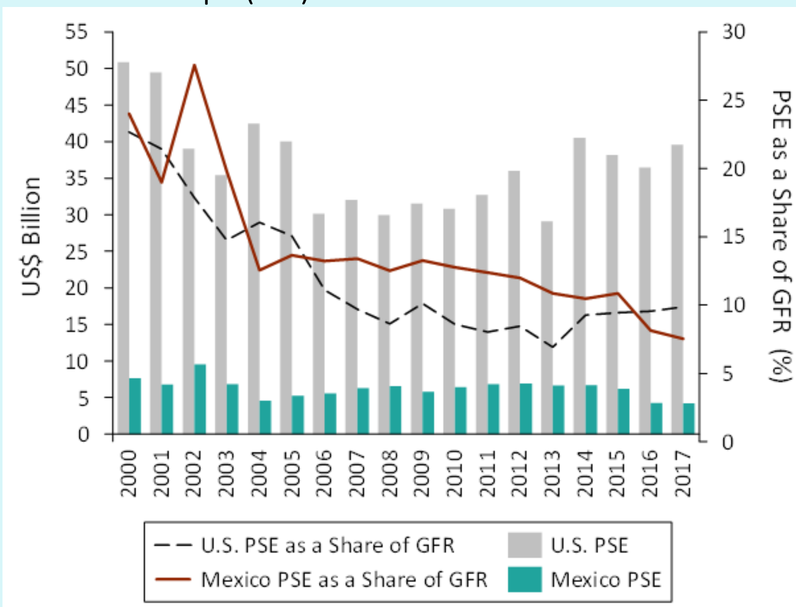
Mexico has attracted international agricultural industries seeking its favorable weather, inexpensive labor, and favorable location relative to major global markets. NAFTA and other trade agreements have facilitated an influx of foreign direct investment (FDI) from international businesses, of which the United States represents the main source (CNIE, 2018). FDI from the United States has been largely propelled by friendly foreign investment provisions under NAFTA. Similar provisions are expected to be maintained under the new proposed USMCA (U.S. Department of Agriculture, 2019e). FDI has been a noteworthy generator of export activity, with a contribution to exports of approximately 29% (UNCTAD, 2018).[3] FDI in the agricultural sector represents less than 1% of total inflow; despite some year-to-year fluctuations, FDI has increased during the last decade (Figure 3).

Political changes and uncertainty regarding United States–Mexico trade and tariffs could inhibit future FDI inflows. To counter this uncertainty, Mexico was the first country to ratify the USMCA in June 2019. The U.S. Congress is expected to vote on the agreement in the next few months. On the other hand, uncertainty regarding trade relationships with China could also benefit Mexico as businesses seek lower tariffs and shipping costs. Some news reports suggest businesses have entertained the possibility of relocating to Mexico as an alternative to China while observing how trade issues and negotiations evolve (Townsend and Martin, 2019).

Government Support

The Mexican government has made major investments in the agricultural sector. Through the Mexican Ministry of Agriculture, Livestock, Rural Development, Fishing and Food (SAGARPA), the government provides producer support (PS) to promote the competitiveness of the agricultural sector through a variety of programs (Wu et al., 2018). Annual PS averaged US$6.3 billion from 2000 to 2017, with a slight decline observed over the last three years (Figure 4). PS relative to the country's gross farm receipts (GFR) has trended downward (Figure 4). When compared with the United States, Mexico's PS as a share of GFR has been slightly higher during most of the years observed in Figure 4, demonstrating Mexico's commitment to supporting its agricultural sector, which, while only a small share of the total economy, is of great importance to the country.

Figure 4. Producer Support Estimates (PSE) and PSE as a Share of Gross Farm Receipts (GFR) in Mexico and the United States



Data Source: OECD (2018).

Currently, two combined programs—the Programa de Fomento a la Agricultura (Agriculture Promotion Program) and the Programa de Productividad y Competitividad Agroalimentaria (Agri-Food Productivity and Competitiveness Program)—provide incentives to promote the competitiveness of agriculture and food value chains through various program components (SADER, 2019). In general, these incentives are geared toward increasing the infrastructure capacity of the sector. For example, in 2019, the component of the program to increase capital investment in the agricultural sector has covered up to 50% of the investment cost (for up to

[3] Measured as the share of foreign value added in exports.

US$0.2 million)[4] in protected agriculture projects,[5] mechanization of production and post-harvest activities, storage infrastructure, and improved seed genetics (SADER, 2019).[6] Agriculture support programs have benefited the entire sector but have stimulated growth in the specialty crop industry in particular.

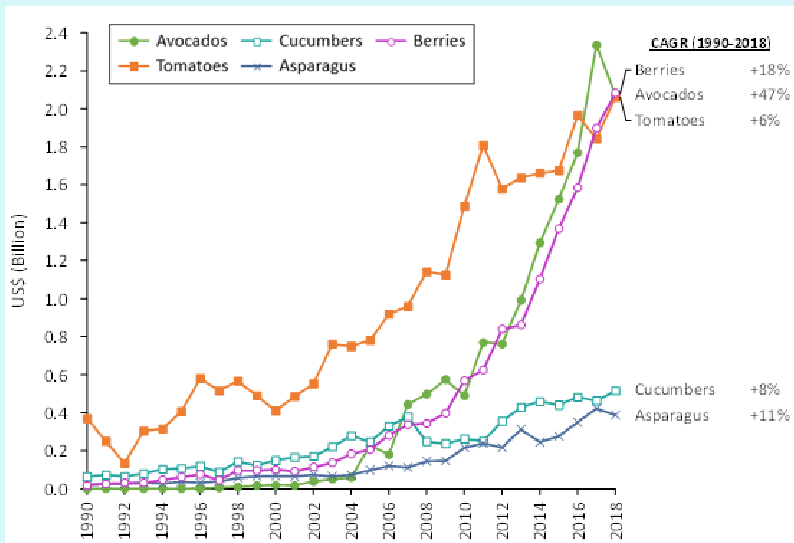
Research and Development (R&D)

Mexico's spending on agricultural R&D has shown modest growth over 2000–2013 (IFPRI, 2019). R&D as a share of agricultural GDP (research intensity) remains at around 1%, below the United States and other high-income countries, which have an average research intensity of 2.47% (Heisey and Fuglie, 2018). Given the importance of R&D as a generator of productivity growth in the agricultural sector, higher investment in research may be needed to generate increased levels of productivity and innovation, particularly for sectors that are lagging.

Specialty Crops

A combination of climate and relatively lower production costs provides Mexico with a comparative advantage in the production of fruit and vegetables. Mexico is a large producer and exporter of fruit and vegetables and ranks in the top two for global exports of avocados, tomatoes, asparagus, limes, chili, cauliflower, and broccoli (SIAP, 2018b). The expansion in the production capacity of the specialty crop sector is attributable to increases in both the extensive margin (acreage) and intensive margin (yields). Within this sector, the protected agriculture and organic production segments have seen notable increases in productive capacity.

Figure 5. Value of Selected Fruit and Vegetables Exported from Mexico to the United States



Data Source: U.S. Department of Agriculture (2019c).
Note: Avocados (HS 080440), tomatoes–fresh or chilled (HS 0702), berries (HS 0810), cucumber (HS 0707), asparagus (HS 070920). CAGR refers to compound annual growth rate.

Subsidies invested in the specialty crop sector—coupled with lower labor costs—have resulted in an increase in production and exports to the United States (Figure 5), which in some cases compete with U.S. production, particularly in southern states (Wu et al., 2018). It has been argued that due in part to this competition, prices and production of fresh tomatoes in the United States have declined (Guan, Biswas, and Wu, 2017). Hodges et al. (2019) estimate that a continuation of this trend would further affect the fruit and vegetable industry (tomatoes, peppers, strawberries, etc.) in Florida and other southern states.

It is important to highlight that, while imports from Mexico may compete with U.S. production, U.S. consumers have benefited from the year-round availability of fruit and vegetables as a result of trade flows (Knutson et al., 2014). The per capita availability of fresh fruit and vegetables in the United States increased by 22% and 15% between 1990 and 2017, respectively (U.S. Department of Agriculture, 2019b). The increase in availability of some

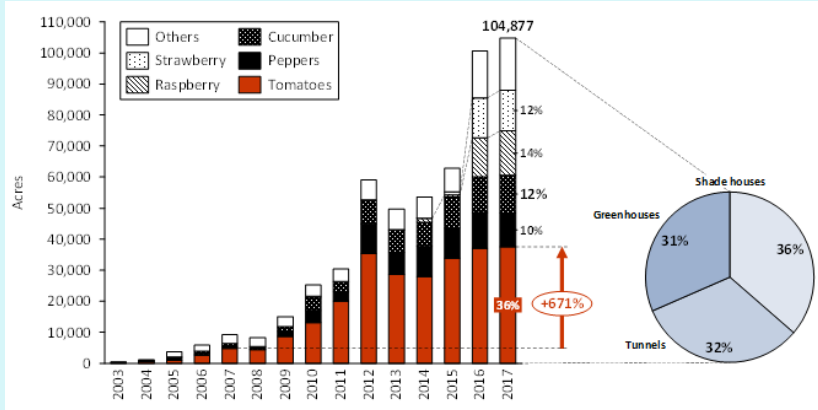
[4] 4 million pesos, using a 2019 exchange rate of US$1 to 19.16709 Mexican pesos.
[5] "Protected agriculture" indicates crops produced under protective structures such as greenhouses, high tunnels, shade houses, etc.
[6] See Wu et al. (2018) for a detailed review of Mexico's subsidy structure in previous years.

selected fruit and vegetables has been significant, such as fresh tomatoes (33%), bell peppers (90%), cucumbers (71%), strawberries (133%), and avocados (429%).

Protected Agriculture

The production area classified as protected agriculture in Mexico increased at a compound annual growth rate (CAGR) of 28% during 2007–2017 (Figure 6). Currently, there are over 100,000 acres under protected agriculture, almost evenly divided among greenhouses, high tunnels, and shade houses. Protected agriculture has allowed producers to improve yields by increasing automation and year-round production while decreasing planted field area. One of the factors that has fueled this increase is the export potential of vegetables (U.S. demand), which has attracted both domestic and foreign capital (Bastida Tapia, 2017). In addition, the Mexican government has subsidized the adoption of protected agriculture as part of its producer support program (currently the Agriculture Promotion Program). In 2019, incentives for protected agriculture projects have been offered for up to 50% of the investment cost (SADER, 2019). However, these subsidies are not unique to Mexico. The United States offers similar cost-share programs that subsidize improvements to infrastructure in agricultural land through programs such as the Environmental Quality Incentives Program–High Tunnel Initiative (U.S. Department of Agriculture, 2019a).

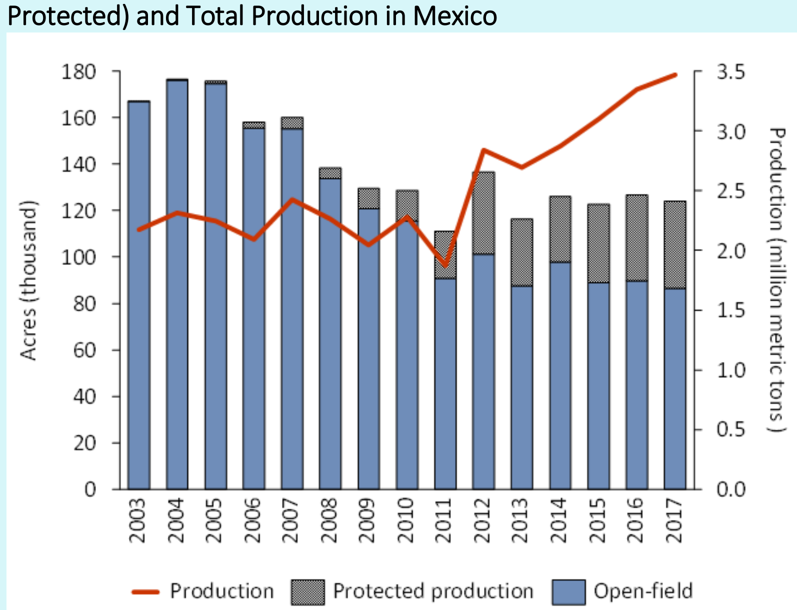
Figure 6. Historical Area under Protected Agriculture in Mexico



Data Source: SIAP (2015) and AMHPAC (2018). Authors' own calculations.
Note: Total protected area 104,877 acres = 42,442 hectares.

Most of the subsidies for protected agriculture in Mexico have been allocated to tomato, pepper, and cucumber production. In 2017, tomatoes accounted for approximately 36% of the area under protected production followed by berries, bell peppers, and cucumbers (Figure 6). Trends have also shown a large increase in the area dedicated to berries since 2014. Protected technology allows producers to obtain better and more consistent quality and greater phytosanitary control for the export market. It is estimated that around 85% of protected production in Mexico is exported (Padilla-Bernal et al., 2008).

Figure 7. Historical Tomato Production Area (Open-Field and Protected) and Total Production in Mexico



Data Source: SIAP (2017) and AMHPAC (2018).

Tomato Industry

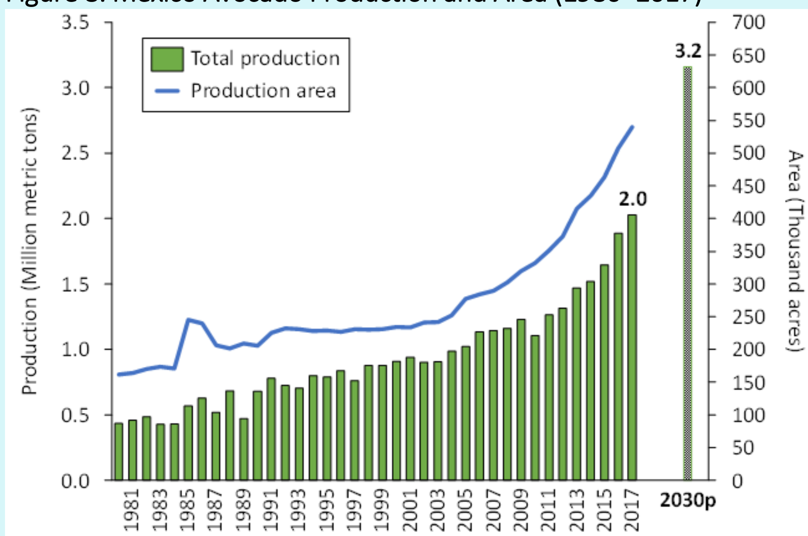
Total tomato production area (open-field and protected) in Mexico has decreased, but total production volume has increased due to infrastructure investments and productivity gains (Figure 7). Protected production area accounted for only 30% of the total tomato area but contributed approximately 63% of total production in 2017. According to projections, tomato production and export capacity could increase by 46% and 77%, respectively, from 2016 to 2024 (SAGARPA, 2017b). The country's main strategies to increase the productivity of the industry include support to protected agriculture, improvements to irrigation technology, and investment in logistics and distribution infrastructure (SAGARPA, 2017b).

Avocado Industry

The avocado is one of Mexico's main export crops and the second-highest generator of foreign income (SIAP, 2018b). Mexico contributed 48% of total world avocado exports in 2016, four times higher than in 1990 (FAOstat, 2018). After an import ban based on the risk of pest infestation was gradually removed from 1997 to 2007, exports to the United States spiked when all states were allowed to import avocados (Peterson and Orden, 2008). Exports to the United States have grown to a CAGR of 15% during the last decade (Figure 5). In 2018, Mexico supplied 87% of the avocados imported into the United States (U.S. Department of Agriculture, 2019c).

Mexican production of avocados grew by 4.7 times from 1980 to 2017, while the area allocated increased by only 3.3 times in the same period (Figure 8). This is a strong indicator of Mexico's potential for avocado production as productivity levels continue to improve. It is estimated that Mexico has the potential to increase its avocado production from 2.03 million metric tons in 2017 to 3.16 million metric tons by 2030 (SAGARPA, 2017a). Mexico has developed a strategic plan covering the entire value chain. Production strategies include increased training in production, sustainable practices, sanitary standard certifications, and technologies to increase productivity. Other strategies include the promotion of avocado value-added enterprises and production and marketing organizations (UNCTAD, 2014; SAGARPA, 2017a). Export strategies include strengthening the market share of Mexican avocados in the United States, Canada, Japan, and China and expanding exports into the European market. The promotion of free trade agreements and standardization of phytosanitary measures are also part of the country's overall strategic plan.

Figure 8. Mexico Avocado Production and Area (1980–2017)



Data Source: SIAP (2017).

Note: Projected production for 2030 from SAGARPA (2017a).

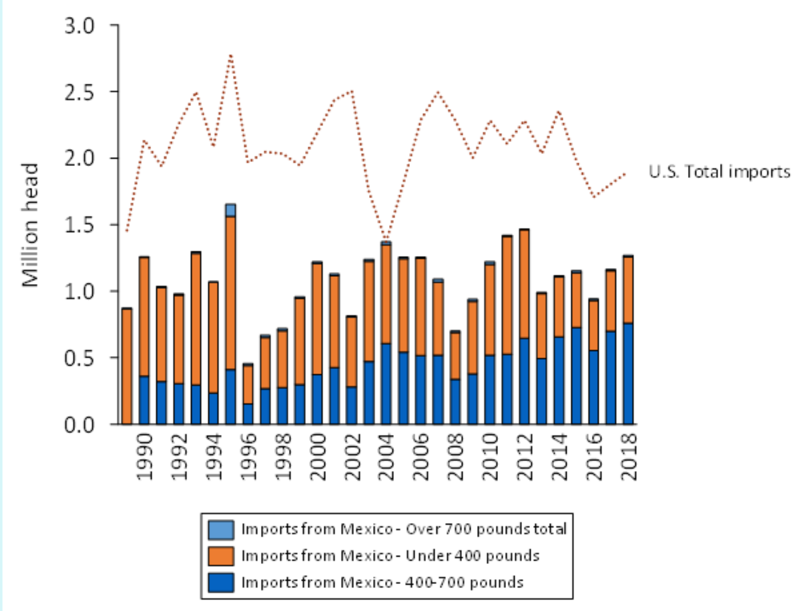
Organic Industry

Mexico is one of the top producers of organic vegetables in the world. With 115,084 acres, Mexico has the second-largest production area after the United States (Dorais and Cull, 2017). Of this, it is estimated that 4,633 acres are protected production, mainly dedicated to organic tomato, cucumber, and pepper production (Dorais and Cull, 2017). Mexico is the leading exporter of organic products to the United States, with a share of around 10% (Demko et al., 2017). Mexico's relevance in the organic sector could increase as demand for organic products continues to rise in developed markets (Barrett et al., 2002; Jaenicke, Dimitri, and Oberholtzer, 2011). The U.S. Department of Agriculture (USDA) estimates that there are more than 1,600 USDA-certified organic operations in Mexico that can export certified organic products into the United States (U.S. Department of Agriculture, 2018).

Beef Industry

Beef is the most important industry within the livestock sector in Mexico. Its cattle inventory, however, has remained relatively steady since the early 2000s (CEC, 2015) and only showed a moderate increase of 8% from 2008 to 2017 (SIAP, 2018a). Mexico and the United States have built a strong symbiotic relationship in the beef industry. Mexico, with its long growing season, extensive forage resources, and inexpensive labor, is an important global player in the cow–calf industry, while the United States, due to its corn production, has a comparative advantage relative to Mexico in finishing high-quality beef that is then exported worldwide. Mexico supplies the U.S. beef industry with enough cattle to allow feedlots to operate at or near capacity to maximize efficiency (Peel et al., 2011). By 2018, 67% of the cattle imported to the United States were supplied by Mexico (U.S. Department of Agriculture, 2019d). Mexico exports primarily steers and heifers to the United States (Figure 9), which are then placed in U.S. stocker operations for backgrounding or finished in U.S. feedlots (Peel et al., 2011).

Figure 9. U.S. Cattle Imports from Mexico



Data Source: U.S. Department of Agriculture (2019d).

Two decades ago, the Mexican beef industry focused its efforts on improving cattle quality and health, which allowed it to successfully respond to the increasing U.S. demand for cattle (Peel et al., 2010). The challenge for Mexico is remaining as the primary live cattle supplier for the United States. This will depend on its ability to continue meeting the quality, health, and breeding standards demanded by the U.S. market (Peel et al., 2011). As Mexico's livestock production systems continue to intensify, productivity is expected to rise, increasing Mexico's production and export capacity.

Challenges and Opportunities

The agricultural sector in Mexico has grown over the past decade, but the country still faces challenges and unrealized opportunities. While larger, technology-intensive operations in Mexico are competitive and generally supply the export market, Mexico's agricultural operations are predominantly small, with limited access to capital, infrastructure, and profitable markets.

The competitiveness of the sector could benefit from higher investment in rural infrastructure and business logistics to facilitate trade and commerce (UNCTAD, 2014).[7] The capacity to meet food safety, food labeling, and sanitary and phytosanitary standards seems to remain a barrier for some exporting companies in Mexico, particularly as new regulations such as the Food Safety and Modernization Act tighten verification restrictions for produce imported into the United States. While Mexico has made improvements in these areas, more investment in the country's capacity to assist producers through extension education and for verification control is still needed (UNCTAD, 2014). In addition, the country's R&D levels are low relative to other countries. More investment in research may be needed to support productivity growth in the sector.

[7] UNCTAD (2014) estimates that logistical costs in Mexico could double those observed in the United States.

Mexico's proximity to the United States, coupled with a strong trade agreement, has opened doors for Mexico's products into the United States, which has resulted in an increase in agricultural exports. However, the country's dependency on the U.S. market also makes it vulnerable to foreign and trade policy changes in the United States. Currently, immigration issues have slowed trade discussions and the current U.S. administration's positions on trade could affect Mexico's agricultural sector. This uncertainty also impacts investment in the sector, which is key to sustaining growth (García-Winder and Chavarría, 2017).

In addition, uncertainty regarding the potentially protectionist policies of the new Mexican administration could reduce investors' confidence in the country and stifle investment in the sector (Gantz, 2019). Since the inauguration of Mexican President Obrador in 2018, the administration has announced efforts to reduce Mexico's dependence on U.S. imports, but questions remain regarding Mexico's comparative advantage when producing grains, cereals, dairy, and meat. It is unclear how a sufficient level of mechanization and productivity can be achieved to increase domestic competitiveness against imports from the United States (Gantz, 2019). This will require further investment in building the productive capacity of these sectors. In 2019, the Mexican government launched a program targeting less developed rural communities to ensure access to fertilizers, credit, price guarantees, and other producer incentives (Haro, 2019; López Obrador, 2019). Some groups have criticized the program because it does not play to the comparative advantage of the country and is not designed to benefit larger-scale farmers, who are responsible for the majority of commercial production. A major concern is that these new policies have added more restrictions and created uncertainty in the agricultural sector, which could prevent large-scale producers from planning in the long term (Blanco, 2019).

Conclusion

Some subsectors within Mexican agriculture have significant production and growth potential. Government support and FDI have resulted in the capitalization of some agricultural industries and propelled the growth in production capacity and trade. For example, the area under protected agriculture has expanded significantly and the production and export of tomatoes, berries, and other vegetables have enjoyed considerable growth. In addition, the avocado industry has developed substantially during the last two decades and exports to the United States have sharply increased. The importance of the avocado industry in Mexico cannot be underestimated, as it has become the second-largest generator of foreign income and has additional expansion capacity.

Nonetheless, challenges still abound in Mexico, where greater investment in infrastructure, business logistics, access to production inputs, and credit is needed. Mexico's trade dependency on the United States and uncertainty regarding the policy direction of the new Mexican and U.S. administrations could affect investment. Mexico, however, could benefit from trade and investment diversion as a result of United States–China trade disputes.

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The Andean Region: An Important and Growing U.S. Agricultural Trade Partner

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Introduction

The region that we refer to as the Andean countries includes five South American nations—Colombia, Ecuador, Peru, Bolivia, and Chile—which share not only the longest continental mountain range in the world (the Andes) but also strong historical and commercial ties. The first four currently comprise the Andean Community (Comunidad Andina, CAN), a free-trade bloc created in 1969. Chile also was a full member but withdrew in 1973, but it still participates as an associate member (CAN, 2019). With growing populations and economies, a combined gross domestic product (GDP) of over $1 trillion, and vast, valuable land and water resources, the region is an important agricultural player in global trade.

Despite shared geography and history, economic and political conditions differ across these five countries. Their heterogeneous climates and natural resources have also led to different developments in their agricultural sectors. We review the status of and trends in the Andean region's agricultural sector, with special emphasis on agricultural trade issues.

Background

In 2017, approximately 127 million people—20% of the population in Latin America and the Caribbean—lived in the Andean countries: 49.1 million in Colombia, followed by 32.3 million in Peru, 18.1 million in Chile, 16.6 million in Ecuador, and 11.1 million in Bolivia (World Bank, 2019). Average per capita GDP across the region was $7,600 in 2017, with some variability across countries, ranging from $3,394 in Bolivia to $15,347 in Chile. The region experienced average annual growth rates (in real per capita GDP) of approximately 2%–3% from 2000 to 2017, an overall increase of approximately 60%.

The diversity of agricultural production in the Andean countries is related to the variety of climate zones, which include tropical, temperate, arid, and cold (National Geographic, 2019). The tropical climate zone is located primarily in the Amazon River basin, the largest basin in the world, which covers large parts of Colombia (30% of the country's total area), Ecuador (51%), Peru (75%), and Bolivia (66%) (FAO, 2015). Forestry and extensive cattle production are the principal agricultural activities in this zone, but commercial crops include coffee, sugarcane, cocoa, palm oil, and banana-growing areas, particularly in Ecuador and Colombia. Rice, cassava, maize, and beans are grown for subsistence (OEC, 2019; FAO, 2015).

At midlevel elevations, temperate climates extend to the south of the Tropic of Capricorn in Chile (National Geographic, 2019). Corn is produced widely in this agro-ecological zone, and vegetables and cut flowers have recently become major agricultural export industries in Ecuador and Colombia (Knapp, 2015).

Arid climates, both cold and extremely hot, occur in coastal deserts and at high elevations in the Andean interior. Although arid conditions make agricultural production difficult, irrigation has allowed crop plantations to expand in these zones (National Geographic, 2019; Gestion, 2019).

Cold climates are found in southern Chile and at the highest elevations. Even though this climate zone is not optimal for agricultural production, native potato species and grains like quinoa are grown there. Sheep and native grazing animals—such as llamas, alpacas, and vicuñas—also are raised in cold climates (National Geographic, 2019).

Agriculture, forestry, and fisheries contributed 7.6% to the Andean countries' GDPs in 2017, above the Latin American average of 4.7% (World Bank, 2019). More importantly, the sector accounts for approximately 22% of jobs in the region (range 11%–30%). Over the past decade, growth in agricultural GDP (3.2%) was above total GDP growth (2.8%) (World Bank, 2019). In spite of the fact that the agricultural sector remains an important component of the Andean countries' economies, high levels of rural poverty, estimated to be between 35% and 58%, still affect agricultural households and laborers in the region (World Bank, 2019).

Land holdings are generally concentrated in the hands of large private owners. According to the FAO (2014), agricultural units with 50 or more hectares own 75% of agricultural land but account for only 8% of total farms. In contrast, agricultural units of 5 or fewer hectares account for 57% of farms but own only 4% of land. The FAO report excludes Bolivia, but the situation is similar or even more pronounced there (Paz Ballivián, 2004).

Production, Productivity, and Policy

Between 2000 and 2016, regional agricultural output and productivity increased for a majority of agricultural products, but rates of growth vary across countries and products (FAO, 2019). We consider 15 crops, chosen based on their importance to export markets, although we also include certain key crops for domestic consumption. Broadly speaking, these crops can be classified into three groups: nontraditional export crops, traditional export crops, and crops for domestic/regional consumption (see Table 1). These crops cover an area of approximately 9.5 million hectares, or about 80% of the region's arable land.

Nontraditional exports had the highest average annual rates of increase in production and land harvested (5.4% and 5.2%, respectively). Moreover, with the exception of carrots, turnips, chilies, and peppers, all crops in the group have average annual rates of increase in production above 4.8%. Historically, Peru has been the main producer of asparagus, avocado, and quinoa, while Ecuador leads in production of cauliflower and broccoli and Colombia is the primary producer of carrots and turnips. Within countries, Ecuadorian production of quinoa, cauliflower, and broccoli has grown quickly (more than 20% annually). Meanwhile, Peru has also experienced high levels of growth (approximately 10%) in the production of avocado, cocoa, and quinoa. Growing demand for these crops—particularly those, such as the "superfood" quinoa, with high nutritional value—in international markets accounts for these crops' higher output levels in the region.

Representing nearly four times the area devoted to nontraditional export crops in 2016, the annual production of traditional export crops has grown at a lower rate on average (3.9% for the group as a whole). Given the region's leading status in the production of some of these crops (e.g., bananas, grapes, and coffee), their production has continued to grow despite well-established international markets and export competition from other regions. Most of the expansion in these crops' production has derived from increases in productivity rather than expansion in land (see Table 1). Colombia and Peru are the leading regional producers of coffee (Colombia is the third largest producer and exporter worldwide). Ecuador leads cocoa production, followed by Peru. Chile is the largest producer of apples and grapes, while Peru is second in both crops. Ecuador and Colombia leads banana production, both regionally and worldwide: Ecuador is the largest exporter in the world (24% of total world exports) and Colombia is sixth largest (6.4%). However, the spread of fusarium wilt tropical race 4 (TR4), which has destroyed crops in Asia, Australia, and Africa, threatens Andean banana production. In August 2019, Colombia confirmed the disease's presence in the Americas and declared a national emergency (Lambert, 2019).

Table 1. Production, Harvested Land, Yields, and Value of Crops in the Andean Region

Crops	Total 2016				Annual Growth, 2000–2016 (%)		
	Production (MT)	Harvested Land (ha)	Yield (MT/ha)	Gross Production Value (US$ millions)	Production	Land	Yield
Corn (D)	6,055,121	1,688,382	3.59	2,104.32	3.43	-0.16	3.68
Potatoes (D)	10,210,628	736,121	13.87	2,901.66	2.80	1.12	1.72
Rice, paddy (D)	8,342,469	1,546,633	5.39	2,729.21	2.37	1.00	1.43
Soybeans (D)	3,327,699	1,392,228	2.39	920.71	7.06	4.81	2.24
Wheat (D)	2,272,776	655,222	3.47	547.08	2.28	-0.24	2.30
Asparagus (NT)	390,563	34,434	11.34	507.15	4.88	2.03	3.03
Avocados (NT)	918,956	113,769	8.08	872.02	6.88	5.82	1.14
Carrots and turnips (NT)	629,672	32,511	19.37	153.13	1.94	1.98	0.05
Cauliflowers and broccoli (NT)	187,724	21,352	8.79	77.60	7.47	12.46	-2.77
Chilies and peppers, green (NT)	203,964	18,706	10.90	148.93	2.40	1.12	3.05
Oil, palm (NT)	9,472,681	590,695	16.04	1,066.01	6.10	5.51	0.82
Quinoa (NT)	148,720	185,350	0.80	166.06	8.11	7.67	1.79
Apples (T)	1,913,539	47,984	39.88	1,195.15	4.65	-0.63	5.34
Bananas (T)	10,760,419	334,044	32.21	2,661.94	2.75	0.55	2.39
Cocoa, beans (T)	348,401	731,272	0.48	807.71	7.37	2.19	5.27
Coffee, green (T)	1,121,335	1,215,513	0.92	1,918.26	2.05	-0.11	2.21
Grapes (T)	2,940,785	247,489	11.88	4,972.62	2.56	2.03	0.54

Notes: D indicates crops for domestic/regional markets; NT indicates nontraditional export crops; T indicates traditional export crops.
Source: FAO (2019).

The five crops intended for the domestic Andean market account for 65% of cultivated area. Despite being produced only for domestic markets, their total production has also expanded—albeit at a lower rate than that of export crops—in addition to increases in the imports of these crops. The growth in production of crops for the Andean market can mainly be attributed to improvements in productivity stemming from the adoption of modern agricultural technologies, including new varieties and the use of fertilizers and pesticides (Table 1), driven in large part by competition from cheaper imports. Colombia and Peru are the main producers of rice, potatoes, and maize, all regional staple foods. Chile dominates wheat production, and Bolivia leads in regional production of soybeans, which are exported primarily to Colombia and Peru (Tridge, 2019).

Animal production in the region, also largely for domestic consumption, experienced important increases in the production of chicken and pork (average annual growth rates of 6% and 4.5%, respectively) from 2000 to 2016. Beef production experienced only a very modest increase (1%), although most of the agricultural land in the region (approximately 110 million hectares) corresponds to permanent meadows and pastures (FAO, 2019). Imports of animal products have also expanded; therefore, there has been room for growth in both internal production and imports to respond to the increased domestic demand for animal protein as the economy and household income grow. Colombia leads regional chicken and beef production, and Chile is the main producer of pork. The region as a whole also has experienced increases in the productivity of meat production. However, productivity changes have been uneven across commodities and countries (FAO, 2019). Colombia is the principal regional producer of milk; regional milk production has increased relatively slowly, with an average annual growth rate of 1.2%; productivity growth also has been very slow. Overall, the animal sector in the region seems to be less dynamic than the crop sector.

Despite the high specialization in the export of raw agricultural commodities, wine is an important processed agricultural product from the region. Production has increased significantly, particularly since 2010 (5% annual growth rate). Chile is the leading regional producer and the fifth-largest exporter in the world.

Agricultural policies in the Andean region also vary, with the dual objectives of promoting exports and domestic production of products that can compete with imports. Market price support policies (e.g., tariffs or quotas that prevent imports and increase domestic prices) have been implemented principally in Colombia, Bolivia, and Ecuador. Direct payments to farmers (e.g., because of market price volatility or adverse weather events) and investment in infrastructure and public goods (e.g., irrigation, agricultural research, plant and animal inspection, etc.) are important in both Peru and Chile. Subsidies for farms' variable inputs are important in Chile (Egas and De Salvo, 2018).

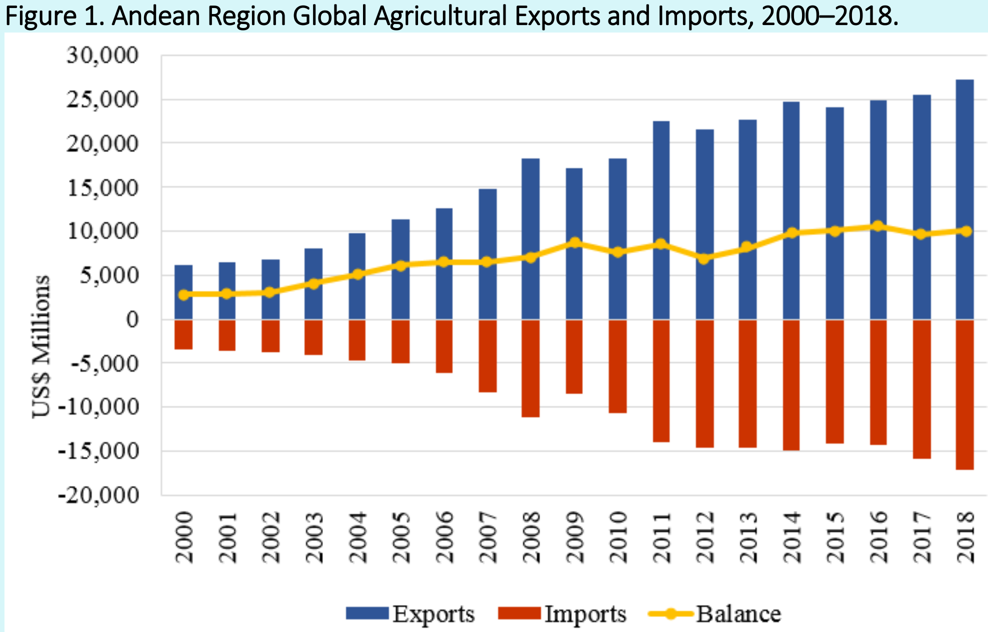
Andean Region Agricultural Trade

Chile was the first country to implement domestic free market and open trade policies, such as the Free Trade Agreements (FTA), with the largest world economies, including the United States, European Union (EU), Japan, Canada, and China. Increased efficiency in its agricultural export base attributable to these policies catapulted the country into its current position as a leading exporter of fresh fruits and wine that benefited from the counter-seasonal production patterns with respect to the Northern Hemisphere. Peru followed suit through land privatization policies and market-oriented schemes, signing the FTA and sanitary protocols with the same leading world economies during the 1990s and 2000s. Further, the country embarked on a series of extensive irrigation projects in coastal areas that incorporated thousands of acres for modern, export-oriented crops. Private investment and the use of modern production technologies helped Peru acquire increasing market shares in the high-value U.S. and EU produce markets. Colombia followed a similar pattern. In 2011, these three countries joined Mexico to form a free trade–oriented area referred to as "Alianza del Pacífico" (Alianza del Pacifico, 2018). After years of domestic-focused policies, Ecuador seems to be redirecting its economic system similarly and has requested admission to this group. In 2018, Chile and Peru also signed the Comprehensive and Progressive Trans Pacific Partnership (CPTPP) agreement, negotiated previously as TPP, which includes nine other Pacific Rim countries. Bolivia, rich in natural resources, trails the remainder of the Andean countries in agricultural trade, except for the eastern soybean production area of Santa Cruz de la Sierra.

US-Andean Region Trade Trends

From 2000 to 2018, the region's strong population and per capita income growth, combined with middle-class expansion and openness to trade, resulted in a fast-growing market for agricultural products, particularly for U.S. commodities such as wheat, soybean products, corn, rice, poultry, pork, and beef, despite competition from other South American countries, principally Brazil and Argentina (Figure 1) (Gao, 2015).

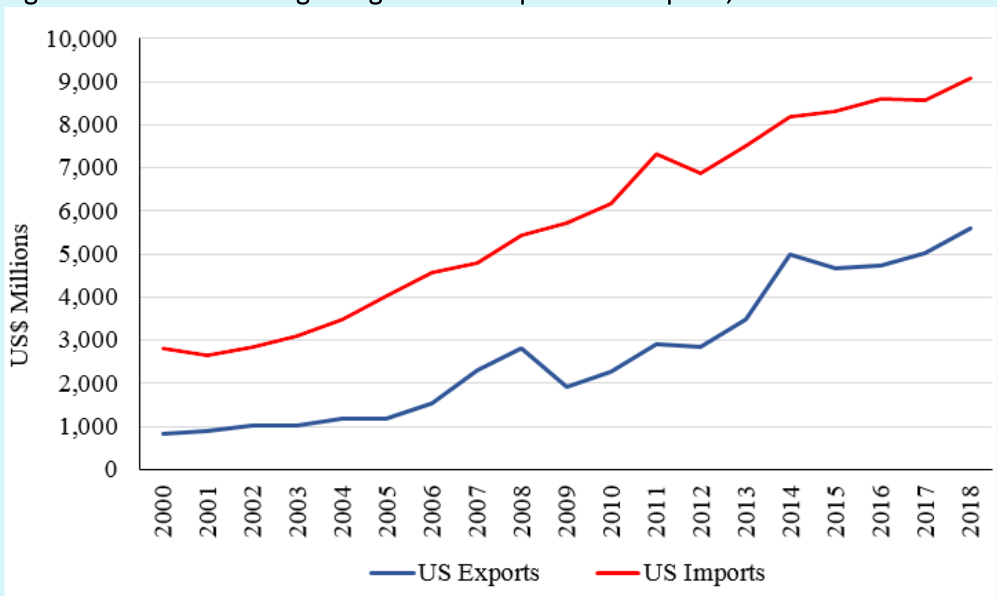
Figure 1. Andean Region Global Agricultural Exports and Imports, 2000–2018.



Note: Elaboration by authors from UN Comtrade (2019).

Overall, the Andean region' (as defined above, excluding Venezuela) had a growing trade surplus with the rest of the world during the 2000–2018 period, increasing from $5 billion in 2000 to approximately $15 billion in 2018 (UN Comtrade, 2019). Agricultural regional exports (excluding intra-regional trade) quadrupled, from approximately $6 billion to $26 billion, with the United States as the single largest export market (approximately 28% in 2018) and China as a distant, but rapidly growing, second destination (9% in 2018). However, the EU, as a bloc, also is a very important trade partner, accounting for approximately 30% of the Andean region's exports (Figure 1).

Figure 2. U.S.–Andean Region Agricultural Exports and Imports, 2000–2018.



Elaboration: Authors. Data from USDA (2019).

Agricultural net imports to the region expanded from approximately $3 billion in 2000 to over $12 billion in 2018 (UN Comtrade, 2019). The United States was not only the largest source of imports but also increased its share of imports to the region, from 28% to 34%, with Argentina a close second. The EU share accounted only for approximately 10% of agricultural imports. Considering agricultural imports and exports combined, the United States is the region's most important trade partner. In aggregate, U.S. agricultural exports to the Andean region not only have increased in value, but also in importance (USDA, 2019). The value of U.S. exports to the region increased 6.4 times, from $0.9 billion in 2000 to $5.5 billion in 2018, while the value of total U.S. agricultural exports to the world and to Latin America (as a whole) grew by only 2.2 times and 3.2 times, respectively (see Figure 2). Colombia represents more than one-third of the region's agricultural imports from the United States, followed by Chile and Peru.

Agricultural imports from the Andean region to the United States also have expanded, increasing from $2.8 billion to $9.5 billion (2000 to 2018), largely because of produce imports from Chile and Peru but also from increased imports of coffee, flowers, and bananas from Colombia and Ecuador (Figure 2) (USDA, 2019). Despite the increase in import value, the share of U.S. agricultural imports from this region declined slightly, from 22% to 20%, because of Mexico's growing contribution. Overall, balance of U.S. agricultural trade with the region has been negative, increasing from −$2.2 billion in 2000 to −$3.5 billion in 2018; and in some cases, the region became a serious competitor for U.S. produce exports, particularly grapes and berries (Figure 2).

Oilseeds and corn are the Andean region's leading imports from the United States, followed by wheat, pork, dairy, and poultry, in that order, with beef and rice following (USDA, 2019). Imports of U.S. oilseeds and products (mainly soybeans) reached nearly $1.4 billion by 2018, a 12-fold increase from 2000, compared with a three-fold increase of U.S. exports to the world. Colombia's share of the region's imports from the United States reached nearly 60%, followed by Peru. Similar trends can be observed in the value of U.S. corn exports to the Andean region, which reached $1.4 billion in 2018, seven times 2000 values, and are exported almost exclusively to Colombia and Peru. U.S. wheat exports to the region reached a value of $400 million in 2018, a two-fold increase from 2000.

Pork and dairy were first among U.S. animal protein exports to the Andean region in 2018, at approximately $300 million each, representing increases of 40 and 12 times relative to 2000 values, respectively. Colombia is by far the largest regional importer of pork products, while Colombia, Peru, and Chile account for similar shares in dairy product imports. Andean imports of poultry from the United States ($230 million in 2018) also grew rapidly, and Ecuador has become the largest regional importer of U.S. poultry. While still smaller in value and importance, beef and veal imports from the United States have increased rapidly as well; Colombia is by far the largest importer, followed by Chile. Finally, U.S. rice exports to the region are still very small in value and highly variable (less than $60 million in 2018) and exported primarily to Colombia. With the exception of wheat and rice imports, the fast-growing demand for other agricultural products from the United States seems to be driven by Andean consumers' demand for animal protein that domestic production alone cannot meet.

Historically, U.S. agricultural imports from the Andean region consisted of products like coffee, cocoa, bananas, flowers, and tropical fruits (USDA, 2019). More recently, given strong U.S. demand for fresh fruits and vegetables and the FTAs the United States has signed, its imports have increased and diversified considerably. The value of U.S. imports of fruits and preparations from the Andean region reached $4.1 billion in 2018, 3.6 times the value of imports in 2000. Chile and Peru have expanded fruit exports to the U.S. market considerably. While Chile exported 4 times the 2000 value in 2018, Peru's fruit exports grew exponentially (70 times) during the same period, and Ecuador was the third-largest fruit exporter to the United States.

Avocados, grapes, mangoes, bananas, and berries are among the top fruits exported to the United States. Grapes, primarily from Chile and Peru, reached a trade value of $1.1 billion in 2018, an almost three-fold increase since 2000. Although most grapes are imported from Chile, grape exports from Peru went from 0 in 2000 to nearly 50% of the Chilean shipments to the United States in 2018. Peru produces grapes on newly irrigated land, where two harvests a year are possible (Redagricola, 2017).

The region trails just behind Mexico as a source of U.S. avocado imports, one of the fastest-growing U.S. imports. Even though the $240 million in 2018 represents only 10% of U.S. imports from Latin America (where Mexico is the largest exporter), Chile was the only South American country that exported to the United States until 2010, when Peruvian avocado imports were allowed into the United States. By 2018, U.S. avocado imports from Peru almost tripled the value of those from Chile. Again, newly irrigated land on the Peruvian coast has provided most of the avocado export supply. Colombia also began avocado production and exports with Chilean and Peruvian investors there.

Although less than half the value of fruit imports, U.S. imports of vegetables and preparations from the Andean region have grown consistently, reaching $760 million in 2018, 7 times the 2000 values. While most of these imports are from Peru (75%), Ecuador has consistently expanded its supply and reached second place in the region. This import category's largest representative has been asparagus, but onions, peppers, and other minor vegetables have also increased in value. Whereas most of the U.S. imports come from the region's coastal and moderate climate areas, in recent years, imports of quinoa from high-altitude regions of Peru and Bolivia have expanded, but these still represent a relatively small value of total imports ($35 million in 2018).

Finally, U.S. imports of other traditional crops from the Andean region (flowers, cocoa, coffee, bananas, and palm oil) have also increased, totaling $3,163 million in 2018, almost double 2000 values. However, their relative importance as a share of total U.S. imports from the region declined, from approximately 56% in 2000 to 35% in 2018.

What Can Be Expected in the Future?

Latin American economic analysts have nearly reached a consensus that the Alianza del Pacífico, with its sound macroeconomic and private investment policies, is positioned to lead future economic growth in Latin America (Alianza del Pacífico, 2018). This group also may include Ecuador, which has applied for membership. Bolivia, although applying alternative sets of policies, also continues to grow, thanks largely to the increase in nonagricultural natural resources exports (e.g., natural gas, tin, and silver). Overall, the Andean region appears poised to expand its population, per capita income, and middle class, which will create a strong demand for imports of food and commodities the region may not produce competitively or sufficiently, primarily cereals, meats, oilseeds, and dairy.

Most of the region's countries could improve their current trade by facilitating their logistics infrastructures, which, with the exception of Chile, lag behind the other large Latin American countries. A recent World Bank study reported logistic costs as a percentage of food product value as high as 32%, 23% and 18% in Peru, Colombia, and Chile, respectively, compared to the OECD average of 13% (Chaherli and Nash, 2013). Fortunately, Colombia, Peru, Ecuador, and even Bolivia have embarked on large projects to modernize and expand their export logistics (Chaherli and Nash, 2013).

All of this may represent an excellent opportunity for the United States to expand agricultural exports to the region. However, two factors must be considered. First, Brazil and Argentina—which also produce the main commodities the U.S. exports to the region—seem to be improving and modernizing their agricultural sectors and may become serious competitive exporters to the Andean region, particularly its southern part (Duff and Padilla, 2015). Second, Chile and Peru (and eventually Colombia) are members of the newly created CPTPP trade area, which will begin implementation in 2019. This free trade area includes Australia, New Zealand, and Canada, strong competitors with the United States in cereals, meats, and dairy products. Third, there is some potential for increased trade among the Andean countries, as they have all experienced economic growth and some specialize in producing certain agricultural products currently exported from the United States.

The United States may be facing a growing surge in fruit and vegetable imports and other products from the Andean region, almost certainly from Chile and Peru, but also likely from Colombia and Ecuador. The region is experiencing rapid growth due to its use of modern agricultural technologies and business practices and the expansion of agricultural land under irrigation. Peruvian coastal irrigation projects are behind schedule but will eventually (in the next five years) incorporate nearly 300,000 hectares of high-quality land dedicated almost entirely to export-oriented produce (Redagricola, 2017). The region has the potential for even further expansion of agricultural land. According to Fischer and Shah (2010), Bolivia, Peru, Colombia, and Ecuador have approximately 109 million hectares of potentially available good land for the production of wheat, maize, soybeans, sugarcane, or palm oil, approximately 10% of which is highly accessible. U.S. consumers will surely benefit from a larger variety of fruits and vegetables with lower prices if the Andean countries can compete efficiently with the lower transportation cost of Mexican exports. Moreover, those imports come when the Northern Hemisphere is in its season of lower production. The region also is innovating by introducing "superfoods" to the rest of the world, including quinoa, açai berries, lucuma, and amaranth, but these crops still account only for a very small share of exports (Krader and Bartenstein, 2018).

Finally, although not the main focus of this article, countries in the Andean region also need to face the challenge of high poverty levels among smallholder farmers who have not benefited from growth in the agricultural sector and its focus on export-oriented policies and markets.

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Agricultural Production of Central America and the Caribbean: Challenges and Opportunities

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Traditionally, the agricultural sector in Central America and the Caribbean (CAC) has played a strategic role in job creation, rural income, export promotion, and food security. For instance, the sector employs 25% of the population of Guatemala, 11% each of Costa Rica and Belize, 6% of Panama, 3.4% of the Dominican Republic, and 1.5% of Trinidad and Tobago (FAO, 2019). Such percentages are higher in rural areas, which has an average employment rate of 60%. As shown in Table 1, the CAC region produced 170.4 million tons of raw food and fiber in 2017, valued at US$21.65 billion at the farm gate.[1]

Table 1. Raw Food Production and Trends in Central America and the Caribbean

	Production 2017			Yearly Average Growth Rate, 1990–2017	
	Metric Tons (thousands)	US$ Millions	Share from Total Value (%)	Volume (%)	Value (%)
Fruits	26,022	6,022	28	2.2	6.0
Meats	3,151	4,220	19	2.7	2.4
Coffee, cocoa, tobacco	1,269	1,784	8	-0.1	5.4
Milk	5,761	1,737	8	1.7	1.2
Grain & cereals	8,265	1,737	8	1.9	3.4
Sugar	88,856	1,227	6	-0.6	−1.7
Vegetables	7,589	1,189	5	4.1	6.2
Oil crops	5,405	1,058	5	6.2	7.5
Roots & tubers	5,916	806	4	3.1	4.1
Aquaponics	189	734	3	9.3	9.4
Eggs	16,246	579	3	2.3	3.7
Pulses	1,237	438	2	2.3	3.6
Other	501	124	1	0.9	−1.1
Total	170,407	21,655	100	2.3[a]	2.6

[a]Excluding sugar, because of its large volume compared to other commodities.
Source: Created by the authors, using data from FAO (2019).

Most of that production takes place in rural areas, which are suffering from accelerated migration toward urban centers. Notwithstanding, 35% of the 93 million CAC inhabitants still live in rural areas (FAO, 2019). Further, although the value of agriculture, forestry, and fishery has increased at a rate of 1.8% per year in real terms, its

[1] The Caribbean countries considered to construct Table 1 include the Antigua and Barbuda, the Bahamas, Barbados, Belize, Dominica, the Dominican Republic, Grenada, Haiti, Jamaica, the Netherlands Antilles, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago.

relative contribution to the economy has decreased significantly as other sectors such as services and manufacturing became more dominant (Table 2).

Table 2. Agriculture, Forestry, and Fishery Contribution to the CAC Economy, 1970–2017

	Value Added (US$ millions)			Share of GDP (%)		
Country/Region	1970	2000	2017	1970	2000	2017
Central America	**5,244**	**9,998**	**15,695**	**13.8**	**9.7**	**7.8**
Guatemala	1,485	3,512	5,967	14.1	11.8	11.3
Costa Rica	696	1,956	2,801	10.0	8.0	5.8
Honduras	633	1,389	2,737	17.8	13.1	13.4
Nicaragua	724	1,073	1,810	14.0	16.4	14.4
El Salvador	1,248	1,098	1,236	17.6	7.2	5.8
Panama	458	970	1,145	9.8	5.8	2.4
Caribbean	**6,612**	**9,160**	**11,903**	**7.4**	**3.9**	**3.6**
Dominican Republic	1,159	2,146	4,332	16.0	6.5	5.7
Cuba	1,721	2,488	2,796	8.8	6.4	3.7
Haiti	1,977	1,771	1,683	45.1	26.7	20.8
Jamaica	459	683	845	5.0	5.5	6.0
Other[a]	1,296	2,071	2,247	2.6	1.4	1.5
Total	**1,856**	**19,158**	**27,598**	**9.3**	**5.7**	**5.2**

[a]Other Caribbean countries include the Anguilla, Antigua and Barbuda, Aruba, the Bahamas, Barbados, Belize, the British Virgin Islands, the Cayman Islands, Curaçao, Dominican Republic, Grenada, Guyana, Montserrat, the Netherlands Antilles (former), Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Saint Maarten (Dutch part), Suriname, Trinidad and Tobago, and the Turks and Caicos Islands.
Source: Created by the authors, using data from FAO (2019).

Like most Latin America regions, the CAC region specializes in exports of natural resources and commodities, having a positive net agricultural trade balance (ECLAC, 2018a). The products responsible for this positive trade balance are vegetables, fruits, nuts, coffee, cocoa, and other minor categories. However, all Caribbean countries are net importers of ag-related products, with an aggregated trade deficit of $5.89 billion. In contrast, all countries in Central America, except for Panama and El Salvador, have a positive trade balance of those products.

State of the Agricultural Sector in Central American and the Caribbean

Data from USDA-FAS (2019) show that the relative composition of the total value of raw food products has changed over the last 20 years in favor of those crops for which the region has a comparative advantage, such as tropical fruits and vegetables, tilapia, shrimp, palm oil, and coconut oil. Prescott et al. (1997) estimated that Honduras and Guatemala had a comparative advantage over the United States on the production of Asparagus and Cucumbers, respectively. Furthermore, the revealed comparative advantage (RCA) index (Balassa, 1965), which we calculated using 2017 export values, shows that the region has a revealed world comparative advantage in tropical products, fish, crustacean, and some oil crops (Table 3). Notice that most of the RCA estimates are above one, which indicates that those countries export more tropical fruits and vegetables, oils, fish, and shrimps than their fair share.

Data from FAO (2019) also show the dynamics of changes in the CAC region over the last 20 years. In terms of value contribution, the share of tropical fruits increased from 12% to 28%. Likewise, the share of both vegetables and oil crops increased from 2% to 5%. In contrast, the contribution of sugar, grains, and cereals decreased significantly. The share of traditional crops (e.g., banana, coffee, cocoa, sugar, and tobacco) has remained stable due to favorable prices (e.g., the price boom of 2003–2012) and the increased acreage of organic cocoa orchards in the Caribbean. To see these trends in the agricultural sector, refer to the annualized growth rate reported in Table 1, which shows that the categories of fruits, traditional crops, vegetables, oil crops, and aquaponics products have grown on average by more than 5% annually. Most of that growth for other categories, like traditional crops and fruits, was driven by price and not by volume.

Table 3. Revealed Comparative Advantage (RCA) of Selected Countries and Commodities

	Tropical Fruits	Frozen Fruits	Other Vegetables	Frozen Vegetables	Fish (tilapia)	Crustaceans (shrimp)	Tropical Oil Crop
Guatemala	5.3	8.9	2.2	10.6	10.7	48.3	32.7
Honduras	9.4	0.2	10.1	–	5.2	25.3	30.9
El Salvador	0.3	1.6	1.1	5.0	15.8	0.1	–
Nicaragua	1.9	2.9	2.9	–	2.1	79.6	2.9
Costa Rica	230.0	13.7	1.9	0.8	3.6	0.5	8.1
Panama	7.8	–	0.7	–	2.8	8.7	3.4
Dominican Rep.	11.1	0.5	7.3	0.6	24.1	2.6	0.2
Jamaica	1.2	0.3	41.2	0.5	0.6	22.4	0.5

Note: For detail on estimation, interpretation, and limitations of the RCA index see Balassa (1965) and Ding and Hadzi-Vaskov (2017).

Within the fruit category, pineapple production has grown the fastest during the last 20 years, overtaking bananas in terms of value. This growth has been driven mainly by Costa Rica, followed by the Dominican Republic, Panama, Honduras, and Jamaica. Other fruits that have grown significantly in terms of value are papaya and avocados (led by the Dominican Republic), specialty fruits (Costa Rica and Caribbean countries), watermelons (Costa Rica, Panama, Honduras, and Jamaica), and melons (Honduras). Mango, mangosteen, and guava production also experienced modest increases. In contrast, the production of citrus, led mainly by Jamaica, has stagnated since the year 2000.

Within the vegetable category, production of tomatoes, specialty vegetables, dry onions, chilies and peppers, and brassicas represented 80% of the total value of vegetable production during the last two decades. In 2016, the most prominent producers were the Dominican Republic, followed by Jamaica, Costa Rica, Honduras, and Panama, which together accounted for 80% of the total value of vegetable production in the region. However, countries like Nicaragua and Honduras are currently achieving the fastest-growing rates of vegetable production. The vegetable productions growing the most are eggplants, okra, lettuce, chicory, chilies, and peppers.

Most tropical oil-crop production takes place in Honduras (oil palm), Dominican Republic (coconuts), Nicaragua (peanuts), and Costa Rica (oil palm). The biggest regional player in aquaponics production is Honduras, with a 34% share, followed by Guatemala (17%), Costa Rica (13%), Nicaragua (13%), and Panama (8%).

Among traditional crops, coffee continues to be the backbone of many rural communities in Central America, especially Honduras, which is the largest producer in the CAC. From 1990 to 2012, the supply of coffee increased significantly due to the attractive prices of the coffee bean on international markets but has since declined due to La Roya (leaf rust) and low prices. Vietnam's entrance into the coffee supply chain and overproduction in Brazil and Colombia have jeopardized the regional coffee industry. On the other hand, cocoa (mainly in the Dominican Republic) and tobacco (the Dominican Republic, Honduras, Nicaragua) production values have increased considerably during the last 20 years. The Caribbean, due to the lack of diseases for cocoa, has become the largest exporter of organic cocoa worldwide.

While the region is slowly diversifying toward other tropical agricultural products, the productivity of its agricultural output needs to continue increasing. At the aggregate level, it has increased through the total factor productivity (TFP), but not homogeneously across commodities. According to the Araujo, Feitosa, and Silva (2014), the change in TFP for selected countries of the CAC region has been positive and grew during 1990–2010. The average rise in TFP for Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua was 2.3% annually. For the selected Caribbean countries (Dominican Republic, Jamaica, Trinidad and Tobago), the average change was 1.4% annually.

Further work is required to understand TFP evolution for each specific ag-related commodity in the region. FAO (2019) data on yield per unit of land indicate that such increases have not been homogeneous across the ag sector. During 1990–2017, yields per hectare increased by 62% on average, calculated from a list of 83 regional products. Although some products (such as chilies, peppers, okra, papayas, watermelon, lettuce, and onion) have enjoyed more than three-digit growth in yield per hectare during that period, many others have lagged (such as coffee, cocoa, sugar cane, melon, banana). Country and regional efforts are required to continue increasing productivity through research, extension, and public investment.

Drivers of Agricultural Output Growth

According to the Economic Commission for Latin America and the Caribbean (ECLAC) (2014), several factors drive regional agricultural output growth. The first is external demand for agricultural products, which is highly linked to the economic cycles of regional trading partners. For example, during the 2008–2009 financial crises, some agricultural exports were affected by lower demand in the United States. Similarly, during the last 10 years, the CAC region has benefited from strong U.S. demand for manufacturing and ag-related products (ECLAC, 2018b). The second driver refers to the international price of exportable commodities and importable inputs such as fertilizer and feeds. Heavy dependence on a reduced number of commodities puts the agricultural sector of some countries at risk. For example, most rural producers in Honduras depend on the price of coffee, which is currently low by historical standards. Thus, efforts to diversify the production and export of tropical agricultural products should be a priority for the region. Although the composition has slightly changed, the region still depends on traditional crops such as bananas, sugar cane, coffee, and cocoa. Additionally, price premiums and specialized markets could be targeted through product differentiation via international production and management practice certifications. The third output growth driver is credit access and government support of agriculture. In particular, the lack of affordable credit options and risk protection against natural disasters—such as hurricane, flooding, and drought—make CAC producers relatively less competitive and more vulnerable to exogenous events compared to their northern and southern counterparts.

Agricultural Policies

According to the Interamerican Development Bank (IDB) Agrimonitor database, the average government support to agriculture in the CAC region is around 15.2% of farmers' total receipts (Table 4), comparable to the support provided by Organization for Economic co-operation and Development (OECD) countries (18%) and higher than average for Latin America and the Caribbean (3.29%) (Egas and de Salvo, 2018). However, around 80% of this support comes from Market Price Support (MPS)[2] and direct support, which have more distorting effect than other types of support. Notwithstanding, the region has been shifting toward more neutral support due to several free trade agreements signed across the region and with other nations and blocs.

The total support estimate (TSE) as a percentage of total gross domestic product (GDP) indicates the relative importance that governments assign to the agricultural sector (Egas and de Salvo, 2018). On average, CAC countries dedicated 2.2% of their GDP to supporting agriculture. This estimate is usually higher for countries—such as Haiti, Guyana, Nicaragua, and Jamaica—with low per capita GDP, a large rural population, considerable food insecurity, and high rural unemployment.

Further, empirical evidence indicates that support to general services (e.g., infrastructure development, marketing, promotion, public goods investments, extension, research, subsidized credit, risk coverage tools) have more

[2] Example of MPS are tariff, quotas, and specific duties.

impact on agricultural development than market price support or direct support (Anríquez et al., 2016). During the period of analysis, the support to general services (GSSE) was only 20% on average. The countries that could benefit the most from increasing the GSSE are Haiti, El Salvador, Guatemala, and Jamaica, which have GSSE shares below 10% relative to the PSE. Lopez and Galinato (2007) suggest that a 10-percentage-point increase in GSSE, holding everything else constant, could lead to a 5% increase in per capita agricultural value added.

Table 4. Support to the Agricultural Sector in Central America and the Caribbean

Country	Year	PSE[a] (%)	GSSE[b] (%)	TSE[c] (as % of GDP)	TSE[c] (as % of Ag-GDP)
Guatemala	2017	-1.5	4.4	-0.1	-0.5
Honduras	2017	4.9	25.5	2.0	8.2
Costa Rica	2018	4.9	22.4	0.8	6.4
Nicaragua	2017	8.6	7.4	3.0	9.4
El Salvador	2017	22.6	4.4	2.7	29.9
Dominican Republic	2017	25.8	8.3	1.7	28.9
Panama	2015	25.0	11.6	1.0	28.8
Belize	2014	6.9	23.8	1.8	9.1
Guyana	2014	13.2	24.1	3.5	19.1
Haiti	2012	26.7	1.8	6.4	27.4
Jamaica	2014	32.7	8.3	2.5	41.9
Suriname	2014	7.4	67.4	1.4	26.9
Trinidad and Tobago	2014	30.4	45.5	0.3	51.9
Average		15.2	20.3	2.2	21.5

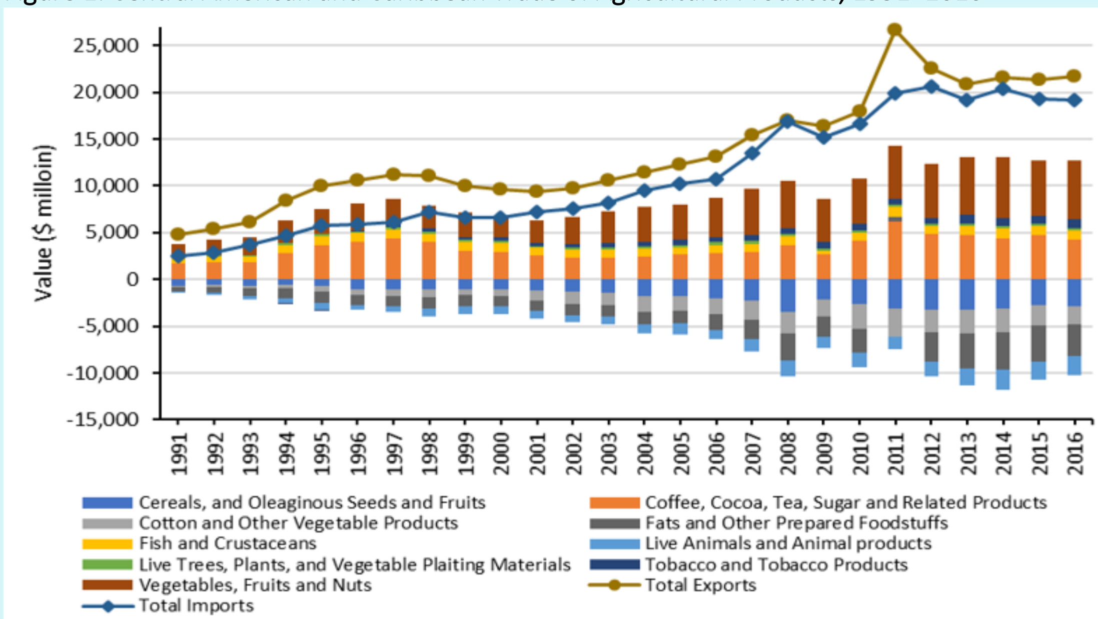
[a]PSE = Producer support estimate; it indicates the percentage of farm revenue due to ag policies.
[b]GSSE = General service support estimate; it indicates the level of support to farmers through services such as extension, research, infrastructure development, ag-health, export promotion, among others.
[c]TSE = Total support estimate; it indicates the support to the ag-sector with respect to GDP or agricultural GDP.
Source: IDB Agrimonitor database.

Trading Partnerships

Its geographical location, tropical climate, existing production capabilities, and political treaties define the international trade of agricultural products from the CAC region. Several trade agreements support regional bilateral and multilateral commerce (WTO, 2019). The Central American Common Market (CACM), Caribbean Community and Common Market (CARICOM), and the Dominican Republic–Central America Free Trade Agreement (CAFTA-DR) are the main trade agreements promoting intra-regional trade. Multiple individual and regional trade agreements have also been signed with the European Union and individual countries in North America, South America, and Asia. Foreign trade is a pillar of the regional economy. In 2018, Central America and the Caribbean exported $30.2 and $9.8 billion worth of agricultural and ag-related goods, which represent a share of 59% and 28%, respectively, from total exports (USDA-FAS, 2019).

As shown in Figure 1[3], the value of agricultural product exports has experienced a four-fold increase since 1991, with over 41% growth in the past decade. Imports of agricultural products have also increased. In 2016, the CAC imported about $19.16 billion in agricultural products. Historically, the agricultural sector in the CAC has had a positive trade balance, with an average annual trade surplus of $2.67 billion between 1991 and 2016. In terms of product categories, the CAC is a net exporter of tropical products such as vegetables, fruits, and nuts; coffee, cocoa, tea, sugar and related products; fish and crustaceans; tobacco and tobacco products; and live trees, plants, and vegetable-planting materials. In 2016, these commodities generated a total trade surplus of $12.75 billion. However, the region is a net importer of cereals and oleaginous seeds and fruits; live animals and animal products; cotton and other vegetable products; and fats and other prepared foodstuffs.

Figure 1. Central American and Caribbean Trade of Agricultural Products, 1991–2016



Notes: Data include Harmonized Tariff Schedule Chapters 1–21, 23, 24, and 52 (US ITC, 2019). Additional differences in import and export values are due to differences in reporting practices among trade partners. Vertical bars represent the trade balance by product category.
Source: Prepared by authors, using data from USDA FAS Global Agricultural Trade System.

CAC agricultural products are traded worldwide (Table 5). North America is the major export destination, with an average annual value of $8.68 billion between 2010 and 2016, followed by Europe ($6.74 billion) and intra-regional trade ($3.045 billion). An additional $3.35 billion worth of agricultural products were exported annually to Asia, Africa, South America, and Oceania during the same time. The distribution of imports differs, with North America, Intra-CAC, and South America being the leading suppliers of agricultural products to the region (Table 5). An annual

[3] Based on data availability, the Central America and the Caribbean trade estimates are based on the trade values reported by the following countries: Anguilla, Antigua and Barbuda, the Bahamas, Barbados, Belize, Bermuda, the British Virgin Islands, the Cayman Islands, Costa Rica, Cuba, Curaçao, Dominica, the Dominican Republic, El Salvador, Grenada, Guadeloupe, Guatemala, Haiti, Honduras, Jamaica, Martinique, Montserrat, Nicaragua, Panama, Saint Lucia, Saint Vincent and the Grenadines, Saint Kitts and Nevis, Saint Maarten, Trinidad and Tobago, and the Turks and Caicos Islands.

average of $15.78 billion was imported from these territories during 2010–2016, representing about 82% of the total imports. In terms of the trade balance, the CAC consistently has a trade surplus with Europe, Asia, and Africa but a growing deficit with South America, North America, and Oceania.

Table 5. Central America and the Caribbean Trade of Agricultural Products by Region, Annual Average (in $ millions)

	Exports			Imports			Trade Balance
	1991–1999	2000–2009	2010–2016	1991–1999	2000–2009	2010–2016	2010–2016
North America	3,512	4,957	8,679	2,731	5,481	9,570	−890
Europe	3,598	4,675	6,739	758	936	1,582	5,157
Intra-CAC	514	1,660	3,045	598	1,780	3,745	−700
Asia	721	838	1,707	309	733	1,171	536
Africa	113	188	899	9	170	469	429
South America	136	142	658	500	1,209	2,460	−1,801
Oceania	25	22	85	116	231	313	−228

Notes: Data include Harmonized Tariff Schedule Chapters 1–21, 23, 24, and 52 (US ITC, 2019). Additional differences in import and export values are due to differences in reporting practices among trade partners.
Source: Prepared by authors, using data from USDA FAS Global Agricultural Trade System.

Export Diversification

Because of the uncertainty of commodity prices and weather, the dependence of low-income CAC countries on a few agricultural commodities represents a risk for their foreign exchange earnings, rural stability, and growth (DeRosa, 1992; Hesse, 2008). The region still depends heavily on exports of traditional crops (e.g., banana, coffee, cocoa, sugar, tobacco). However, such dependence has decreased during the last 30 years, from 69% to 43%. The dependence on traditional crops varies from country to country. In Central America, Panama and Honduras are most dependent on traditional crops, which make up over 50% of their exports. El Salvador and Costa Rica have done the most to reduce such dependence, which has dropped from about 90% to only 40% of total ag-related exports. In the Caribbean, dependence on sugar, coffee, and tobacco has decreased, but reliance on organic and fair-trade banana and cocoa exports has increased.

Conclusions and Implications

Agricultural production and exports play a strategic role in creating jobs, bringing in rural income, and guaranteeing food security for the 31.8 million people living in the region's rural areas. Empirical evidence indicates that agricultural growth significantly helps reduce poverty in rural areas, even more than growth in other sectors of the economy (Ravallion and Datt 1996; Kakwani, 1993; Thorbecke and Jung, 1996; Khan, 1999; de Janvry and Sadoulet, 2002; Anríquez and López, 2007).

Current interventions in agriculture rely on protectionist agricultural policies and lack of investment. Governments should work towards better-targeted intervention policies. For example, the region should continue restructuring agricultural government support toward general services, such as infrastructure development, marketing and promotion of the national products, extension, research, easy access to credit, and weather-risk protection. Support to general services is still below 10% with respect to the producer support estimates. Empirical evidence by Anríquez et al. (2016) suggests that a 10-percentage-point increase on GSSE, holding total expenditures constant, would lead to a 5% increase in per capita agricultural value-added. This type of intervention would have a much greater impact on growing agricultural production and export than the current support through market prices.

The value of agriculture, forestry, and fisheries has increased at a rate of 1.8% per year in real terms. Its relative composition of the total value of raw food products at the farm gate has changed over the last 20 years in favor of those crops for which the region has a comparative advantage. The agricultural categories that have grown the most are fruits, vegetables, oil crops, and aquaculture products. Those categories have grown on average by more than 5% annually since the 1990s.

Foreign trade has been fundamental to the growth of the CAC agricultural sector. Historically, the region has a positive trade balance in terms of agricultural products. In 2016, $21.69 billion in agricultural commodities were exported compared to the $19.16 billion imported. The CAC excels in the export of tropical products (e.g., vegetables, fruits, coffee, sugar, aquaculture products, tobacco, etc.) but has a deficit in the production of cereals, oil crops, animal products, cotton, and fats. The biggest commercial partner is the United States, which benefits from diversified year-round tropical fruit and vegetable imports. In the last 20 years, the export of tropical fruits and vegetables from the region not only increased in volume and value but in diversity as well. For instance, the tropical products exported to the United States increased by 12% over 2000–2018 (USDA-FAS, 2019). The proximity and preferential access of most CAC countries to the U.S. market offer a unique opportunity for the region to continue increasing exports. Further, the CAC should take advantage of its privileged tropical position to increase the variety of fruits and vegetables produced to reduce dependence on a limited array of commodities.

For More Information

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