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CHINA local global

Why Brazil Sought Chinese Investments to Diversify Its Manufacturing Economy

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China Local/Global

China has become a global power, but there is too little debate about *how* this has happened and what it means. Many argue that China exports its developmental model and imposes it on other countries. But Chinese players also extend their influence by working through local actors and institutions while adapting and assimilating local and traditional forms, norms, and practices.

With a generous multiyear grant from the Ford Foundation, Carnegie has launched an innovative body of research on Chinese engagement strategies in seven regions of the world—Africa, Central Asia, Latin America, the Middle East and North Africa, the Pacific, South Asia, and Southeast Asia. Through a mix of research and strategic convening, this project explores these complex dynamics, including the ways Chinese firms are adapting to local labor laws in Latin America, Chinese banks and funds are exploring traditional Islamic financial and credit products in Southeast Asia and the Middle East, and Chinese actors are helping local workers upgrade their skills in Central Asia. These adaptive Chinese strategies that accommodate and work within local realities are mostly ignored by Western policymakers in particular.

Ultimately, the project aims to significantly broaden understanding and debate about China's role in the world and to generate innovative policy ideas. These could enable local players to better channel Chinese energies to support their societies and economies; provide lessons for Western engagement around the world, especially in developing countries; help China's own policy community learn from the diversity of Chinese experience; and potentially reduce frictions.

Evan A. Feigenbaum
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Summary

Since the beginning of the twenty-first century, economic relations between Brazil and China have grown significantly. The main driver of this process has been China's enormous demand for agricultural, energy, and mineral commodities. On the one hand, Brazil's strong competitiveness in these products has helped the country consolidate its role as an important supplier to China, increasing exports and turning China into the main destination for Brazilian exports since 2009.[1] On the other hand, China, by virtue of its status as the "factory of the world," has established itself as the main supplier of manufactured products to Brazil.[2]

Nonetheless, Brazilian scholars, think tanks, and private manufacturing firms have raised concerns. They have done so despite the great boost in bilateral trade flows; the favorable trade balance for Brazil; and the leveraging of businesses in several Brazilian sectors such as soybeans, iron ore, and oil. These concerns are related to the excessive concentration of Brazilian exports in a few products, the environmental impacts of these exporting activities, and the effects of strong Chinese manufacturing competition on Brazil's domestic market.

These worries have become more significant when one considers the growing importance of manufacturing changes with the diffusion of Fourth Industrial Revolution technologies and the search for new renewable energy sources and environmental sustainability. For Brazil, this matter reflects a need to advance bilateral relations beyond existing export trade volumes and toward new drivers of more diversified economic growth that will help the country escape a specialization in commodities.

The fortunes of the Chinese company BYD in Brazil are highly relevant to these trends. BYD is a company that has diversified from the production of batteries into different innovative industrial sectors, such as renewable energy and electric vehicles. BYD has also been expanding rapidly in international markets, and in that process it chose Brazil as an important market, where it has built factories to produce electric bus chassis, photovoltaic panels, and batteries for electric buses.

BYD's trajectory in Brazil certainly has not been smooth. On the contrary, the firm has had to adapt to market fluctuations and, above all, to changes in the Brazilian government's economic policies, which have made the company's experience in the country quite turbulent. Despite this, BYD survived its first years in Brazil and more recently has been showing signs of continuing to invest in the Brazilian market.

Analysis of BYD's experience in Brazil shows, on the one hand, that there are important possibilities for new economic relations with China that go beyond trade in commodities, with productive

investments that can potentially help Brazil simultaneously incorporate more knowledge-intensive activities and drive positive environmental impacts by generating renewable energy and reducing carbon emissions. On the other hand, the story of BYD also shows that the transformation of these possibilities into effective benefits requires coordinated actions on the part of Brazilian policymakers to offer a long-term horizon for Chinese investments.

In that spirit, Brazil must craft a long-term strategy for its economic relationship with China to increase the odds that bilateral engagement can advance in a new and more sustainable, mutually beneficial direction.

Introduction

In the first two decades of the twenty-first century, China has grown in importance and influence for Latin American economies. This trend is visible in terms of not only expanding trade flows but also direct investment, infrastructure projects, and financing from Chinese banks.

In Brazil, like in other Latin American economies, trade relations have been the main driver of deepening economic ties with China. While bilateral trade has ensured strong growth in exports of agricultural, energy, and mineral commodities, the entry of Chinese manufactured goods into Brazil has also been noticeable. Given that Brazil has the largest domestic market and one of the most diversified manufacturing sectors in Latin America, this asymmetry in trade flows has fostered an intense debate on the effects of trade integration with China on Brazil's sectoral economic specialization and long-term growth.[3]

The increase in Chinese investment and the growth of Chinese companies in Brazil have also been widely recognized. While several analysts see these developments positively, others have highlighted that the affected investment sectors reinforce patterns of commodity-heavy trade and large infrastructure projects designed to ensure export flows, tendencies that also have high potential environmental and social impacts, since they occur mainly in sensitive ecological regions such as the Brazilian Amazon and the Cerrado.

This debate invokes terms such as Dutch disease, the natural resource curse, and deindustrialization. Effectively managing the effects of deepening economic ties with China is an important challenge for Brazil, particularly as worldwide technological changes associated with the Fourth Industrial Revolution grow and the requirements for social and environmental sustainability evolve. An aggregate analysis that seeks to highlight asymmetrical trade relations or to assess whether China has

provoked deindustrialization in Brazil is one piece of the puzzle, but there are other important facets to these issues too. It is also vital to study how to build a kind of relationship with China that more effectively capitalizes on opportunities to promote Brazilian industrial and technological upgrading.

A Shenzhen-based Chinese company called BYD has had manufacturing operations in Brazil since 2015. BYD was founded in 1995 and left an early mark in the production of batteries, especially for the mobile phone industry. From there, the conglomerate diversified rapidly to other parts of the electronics industry, and in the early 2000s it moved into automotive production. More recently, the group has made investments to integrate various energy-related activities, including the production of batteries, solar panels, and electric mobility products, becoming a global leader in the production of electric cars.[4]

A more granular look at BYD's strategy in Brazil can unlock new insights into dimensions not completely captured by more generalized, macroeconomic analysis. For example, which factors, from the perspective of the Chinese company, were fundamental for the diversification of industrial activities in Brazil? What was the influence of the Brazilian's government's public policy agenda? What obstacles did the company face that could have been avoided or mitigated by public policy? How could economic activities carried out locally be upgraded?

BYD's market entry into Brazil took place under favorable conditions amid the diplomatic rapprochement between Brazil and China, good prospects for Brazilian market growth, and a set of Brazilian public policies that aimed to stimulate local production. However, constant changes in Brazil's economic policy made it harder for the corporation to run businesses in the country, forcing the company to make important adaptations to survive, limiting or delaying positive effects on industrial upgrading.

While Chinese firms operating in many countries around the world have resorted to importing equipment from trusted Chinese suppliers, BYD's approach in Brazil shows how it is possible to generate employment and added value locally and incorporate some knowledge-intensive activities into local production, including through interactions with nearby universities and research institutes. It also shows that the actions of Chinese companies abroad vary and do not necessarily follow a single global or even regional model.

This paper is organized into three parts. The first section reviews the evolution of economic relations between Brazil and China. It highlights the classic asymmetry of trade flows between Latin American economies and China but then explores a change in Brazil toward a growing concern with the negative impacts on the manufacturing sector, emphasizing the need to foster more sophisticated and higher value-added sectors and economic activities in the country's relationship with China. This section also notes the debate on the potential social and environmental impacts of Chinese investments amid the growing presence of Chinese companies in Brazil.

The second section turns to BYD's activities in Brazil. As the company has grown its role in diverse but related sectors (including electric buses, solar panels, and batteries), it has had to navigate local regulations and content requirements. The section then emphasizes the relevant factors for the company's decision to produce locally, with an emphasis on the aspects related to government policies directed to support local production. For BYD, this meant that having a local production plant was the key to becoming an equipment supplier to Brazilian renewable energy providers. This fact, combined with other Brazilian incentives for local production, has ensured that BYD would pursue a Brazil-for-Brazil strategy for its market entry and economic engagement in the country. Whereas Chinese firms have been able to lean on Chinese suppliers, Chinese financing, and even Chinese labor in many other countries and contexts, the Brazilian case shows how local content requirements and other forms of local conditionality could reshape the way Chinese firms design and conduct their operations. However, the changes that have taken place over time in some of these policies were factors that made the company's adaptation in Brazil hard work, as it forged a path of change and course corrections.

A concluding section draws some lessons and warnings from BYD's approach in Brazil for other Latin American economies on how to use local regulations and content requirements as a source of leverage to channel and harness Chinese investment to meet their national development goals.

China and the Imperatives of Brazil's Economic Development

Brazil established diplomatic relations with the People's Republic of China in 1974, but economic ties have continued to gain steam in the last few decades. Bilateral relations have grown rapidly, initially driven by strengthened trade relations but later encompassing other dimensions like foreign direct investment (FDI), infrastructure, and project financing.[5] In addition to the accelerated growth of the Chinese economy once economic reforms began in the late 1970s, the country's industrial development, rapid urbanization, and substantial expansion of infrastructure have affected both the sheer amounts of commodities the Chinese economy needs and the prices China pays for those goods in global markets.[6]

China's economic heft has had important effects on commodity markets and prices for countries throughout Latin America.[7] Due to Brazil's sheer size and the importance of commodity exports for its economy, Chinese demand became an especially significant factor, influencing the agriculture, minerals, and oil sectors through enhanced bilateral trade flows.

Brazil's Growing But Skewed Trade Numbers

Brazilian exports to China grew rapidly from $1.1 billion in 2000 up until 2011.[8] After some instability between 2012 and 2016, Brazil's exports to China began increasing again in 2017 and reached a remarkable $67.8 billion in 2020. In relative terms, China went from a nearly 2 percent share of Brazilian exports in 2000 to 32.4 percent in 2020. On the import side, there was also significant growth from 2000 until 2014, as China made gains as a new but vital economic partner for Brazil. After that, the economic recession that Brazil weathered in 2015 and 2016, followed by a period of low growth, caused imports from China to stagnate, but they still reached $34.8 billion in 2020, or 21.9 percent of total Brazilian imports that year.

Another way to look at the increasing importance of China in Brazil's external trade is to compare growth rates with the total value of Brazil's exports to those of its other trading partners. Exports to China grew at an average rate of 23 percent per year between 2000 and 2020, whereas the annual growth rate over this same period was 4.9 percent for all of Brazil's other trading partners. For imports, the rates were around 18.2 percent (China) and 4.1 percent (all other trading partners), respectively.

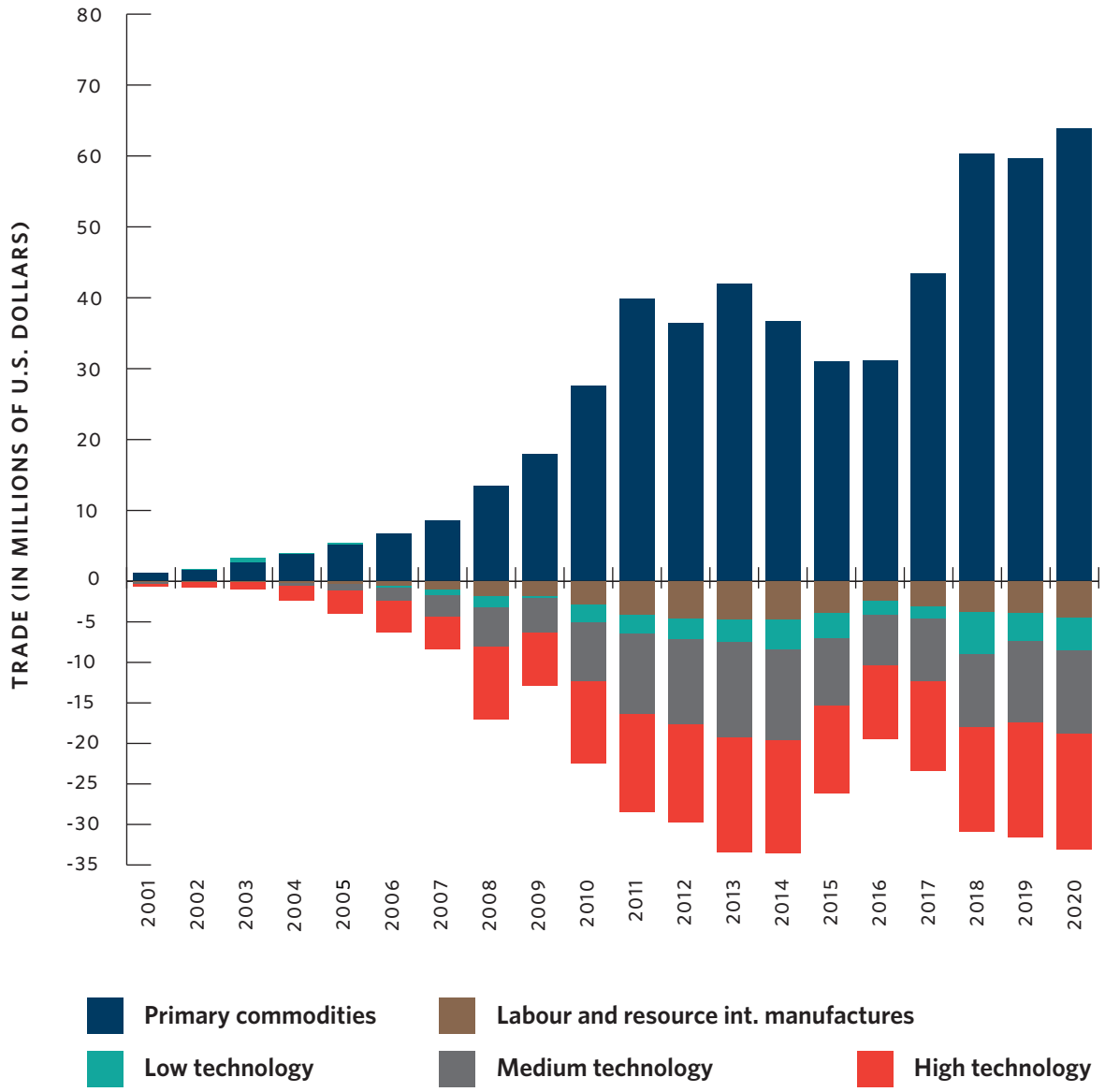
Put simply, trade integration with China has resulted in an enormous jump in the scope and scale of Brazilian exports and a huge boom to Brazil's agricultural producers, oil sector, and other extractive industries. Notably, the bilateral trade surplus favored Brazil for most of this period, contributing to an increase in Brazil's international reserves and a reduction in the country's external economic vulnerabilities. In 2020, Brazil's trade surplus with China was $33 billion, accounting for roughly two-thirds of Brazil's total trade surplus of $51 billion.[9]

Despite this extraordinary growth in bilateral trade, some observers have nonetheless raised concerns because Brazilian exports have been highly concentrated in primary commodities, while imports from China have included a diversified set of manufactured products.[10]

The data presented in figure 1 clearly show the contrast in the composition of trade flows between Brazil and China. Brazil boasts a strong overall trade surplus on the strength of its abundant exports of primary commodities—mainly soybeans, iron ore, and petroleum. In 2020, these goods were responsible for approximately 75 percent of all Brazilian exports to China.[11] Despite this overall trade surplus, however, Brazil imports far more from China than it exports in key categories of high-value-added goods, which puts a dent in its overall trade surplus. These goods, concentrated in medium and high technology sectors, include a diverse range of industrial products such as electronics, industrial equipment, automotive components, chemicals, textiles, and apparel.[12] For a country like Brazil that has ambitions to unleash an industrial transformation and has no desire to remain a commodities exporter permanently, this is a concerning picture.

FIGURE 1

China-Brazil Merchandise Trade by Product Class (2001–2020)



SOURCE: United Nations Conference on Trade and Development, "Merchandise Trade Matrix in Thousands United States Dollars , Annual, 2001–2020," https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=217476.

The fast growth of manufacturing imports from China has raised local concerns about whether Brazilian manufacturers can compete and survive domestically. In addition, Chinese exports similarly risk saturating the markets of nearby Brazilian trading partners like the three other original Mercosur economies of Argentina, Paraguay, and Uruguay.[13] Business associations, such as the São Paulo Federation of Industry, share these concerns and have called on the Brazilian government to restrict Chinese competition with anti-dumping measures and other policy tools.

This evolving debate about the effects of Chinese manufacturing competition on deindustrialization in Brazil is complex and involves not just direct effects but also indirect ones associated with, for instance, how commodity exports to China influence Brazil's exchange rate. Terms such as Dutch disease, the national resource curse, deindustrialization, and center-periphery relationships have all been commonly used to highlight these concerns about how trade with China negatively affects Brazil's economy.[14]

A 2021 report published by the United Nations Conference on Trade and Development (UNCTAD) argues that Brazil shares these characteristics of commodity dependence with other developing countries, leading to low growth, macroeconomic instability, and difficulties in raising productivity and diversifying the composition of the country's economy.[15] For the UNCTAD and other actors, the prescription is straightforward: Brazil needs to diversify its economic production by leaning more heavily on the industrial and service sectors, incorporating more knowledge-based and technology-intensive products into the economy to overcome the trap of overreliance on commodity exports.

Concerns about excessive specialization in commodities have been present since at least the early 2000s when the Brazilian government sought to resume more active industrial and technological policies, precisely (and not coincidently) as bilateral trade relations with China were intensifying. Changes in this direction occurred after a wave of more liberal policies that had taken place in the 1990s, which not only bet on trade and financial opening and privatization but also abandoned industrial policies. From 2004 onward, however, the Brazilian government renewed its focus on industrial and innovation policy.

Brazilian industrial policy at this time had different aims, scopes, and instruments, depending on the sector in question. A detailed description of the whole policy is not necessary here, but some important elements will be highlighted in the next section on BYD related to the automotive and solar panels sectors.[16] The government's efforts to revitalize industrial policy remained significant, especially after the 2007–2008 global financial crisis and lasted until former president Dilma Rousseff was impeached in 2016. Since then, however, the Brazilian government under president Michel Temer, and especially under President Jair Bolsonaro and Minister of Economy Paulo Guedes, has oscillated back to a liberal vision of economic policymaking as they have dismantled some of their predecessors' polices.

Environmental concerns have added another layer of complexities to these economic debates since commodity extraction and harvesting can have a negative environmental impact. The main worry in Brazil has been deforestation caused by the expansion of soybean and livestock production in important ecosystems such as the Amazon rainforest and the Cerrado.[17] According to a study carried out by a nonprofit institution specializing in environmental reporting called CDP and a group called

Trase that measures the environmental impact of commodity supply chains, "in 2017 soy imports into China were associated with 6.5 million tons of CO_2 emissions linked to deforestation for soy expansion in the Amazon and Cerrado. This represents 43 percent of all CO_2 emissions risk from soy deforestation in these regions."[18]

As multiple studies have noted, Brazil has consistently sought to play a strategic role in the global food security agenda. It has also been prominent in global discussions on environmental sustainability and renewable energy.[19] However, the election of Bolsonaro negatively influenced the country's image because of his disastrous environmental policies, which have resulted in the spread of fires and illegal deforestation. These studies and others point to a need for Brazil to rethink bilateral trade relations with external partners by making environmental sustainability a pillar of its national economic and commercial strategies, considering the centrality of environmentalism to global multilateralism. It may be even more important with China, given the role that sustainability increasingly plays in its own long-term development strategy.[20]

Notably, economic concerns over Brazil's industrial and technological development and misgivings about environmental and social sustainability affect not only trade with China but also Chinese investment. In the 2010s, what had been a trade-centric relationship began to shift as the two governments and both Brazilian and Chinese firms started putting greater emphasis on FDI. Beijing's support for the internationalization of Chinese companies, reinforced beginning in 2013 with the rollout of the infrastructure investment push known as the Belt and Road Initiative (BRI), became an important driver for Chinese companies to increase their presence in Brazil.[21]

But the BRI alone does not explain the growing profile of Chinese firms in Brazil's domestic market. This trend also has stemmed from other factors like the opportunities afforded by the huge potential size of Brazil's market, its comparatively open business environment with few restrictions on foreign companies, and the availability of important Brazilian assets for foreign players to acquire.[22]

Moreover, before Bolsonaro took office, Brazilian foreign policy—especially under former president Luis Inácio Lula da Silva, known colloquially as Lula—sought greater alignment with countries in the Global South and especially with China. For its part, too, the Chinese government underscored the importance of Latin America during this period, launching a regional strategy for Latin America for the first time in 2008,[23] which it then updated in 2016.[24] Although this document covered all of Latin America, it highlighted the importance of Brazil for Chinese policymaking in the region and sought to leverage the two countries' joint membership in the BRICS group (along with Russia, India, and South Africa) to improve relations. This diplomatic attention was then supplemented with various strategies and documents released bilaterally, such as the joint Ten-Year Cooperation Plan launched in 2012 and the 2015–2021 Joint Action Plan that Beijing and Brasilia signed in 2015.[25]

The Effects of Chinese Investment in Brazil

These heightened strategic and policy aspirations on both sides soon yielded a concomitant emphasis on Chinese investment in Brazil. Official statistics from the Brazilian Central Bank in table 1 show that, in 2005, Chinese investment stock in Brazil was just around $327 million, or a tiny 0.2 percent of the country's total stock of foreign investment. By 2010, Chinese investment stock had risen to $7.9 billion and had reached 1.3 percent. However, the most robust growth occurred between 2010 and 2019, with the stock of Chinese FDI reaching $28.1 billion, as China climbed the ranks of Brazil's leading foreign investors. While long-standing partners including the United States, European countries like Spain and France, and Japan remained dominant, China was one of the fastest-growing foreign investors during this decade.

TABLE 1

Chinese Foreign Direct Investment Position in Brazil by Sector
(in millions of U.S. dollars and as a % share)

	2005		2010		2019	
Sector	**Value**	**%**	**Value**	**%**	**Value**	**%**
Agriculture	-	-	6.2	0.1	6.4	0.0
Mining and Oil Extraction	16.7	5.1	7,146.6	90.8	10,699.9	38.1
Manufacturing	281.9	86.3	209.5	2.7	623.6	2.2
Infrastructure	**3.2**	**1**	**49.9**	**0.6**	**14,635.4**	**52.0**
Electricity and Water	-	-	-	-	14,181.6	50.4
Construction	2.7	0.8	1.4	0.0	209.9	0.7
Transportation and Storage	0.0	0.0	1.5	0.0	52.5	0.2
Information and Telecoms	0.5	0.2	47.0	0.6	191.4	0.7
Trade and Auto Repair	22.5	6.9	75.3	1.0	1071.0	3.8
Financial Services	-	-	372.2	4.7	780.4	2.8
Real Estate	1.0	0.3	0.3	0.0	171.9	0.6
Other Services	2.0	0.6	14.1	0.2	131.9	0.5
Total	326.6	100.0	7,874.0	100.0	28,120.6	100.0
Share in Brazilian Total	0.2%		1.3%		4.5%	

SOURCES: Central Bank of Brazil, "Direct Investment Report – December 2020," Central Bank of Brazil, December 2020, https://www.bcb.gov.br/publicacoes/relatorioid/RelatorioID2019; and Central Bank of Brazil, "Direct Investment Report: Complete Tables," Central Bank of Brazil, December 2020, https://www.bcb.gov.br/content/publicacoes/relatorioidp/RelatorioID2019/TabelasCompletasPosicaoIDP.xlsx. (See table 14 in this source.)

Strikingly, between 2005 and 2010, the sectoral breakdown in the growth of Chinese investment was quite concentrated in extractive sectors. Over this period, Chinese oil and mineral companies were responsible for the largest investments in the Brazilian economy. Between 2010 and 2019, despite some sectoral diversification, Chinese investment was still fairly concentrated in extractive industries, though the electricity-generation sector made significant gains too. Chinese FDI stock in infrastructure went from just 0.6 percent of total Chinese investment in 2010 to more than half of the total in 2019, with the electricity and water sectors alone representing 50.4 percent. Some scholars have highlighted how, in a short period of time, Chinese companies have become, through large acquisitions, important actors in the generation, transmission, and distribution of electricity in Brazil.[26]

During this period, the predominance of mergers and acquisitions was evident not only in the electricity sector. Most Chinese investment at this time involved such deals, not greenfield investments. According to an estimate in the author's previous work, deals involving mergers and acquisitions accounted for 85 percent of Chinese investment between 2010 and 2013, a figure that grew to a staggering 95 percent between 2014 and 2017.[27]

Another paper reached a different set of numerical conclusions based on another methodology, but it also showed a similar story: the total volume of Chinese investments in Brazil announced and confirmed between 2007 and 2020 was $66.1 billion, with 48 percent directed to electricity generation, followed by oil and gas operations (28 percent) and metal and mineral extraction (7 percent).[28] The manufacturing industry had only a 6 percent share.

Despite the overall growth of Chinese investment in Brazil, the concentration of this investment in extractive sectors reinforced a trend toward higher exports of commodities, whereas financial backing for manufacturing and knowledge-intensive economic activities was not very significant during this period. This trend did not meet Brazilians' hopes to grow the country's manufacturing sector and manufacturing-related local employment. Such investment contributed little to the diversification of Brazil's economy and growth in more technology-based and skill-intensive sectors.

Brazil's Eroding Manufacturing Competitiveness

Resolving this problem is not an easy task for a country like Brazil. Indeed, some analysts have highlighted the challenges associated with fostering such structural changes to boost industrialization and speed up technological change.[29] Finding new growth pathways has been especially difficult in the wake of the global financial crisis, not least because key technologies are changing far faster than developing countries can assimilate and adopt them. These technologies include cloud computing, big data, artificial intelligence and related applications, 5G telecommunications networks, and additive and intelligent manufacturing. Even green technologies, which would be crucial to helping Brazil build a sustainable economy, are changing rapidly.[30] To tap into these technologies, Brazilian manufacturers would need to incorporate and master dynamic effects of scale, ensure productive and technological spillovers, and raise productivity and wages by upskilling workers.

The growing integration of industrial activities with sophisticated software as well as with information and telecommunication services is also important for an economy that aims to undertake such an economic transition.[31] This task requires public and private efforts aimed at accelerating the necessary economic adaptations without sacrificing workers in the process. Innovation and technology adoption are economically essential, but so is social and environmental sustainability.

As table 2 shows, Brazil has endured a continuous process of deindustrialization, measured by losses in the share of value-added manufacturing in terms of the country's gross domestic product (GDP). Brazil's indicator dropped from 14.7 percent in 1990 to 9.9 percent in 2020. Brazil, which was once one of the main manufacturing hubs among developing countries, has been systematically slipping in status, surpassed by others. Thus, when measured against other emerging economies (excluding China), Brazil's share of value-added manufacturing slipped from 14 percent in 1990 to 7.4 percent in 2020 and from 2.5 percent to 1.3 percent measured against the world as a whole. This drop in Brazil's comparative standing has been especially pronounced in the last decade, a period of turmoil in the world economy as a result of the global financial crisis and the growing adoption of emerging technologies associated with the Fourth Industrial Revolution.

TABLE 2
Deindustrialization in Brazil

	1990	2000	2010	2020
Brazil's manufacturing value added (MVA) as a % of GDP	14.6	13.7	12.4	10.2
Brazil's MVA (as a % of world MVA)	2.6	2.3	2.1	1.3

SOURCES: United Nations Industrial Development Organization (UNIDO), "Competitive Industrial Performance Index," UNIDO, 1990–2020, https://stat.unido.org/cip/; and UNIDO, "Competitive Industrial Performance Index 2020: Country Profiles," UNIDO, 2020, https://stat.unido.org/content/publications/competitive-industrial-performance-index-2020%253a-country-profiles.

To be sure, the China factor is not the only thing responsible for Brazil's deindustrialization and decline in manufacturing competitiveness. These setbacks stem mostly from domestic drivers and causes. However, competition with China has made these Brazilian problems more pronounced while making the task of raising productivity and income levels more urgent.

For Brazil to reach a new stage in bilateral relations with China, it is important that Brazilian policymakers and business leaders consider ways of engagement beyond those that have already been consolidated. In just twenty years, China has become Brazil's main trading partner, and Chinese companies have become ever more visible through their direct operations in the country. Discussions

about the effects of this engagement with China on Brazil's economic, social, and environmental development must account for qualitative aspects of Brazil's export patterns, pay attention to how readily Chinese investment helps Brazil's economy diversify (especially in knowledge-intensive sectors), and more effectively incorporate environmental considerations. In other words, Brazil must rethink its relationship with China strategically in ways that boost the momentum of the Brazilian economy amid a challenging global environment.

BYD's Limited Success at Adaptation in Brazil

Chinese companies like BYD will be important fixtures in the story of how well Brazil rebalances its economy and sheds its reliance on commodity exports for more specialized manufacturing. BYD is one of China's largest companies and has a prominent role in the electric vehicle sector, where it has been vying for a leading market position with companies such as Tesla and Volkswagen.[32] In addition to the automotive sector, the company has a considerable presence in several industrial segments and has sought to position itself as a company committed to environmentally sustainable solutions.

By 2021, BYD amassed total annual revenues of 216.1 billion renminbi ($34 billion), with a total workforce of more than 280,000 employees.[33] The firm still generates a great deal of its revenue in China, but the group is rapidly striving to internationalize its reach.[34] The conglomerate has operations in Asia, Europe, the United States, and South America. In South America, its main base of operations is Brazil, where BYD has made investments to produce electric bus chassis, solar panels, and batteries.

BYD's expansion in Brazil is well worth examining for several reasons. The company's specialization in the manufacturing of technologically advanced sustainable products stands out given Brazil's need to expand manufacturing in an environmentally conscious way. And while there have been many studies of Chinese firms operating in Brazil's energy sector,[35] there have been far fewer on industrial companies like BYD.[36] The firm's operations in Brazil also show there is potential for Chinese investment in the country and for bilateral relations to move beyond commodities into more knowledge-intensive and sustainable economic activities.

On the other hand, BYD's expansion also reveals the negative effects of the difficulties Brazil has faced in seeking to establish a long-term strategy for the country's economic and technological development. BYD's entry into the Brazilian market was marked by significant efforts to adapt to the pendulum swings of the country's economic policymaking. The changes observed in that policy between when the firm decided to enter the market and its current operations ended up requiring a redoubled struggle to survive and grow in the Brazilian economy.

A detailed look at the company's adaptation to local conditions in Brazil and especially its relationship with Brazil's public policy agenda can provide important clues for the necessary changes future Brazilian policymakers must embrace. Such insights could even offer food for thought for other countries that may have similar concerns.

Before addressing the opening of BYD's factories in Brazil, it is important to understand the factors behind the Chinese company's decision to set up business operations in the country. Two academic studies highlight that BYD used its expertise in energy storage to master a set of technologies involving batteries, electric motors, electronic controls, charging infrastructure, and other aspects of automotive production.[37] These capabilities, combined with incentives from the Chinese government, prompted BYD to expand internationally. The case of BYD's internationalization fits well with the findings of Ravi Ramamurti and Jenny Hilleman.[38] They point out that Chinese multinationals launched themselves into international markets faster than companies from developed countries did, due to both strong state support and Chinese firms' ability to supplant rivals and gain an edge in traditional labor-intensive sectors and some more technology-intensive emerging sectors.

Another study highlighted the importance of the BRI for accelerating BYD's international expansion, as this initiative sought to foster investments in connectivity and infrastructure abroad. It also emphasized that developing countries were relevant targets for the company, given some conditions similar to those observed in China, such as densely populated urban centers and chronic problems of traffic congestion and pollutant emissions, especially in large cities. These conditions made cities in countries such as Indonesia, India, Mexico, and Brazil suitable for the solutions offered by BYD, such as electric buses and monorails, which would be faster and cheaper to deploy than more traditional solutions like subways.[39]

Other additional factors help explain the conglomerate's decision to invest in Brazil. First, it is worth remembering that the Brazilian economy went through a period of faster GDP growth, especially from the early 2000s to 2013, with an important expansion in Brazilians' income and employment prospects, which prompted strong growth in Brazil's domestic market in several sectors.[40] This intense growth, which continued even through the turmoil of the global financial crisis, created the expectation that the Brazilian economy would continue to expand, at least until that cycle of expansion began to reverse in 2014. Consider the automotive sector, for example. The total production of automobiles, trucks, and buses in Brazil increased from around 1.7 million vehicles in 2003 to 3.7 million in 2013.[41] Such growth fostered an expectation of new business opportunities in several other areas, like the infrastructure sector, where there was a need to increase investment in telecommunications, transportation, and energy to support the country's economic expansion.

A second factor was the diplomatic rapprochement between Brazil and China. This factor reached its highest point in 2014 when Chinese President Xi Jinping visited Brazil, followed by a 2015 visit by Prime Minister Li Keqiang. During Xi's visit, BYD announced a project to build a chassis factory for electric buses in Brazil, and during the Li's visit the construction of the solar panels plant was unveiled.[42]

While these first two general factors affected all Chinese companies, the third one is more related to the economic sectors where BYD has invested. Starting in 2004, the Brazilian government resumed industrial and technological policies for a time. As the initiative unfolded, Brazilian officials unveiled various measures designed to promote industrial activities including in the automotive and solar panels sectors.

BYD's investment decisions and the subsequent difficulties the firm faced and adaptations it made must be interpreted in this context of changes in the Brazilian economy and political scene, with strong deviations between when the firm chose to enter the Brazilian market and began operations. A closer look at BYD's two main business operations in Brazil—chassis for electric buses and solar panels—is instructive.[43]

Chassis and Batteries for Electric Buses

BYD started its operations in Brazil with a manufacturing plant designed to make chassis for electric buses, a facility that opened in 2015 in Campinas (in the state of São Paulo), the year after it was announced. The firm assumed that Brazil's automotive market would keep expanding at a healthy rate and that demand for electric buses in large Brazilian urban centers would grow. The plant's initial installed capacity was 500 units per year, with the expectation of progressively increasing the share of inputs and components sourced from Brazilian suppliers.[44]

However, when the factory was completed in 2015, the country's automotive sector was experiencing a severe slowdown compared to the production levels seen in 2013. From a total production volume of 3.7 million vehicles in 2013, it dropped to 2.4 million in 2015. Since then, the sector has continued to have ups and downs, and in 2020, Brazil's total automotive production was around 2 million units (1.7 million fewer than in 2013).[45]

Even so, BYD expected that the market for electric buses would grow quickly as electric buses replaced ones with combustion engines at least in large cities, particularly since this market is less dependent on growth in personal incomes and more linked with purchases controlled by local governments. While the Brazilian government rolled out a new automotive policy in 2018 (Rota 2030) that incentivized advances in energy efficiency and vehicle safety, it contained no specific incentives for the electric vehicle market.[46] As a result, the expansion of the electric bus market came to depend heavily on city-level incentives and regulations.

The city of São Paulo, for example, approved a 2009 law that incorporated environmental and sustainability criteria and sought to reduce carbon dioxide emissions and toxic pollutants emitted by public transit vehicles by gradually shifting to cleaner fuels and technologies. The goal was for all the city's bus lines to use alternatives to fossil fuels by 2018.[47] Yet these ambitious goals were not achieved because city policymakers did not consider institutional, financial, technological, and regulatory complicating factors, including the difficulty of applying the law to existing concession contracts. The provision of urban public transport in Brazil is the responsibility of municipal governments, which generally choose to enter into concession contracts for the private sector to operate the transport system through public tenders. The contractual conditions cannot be changed unless the concession period ends and new bids are held. There was an expectation that a large round of new bids would be held in São Paulo in 2013. However, a set of social demonstrations against the increase in bus fares ended up postponing the renewal of contracts.[48]

When the law produced few results, a new law started to be discussed and was launched in early 2018. This new law established a more realistic goal of reducing emissions levels by 50 percent by 2027 and by 100 percent by 2037 (based on the public transport fleet's total emissions levels in 2016).[49] Gradually, São Paulo's electric bus fleet has been growing; in early 2022, the city had 219 electric buses, though that figure still amounts to only 1.5 percent of the city's total buses.[50]

Like São Paulo, other major Brazilian cities, including Brasília, Curitiba, Campinas, and São José dos Campos, are making regulatory changes aimed at reducing emissions. São José dos Campos, for instance, implemented electric bus lines in the hopes of creating well-functioning transport corridors between the city's most populated areas. BYD won the tender for the purchase of the buses, a decision that was reached in 2020.[51] As a result, the factory in Campinas began to produce electric chassis for urban buses measuring 22 meters in length, which were designed to carry 168 passengers.[52]

While these initiatives to reduce emissions in urban areas by encouraging the use of electric buses have been largely left to municipal governments without federal planning or coordination, an important instrument to favor national production is the financing offered by the Brazilian Development Bank through a special credit line called the Financing Fund for the Acquisition of Industrial Machinery and Equipment (FINAME). FINAME has existed since 1966 and is the main instrument for financing equipment and capital goods in Brazil. The Brazilian Development Bank is the main provider of long-term credit in the country, so having a capital good accredited with FINAME is essential to guaranteeing that the purchaser has long-term funding. Between 2002 and 2018, it accounted annually for between 20 and 40 percent of all Brazilian Development Bank loans.[53]

Linking this funding to local content requirements gives financial competitiveness to the manufacturer while encouraging the development and maintenance of a national supply chain.[54] Companies that manufacture machinery and equipment and want their customers to get financing from the Brazilian Development Bank through FINAME need to go through an accreditation process, which involves verifying that the company is complying with local content requirements.

Historically, the local content rule was measured by two indexes.[55] The first one was calculated by the ratio between the value of imported components and the selling price of the finished product. The second one involved the ratio between the weight of imported inputs and the total weight of the product. To be accredited, a product had to be simultaneously below 50 percent on the value index and below 40 percent on the weight index. In the last review (carried out in 2017), the measure of local content changed to an index composed of a quantitative indicator and a qualitative one. The quantitative indicator is measured in terms of the ratio between the costs of inputs, services, and labor sourced nationally and the total costs of inputs, services, and labor. The minimum national content level in the quantitative index is 30 percent. As for the qualitative index, aspects such as investment in innovation, export insertion, and the use of technical labor and high technological components are evaluated and converted into a kind of bonus, which must correspond to at least a 20 percent nationalization index, so that the total index reaches a minimum of 50 percent.

The 2017 change in the methodology for measuring local content made it easier for BYD to meet the requirements of the nationalization index to have its products financed via FINAME and to operate on more equal footing with the makers of traditional combustion engine buses, companies that have long been able to get financing from FINAME.

But to ensure full compliance with local content requirements, BYD decided to open a third factory in Brazil to produce batteries, which were previously being imported, for the electric buses assembled in Campinas. The factory for producing lithium iron phosphate batteries is located in the Industrial Pole of Manaus in the state of Amazonas.[56] The Industrial Pole of Manaus was created in 1967 as an economic zone that grants tax incentives to encourage the decentralization of Brazilian industrial production and to foster the development of the Amazon region. Currently, the main federal tax incentives are a reduction of up to 88 percent of the import tax on inputs and an exemption from the tax on industrialized products. Those incentives made it more favorable for the company to build the factory in Manaus.[57]

With a production capacity of 1,000 units per year, the factory started operations in 2020. That same year, the chassis for electric buses were accredited by FINAME, unlocking favorable financing terms for potential buyers.[58] According to an interview with a BYD manager, the accreditation is key to increasing the competitiveness of electric buses since they have higher acquisition costs, though they also have lower operating and maintenance costs compared to combustion engine buses.[59] The possibility for buyers to have long-term financing is a crucial element in purchasing decisions. According to the same interviewee, the company could potentially seek to supply batteries in the future for other electric bus or truck manufacturers that will operate in Brazil.

Although the adoption of electric buses in Brazil has been slow, there have been signs of growth, especially since 2019. Despite the effects of the coronavirus pandemic, which reduced the use of public transportation and affected the revenue streams of transportation companies, the expectation is that the search for sustainability will accelerate this market's future growth. For instance, a 2021 report projected that,[60] under current taxation conditions, the accumulated production total of electric buses would reach around 4,100 units by 2025, a figure that would correspond to 5.3 percent of the market; this amount was projected to reach about 13,900 vehicles by 2030 (17.7 percent of the market). Under a more optimistic scenario in which companies would be offered tax incentives, the report stated that the accumulated production of electric buses would be about 17,000 (21.6 percent) by 2025 and 35,100 (45.8 percent) by 2030.

That would signify considerable progress given the limited number of electric buses in Brazil currently. According to the E-bus radar platform,[61] in 2022 Brazil had only 371 electric buses, a figure that would represent just under 2 percent of the total fleet in cities where electric buses are used;[62] this is a paltry number compared to the estimated 125,000 urban buses throughout the country in 2020.[63]

For comparison's sake, the Brazilian electric bus fleet (according to the E-bus radar platform) is much smaller than those of Chile (849 vehicles and 8.9 percent of the total buses) and Colombia (1,589 buses and 11.4 percent of the total buses), two countries where the diffusion of electric buses has been more rapid, particularly in the cities of Santiago and Bogotá, respectively. In 2018, the Chilean government formulated a national electric vehicle strategy, which established a goal of having 100 percent of urban public transport be electric by 2050.[64] In addition, Chile has been experimenting with new models of bidding and other relevant processes. In Santiago, electrical companies (such as Enel Chile and ENGIE) forged a partnership with transport operators (like Transantiago), turning Santiago into one of the leading cities in the world (after Shenzhen) notable for its fleet of electric buses.[65]

Since arriving in Brazil to manufacture electric bus chassis, BYD has maintained the expectation that the Brazilian market will exhibit more significant growth. The production verticalization with the manufacturing of batteries is a sign of this bet. The evolution of the company's strategy, however, has been marked by the need to adapt to Brazil's unstable market conditions and to navigate a complex set of rules and incentives.

Regarding demand-side incentives, due to the lack of a national plan or strategy in Brazil like the one Chile has crafted to guide the actions of city governments, the initiatives of local administrations in Brazil have been heterogeneous, with policies aimed at reducing the emissions of urban bus fleets concentrated in a few large cities. Even large Brazilian cities have faced difficulties in dealing with issues related to financing, regulatory changes, and fostering new business models. From BYD's point of view, this has necessitated ongoing efforts to monitor new opportunities in different cities and publicize the ecological advantages of the company's products.

As for government support and stimulus for production and sales, BYD has sought to improve the conditions for its competition with the makers of traditional combustion engine buses, as shown by how it strived to comply with the nationalization indexes of FINAME. However, both FINAME and the existing incentives in the Industrial Pole of Manaus, where the company located the battery production plant, are traditional instruments to support industrial production in Brazil. They are not part of a policy aimed at promoting the production of industrial goods associated with environmental sustainability, such as the one existing in China.[66] As highlighted earlier, the Brazilian automotive policy does not have incentives focused on the production of electric vehicles in the country.

Perhaps a more assertive strategy combining stimulus, federal goals designed to guide state and municipal actions meant to increase the use of transport options that do not use fossil fuels, and the incorporation of support in the Brazilian automotive policy for the manufacturing of products for collective electric mobility could increase the scale of production in Brazil more quickly. Doing so would help open the way for BYD to keep contributing to efforts to reduce the level of carbon dioxide emissions from urban transport in Brazil and sell these goods to other Latin American countries, thus helping diversify Brazil's exports.

Solar Panels

BYD's production of solar panels in Brazil has been subject to even greater turbulence than its manufacturing of chassis for electric buses. The company unveiled a production plant for solar panels in Campinas in 2017 at the same site where the bus production line is located, with investments of 150 million Brazilian reals (around $47.7 million) and a production capacity of 200 megawatts.[67] At that time, the solar panel plant was one of the most modern in the world, employing double-glass technology, which offers increased energy efficiency, durability, and resistance compared to traditional methods.

According to BYD's marketing manager in Brazil, the company's investment decision was strongly linked to three fundamental pillars of the Brazilian government's renewable energy and industrial policies.[68] In the context of its resumed industrial and technology policies, the Brazilian government sought to coordinate the actions of several ministries to promote new sources of energy and at the same time stimulate the country's productive capacity. These policies fostered expectations of boosted demand for solar panels, friendly industrial and tax policies to spur localized manufacturing, and government financing to help promote local production. The reversal of these policies soon after the company opened its solar panel factory in 2017 resulted in many difficulties, which jeopardized this site's business operations in Brazil.

The first pillar was the prospect of strong growth in demand for solar panels resulting from the push to look for new sources of renewable energy. Key actors in this area are Brazil's Ministry of Mines and Energy and the National Electric Energy Agency (ANEEL), the leading regulator of the country's electricity sector and the agency responsible for organizing auctions for energy generation in Brazil.

Expectations of a strong increase in demand for solar panels stemmed from signaling by Brazilian officials and regulators that there would be incentives for new sources of renewable energy. For example, the government's 2017 energy expansion plan indicated that the country's centralized capacity for generating solar energy would rise from nearly zero that year to represent 2.7 percent of Brazil's total electric energy-generating capacity in 2021 and about 4.7 percent in 2026. In absolute terms, this projection would represent an expansion of around 9.7 gigawatts over this period.[69]

Unfortunately, unforeseen circumstances undercut these expectations. The auctions that ANEEL held in 2014 and 2015 resulted in a strong expansion in the supply of photovoltaic energy to be delivered between 2017 and 2018. In 2016, however, a planned auction for solar energy was canceled,[70] and solar energy was excluded from a subsequent 2017 auction.[71] These setbacks wreaked havoc on expectations of heightened demand, as Brazil went nearly two years without major centralized solar generation projects, just when BYD (and another Chinese-controlled company called Canadian Solar) opened local production capacity.

Despite the projections in the government's official reports, since 2016, Brazil's Ministry of Mines and Energy has seemed to become less concerned with encouraging renewable energy use. For

example, amid Brazil's water shortage crisis in 2021, the ministry was forced to hold an emergency auction to guarantee the security of Brazil's energy supply, which is strongly dependent on hydroelectric power. In the auction, most of the contracting (fourteen of seventeen projects) was for gas-fired thermal plants, along with two solar projects and one involving biomass. The average cost per megawatt hour for the thermal projects was 1,599 Brazilian reals, while that of the solar and biomass projects was 343 reals.[72] At the end of 2021, another auction was held, and 4.6 gigawatts worth of projects were contracted at a cost of 824 reals per megawatt hour, including fifteen gas, fuel oil, and diesel projects—while there was only one biomass thermal project and no solar or wind ones.[73] The second pillar involved government efforts to stimulate local production of photovoltaic modules through industrial policy and tax incentives. These efforts were linked to the Support Program for the Development of the Semiconductor Industry (PADIS), overseen by the Ministry of Science, Technology, and Innovations. Created in 2007, this program was originally designed to strengthen local manufacturers active in the semiconductor and electronic displays supply chain. The federal government's objectives were to promote local production and investment and to increase the competitiveness of the incentivized products. While this policy lowered taxes on industrial products and imports of inputs, it requires the companies that benefit to invest in R&D in microelectronics, optoelectronics, and computer support tools (such as software) for designing and manufacturing relevant components.[74]

In 2014, photovoltaic modules were incorporated into the PADIS framework,[75] as the Brazilian government continued seeking to boost the country's manufacturing capacity. However, according to BYD's marketing director,[76] an important aspect of the incentives depended on the government updating the annexes that list the inputs that could qualify for the suspension of federal taxes, an update that never occurred, making the policy ineffective.[77]

The Brazilian government eventually began enacting a more liberal economic policy, a change that was initiated under former president Michel Temer and was radicalized under Bolsonaro's government. A step in this direction was expanded use of an instrument called an ex-tariff. With this instrument, the foreign trade chamber from Brazil's Ministry of Economy can temporarily grant reduced import tariff rates on capital goods, IT equipment, and telecommunication goods for which there are no suitable nationally produced equivalents.

Ex-tariffs were granted to several solar panel products in 2020.[7879] As these import tax reductions in theory could only be granted to products without domestic production, a dispute arose between importers and domestic producers, including BYD, over the legality of the action and the criteria used to grant the tax reduction.[80] According to BYD, the criteria used by the foreign trade chamber from Brazil's Ministry of Economy to consider products with no national production and which, therefore, could be imported without a tax, were excessively broad and ended up reaching the products manufactured by the company in Brazil, since foreign competitors could then import solar panels produced abroad more cheaply under ex-tariffs. In addition, as BYD had to pay an import tax on its imported components to manufacture in Brazil, industrial production in the country ended up being disadvantaged.

The strong devaluation of the Brazilian real against the dollar throughout 2020, however, ended up eliminating part of the advantage for importers coming from the reduction of the import tax.[81] Even so, the episode highlighted the change in the direction of economic policy driven by the Ministry of Economy under the Bolsonaro government in relation to the period during which BYD had decided to build the factory in Brazil. It is interesting to note that a report from the Ministry of Science, Technology, and Innovation seemed to acknowledge the lack of coherence between the actions of different parts of the government. In 2021, a PADIS evaluation report stated that the government's inability to update the PADIS program's input list, the use of ex-tariffs, and other measures "made imports more competitive. Photovoltaic cells and panels became economically unfeasible and uncompetitive in the country."[82]

Finally, the third pillar of the government's push to foster greater local manufacturing involved government financing support that involved seeking to add solar panels to the Brazilian Development Bank's FINAME list.[83] As previously mentioned, accreditation on the FINAME supplier list is essential for promoting local manufacturing production in Brazil.

Although BYD has its solar panels accredited with FINAME, this advantage was threatened by changes in the policies of Brazil's Banco do Nordeste (or Northeast Bank), a federal public bank that is responsible for transferring resources from the Northeast Financing Constitutional Fund.[84] In 2015, the Ministry of National Integration, which is responsible for regulating the use of the Northeast Financing Constitutional Fund, issued an ordinance that opened the possibility of funding electric energy generation projects.

Initially, the rules were aligned with the Brazilian Development Bank's FINAME rules, since there was a requirement that the equipment financed in these projects had 60 percent nationalization rates.[85] However, in 2016, another ordinance was issued allowing the financing of imported products in the case of photovoltaic projects.[86] That was significant because northeastern Brazil has the highest amount of solar radiation and, therefore, is where the photovoltaic projects were most concentrated.[87] In this way, at least for projects carried out in northeastern Brazil, the financial advantages of complying with the nationalization indexes to help purchasers gain access to long-term financing from FINAME were nullified, since they could resort to Northeast Bank and its financing for imported photovoltaic modules.[88]

The changes to the Brazilian government's plans to support the local production of photovoltaic modules in Brazil and private sector dissatisfaction with the growing inconsistency in these government actions led the Ministry of Industry and Foreign Trade to create, at the end of 2017, a working group with the participation of the private sector and different parts of the government. The working group's objective was to diagnose the main problems and put forward possible solutions.[89] One of the main problems pointed out in the working group's final report was precisely the need to rediscuss the financing rules between public banks to make their actions complementary and not contradictory.

Despite this diagnosis and these recommendations, no effective government response materialized, not least because, in 2019, when Bolsonaro assumed the presidency, he transformed the Ministry of Industry and Foreign Trade, which had led the working group, into a secretariat of the Ministry of Economy.[90] On the contrary, as highlighted earlier, the entanglement around ex-tariffs made the situation even more difficult. Some photovoltaic modules producers, like Canadian Solar, which had started solar panel production in 2017, ended domestic production in 2021.[91]

The continuation of BYD's operations in Brazil was possible due to the growth in the distributed power-generation market. There has been robust growth in the residential market and the market for small urban and rural companies for their own energy needs and for reselling surplus energy to the country's power grid. This development is a result of both the cheapening of residential photovoltaic modules and increases in electricity prices, which have encouraged more consumers to try generating their own power. In this case, having production located in Brazil favors sales to this more dispersed base of small-scale users, giving firms with a domestic presence (like BYD) an advantage over foreign competitors. In addition, the ex-tariff policy did not affect products associated with distributed power generation as much. Brazil's distributed power generation system had an installed capacity for solar power generation of only 190 megawatts in 2017, which corresponded to only 16 percent of the total installed capacity of solar energy in the country. But by 2021, this installed capacity had grown to around 9.2 gigawatts, representing 66 percent of total capacity. Between 2019 and 2021, distributed power generation accounted for 75 percent of the expansion in Brazil's solar energy-generation capacity.[92]

Due to these recent changes, BYD has invested in modernizing the plant and increasing its production capacity to 500 megawatts per year.[93] The increase in production capacity also is meant to ensure the maintenance of its R&D activities in Brazil. Since 2017, as a counterpart to PADIS, the company has been consolidating its R&D infrastructure in Brazil and establishing partnerships with universities such as UNICAMP and research institutes such as the Eldorado Research Institute and Renato Archer Center for Information Technology. The investments are designed to adapt the company's technology to specific conditions in Brazil, such as the resistance of photovoltaic modules to prolonged heatwaves for longer periods than those verified for use in, for example, China or the United States.[94] At the same time, BYD seeks to access and incorporate the existing technological competencies of the Campinas region, through collaboration with the aforementioned institutions and others like the National Center for Research in Energy and Materials, linked to the Ministry of Science, Technology, and Innovations. If demand growth is sustained in the future, BYD could conceivably implement another productive stage in Brazil by beginning in-country production of the solar cells (currently imported) needed for the photovoltaic modules assembled in Brazil.[95]

Conclusion

BYD's fortunes in Brazil are instructive. First of all, the company's investments in the country point to the possibility of a strengthened relationship with China not only in Brazil, but in Latin America more generally. This includes economic ties that go beyond existing ones, particularly those based on commodity exports. These investments indicate that bilateral relations, under certain conditions, can help to strengthen the manufacturing base of Latin American countries, generate jobs, and spur the development of more technology-intensive products with positive environmental impacts, while not necessarily prompting deindustrialization.

The story of BYD also reveals that there are opportunities for Brazil to attract the domestic production of more knowledge-intensive products in sectors that favor environmental sustainability and incorporate R&D activities, including in partnerships with research institutes and universities. In certain cases, Brazil has a chance to get more plugged into important industrial supply chains as the example of batteries and chassis for electric buses shows. However, these potentially positive impacts on Brazil's economy are not guaranteed, nor will they occur automatically. They depend on a set of conditions that are not always easy to achieve, especially in Latin American countries.

First, it is important to highlight the availability of policy instruments that can be mobilized to favor such investments. This includes, for example, the fundamental role of the Brazilian Development Bank and FINAME in the decisionmaking behind the local production of bus chassis, batteries, and solar panels. That factor gives Brazil a singular edge in relation to other countries in Latin America.

But in addition to the Brazilian government's policy instruments, BYD's trajectory in Brazil also shows how important it is for the governments of China's trading partners (especially those of developing countries) to have consistent, credible, long-term policies that are well-coordinated between different ministries and levels of government.

In the case of the electric bus chassis, Brazilian regulations on emissions and concessions for public transport companies are largely driven locally, with little national-level guidance or regulation. Some large Brazilian cities have been making progress on electrifying their bus fleets, but at a much slower pace than in other Latin American countries such as Chile. The case of Chile shows how it is possible to harness national guidelines to stimulate progress at the local level.

If having a national strategy to guide local initiatives can be important on the demand side, the fundamental instrument on the supply and local manufacturing side has been the Brazilian Development Bank and its FINAME list. Unlike other countries that have a more explicit incentive policy for the production of electric vehicles and for electric urban mobility, Brazil's government has not prioritized this dimension. Thus, the financial incentives for local production promoted by the Brazilian Development Bank have played an important, albeit solitary, role in enabling and increasing the degree of localized manufacturing production, as in the case of batteries. Countries that do not have a similar instrument end up becoming more dependent on financing from Chinese

banks, which prioritize suppliers from China. Even so, an urban mobility policy to stimulate the production and use of electric transport could perhaps accelerate the increase in production levels in Brazil, even making it possible to export from Brazil to other countries in Latin America, where there is significant potential demand.

BYD's experience with the solar panel sector also shows that a coordinated policy among different government actors and programs including the Ministry of Energy, ANEEL, the Ministry of Science, Technology, and Innovations; and the Brazilian Development Bank was important for shaping BYD's decision to produce in Brazil. However, the policy changes that took place after the company had already established a foothold in Brazil also indicate the damage that can be done when such policies are not sustained. The production of solar panels by BYD in Brazil has gone through difficult times, especially due to uncertainty regarding the Brazilian government's initial plans for supporting local production. Fortunately, the initially unforeseen increase in demand for distributed solar power generation ended up making it possible for the company to remain in Brazil.

Perhaps, if the previous policy had been maintained and coupled with the increase in demand resulting from the growth of distributed solar power generation, there could eventually be room for greater local added value, incorporating the production of new stages in the value chain, such as the production of photovoltaic cells. The increase in the scale of production may also make it possible in the future for BYD to export from Brazil to other Latin American countries.

The case of BYD is just one example of China's economic engagement with trading partners around the world, but it is quite representative of a new phase of the Chinese economy, which has been increasingly concerned with environmental sustainability and moving toward more knowledge-based and technology-intensive sectors. This transition opens new possibilities for partnerships with Brazil and other Latin American countries that go beyond the commodity-exporting arrangements that have been consolidated over the last twenty years.

However, effectively taking advantage of these opportunities is an arduous task that requires long-term organizational foresight and planning to mobilize and coordinate policies among different levels of government including various ministries. Furthermore, it is vital that such policies be insulated over the long term from the region's frequent changes in political tides, so that it is possible to consolidate the next two decades of growth on a mutually beneficial basis.

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