Original articles
Economia e Sociedade, Campinas, Unicamp. IE
http://dx.doi.org/10.1590/1982-3533.2023v32n1art06

Potential impacts of the Mercosur-EU agreement on the automotive value chains in Brazil and Argentina *

Federico Dulcich **

Abstract

This paper investigates the potential effects of the Mercosur-EU agreement for the automotive value chains in Argentina and Brazil, identifying the trade balance movements of each partner. Its main results point to an improved trade balance in most automotive and auto parts products for the EU. Besides differences in international competitiveness, other factors prompt these results, such as differences in production scale between partners, greater tariff preferences granted by Mercosur, greater potential demand for vehicles in Argentina and Brazil than in the EU, higher regulation requirements on product and process quality in the EU market, among others.

Keywords: Automotive value chain, Free trade agreement, European Union, Mercosur.

Resumo

Impactos potenciais do Acordo Mercosul-União Europeia

Este trabalho estuda os potenciais efeitos do acordo Mercosul-UE para a cadeia de valor automotiva na Argentina e no Brasil, identificando para onde se moverão as balanças comerciais de cada um dos produtos de cada um dos sócios. Os principais resultados indicam que a UE melhorará sua balança comercial na grande maioria dos produtos automotivos e de autopeças. Além das diferenças de competitividade internacional, outros fatores impulsionam esses resultados, como as diferenças de escala de produção entre os sócios, as maiores preferências tarifárias concedidas pelo Mercosul, o maior potencial de demanda por veículos na Argentina e no Brasil do que na UE, os mais altos requisitos do mercado da UE em termos de regulamentações sobre a qualidade de produtos e processos, entre outros.

Palavras-chave: Cadeia de valor automotiva, Acordo de livre comércio, União Europeia, Mercosul**.**
JEL: F15, L62, F13.

1 Introduction

The automotive value chain consists of two prominent sectors in the productive structure of Mercosur countries: the automotive and auto parts industries, which concentrate 4% of the gross domestic product (GDP) in Brazil (Anfavea, 2019), and 1% of GDP in Argentina (SPE, 2018). Moreover, they represent 11% of total exports and 6% of formal industrial employment in Argentina (SPE, 2018), and 22% of the manufacturing industrial gross domestic product (GDP) in Brazil (Anfavea, 2019).

In these countries, automotive chains are highly determined by regional regulation, particularly the Economic Complementation Agreement (ECA) No. 14 between Brazil and Argentina, which establishes a 35% import duty for most extra-zone imported vehicles, from 14% to 18% for

* Article received on March 29, 2021 and approved on August 22, 2022.

** CONICET Researcher at National Technological University, General Pacheco Regional Faculty, Buenos Aires, Argentina. E-mail: federicomd2001@gmail.com. ORCID: https://orcid.org/0000-0002-3375-1906.

most extra-zone imported auto parts, and regulates bilateral trade (by the so-called *flex* coefficient) to avoid large trade imbalances.

This regional automotive value chain has recently undergone two important regulatory changes: the signing of the Mercosur-EU Agreement in June 2019[1]; and the changes in the Brazil-Argentina regulation of the automotive chain brought by the signing of the ECA No. 14 43º protocol in October 2019. The former involves a major economic opening of the regional automotive value chain in the medium term, whereas the later represents a gradual deregulation of the bilateral automotive and auto parts trade.

Given this context, this article sought to analyse the potential impact of the Mercosur-EU Agreement on the Brazilian and Argentinian automotive value chains, and briefly comment on the deregulation of the bilateral automotive and auto parts trade (whose justified specific analysis exceeds the objectives of this paper).

Apart from this introduction, this article is structured as follows. Section two explores the study's theoretical framework, whereas the third section explains the adopted methodology. Section four analyses the current situation of the automotive value chain in the European Union and Mercosur, whereas the fifth section investigates the potential impact of the Mercosur-EU Agreement on the automotive value chains in Brazil and Argentina. Section six proposes some hypotheses about the Mercosur-EU agreement under the transition to electric mobility. Finally, the paper presents its conclusions.

2 Theoretical framework

2.1 Regional economic integration

The European Union – a common market – and Mercosur – a customs union – have recently signed a free trade agreement (FTA)[2]. The reasons why different countries or regions promote economic integration processes through FTAs vary but are generally associated with its positive effects on static and dynamic terms (Balassa, 1961).

In static terms, intraregional trade liberalisation tends to favour greater productive and commercial specialization among the involved partners based on their static comparative advantages, which allows to improve the allocation of resources within the trade bloc and take advantage of the existing economies of scale in different sectors (Balassa, 1961; Baldwin; Venables, 1995). Integration

(1) Currently, the Mercosur-EU agreement is on its closing stages, which involves a legal and formal review, and translating them into the official languages of the relevant countries. Then, each partner must complete the internal legal procedures necessary for its implementation (or provisional application). Progress of these processes was hampered by the EU's criticism of the Bolsonaro administration's environmental policy in Brazil, and by the resurgence of protectionist stances from the agrobusiness sector in specific European countries (such as France), among other reasons (Caetano; Pose, 2020).

(2) A customs union implies a trade liberalisation regarding goods and services between the partners as well as implementing a common external tariff against third countries or regions. A common market also liberalises factor markets between partners, unifying them. A free trade agreement only liberalises trade in goods and services between partners, without homogenising tariffs against third countries or liberalising the factor market (Baldwin; Venables, 1995). Importantly, these institutions usually incorporate topics that exceed foreign trade regulation of goods and services, such as investment regulation, intellectual property rights, public procurement, etc. (Baldwin, 2011).

static benefits derive not only from production, but also from increased consumer welfare (Balassa, 1961) since the processes tend to reduce their prices.

In dynamic terms, the productive pattern originated in the international specialization emerging from the FTA impacts the technological dynamics of the economy by the internal and external effects of technological change. Specialising in sectors with greater technological dynamics allows countries to increase the profits generated by international trade (Krugman, 1979; Grossman; Helpman, 1994), when technological change generates greater profits by reducing costs or price premiums for differentiated products. At the same time, the greater technological dynamics of the sectors in which a country specialises internationally can generate technological externalities (Haberler, 1950; Baldwin; Venables, 1995), increasing the economy's aggregate productivity.

FTA-led economic integration tends to create new trade flows via specialization within the bloc (Balassa, 1961), where local production geared towards the domestic market is replaced by intraregional preferential imports from the partner with greater comparative advantages in any economic sector, improving the region's static efficiency. Specialization within the bloc, however, does not mean that trade within the region tends to balance. Exchange rate adjustments in the face of large trade deficits (abstracting from the capital and financial account and other components of the current account), by expanding exports and decreasing imports, occur for the entire exchange market, and not only for exchanges within the region. Thus, an FTA may result in increased intraregional trade deficit for one of the partners, offset by exchange rate adjustments that generate increased exports and trade surplus with third countries (outside the FTA) in the medium term.

Moreover, FTAs tend to divert trade from partners with third countries and regions (Balassa, 1961), which are more efficient suppliers (as the origin of imports when they all faced the same import tariffs), but which are displaced by preferential intraregional imports.

2.2 The automotive value chain

The topic of global value chains has been widely discussed by specialised literature. Gereffi et al. (2005) highlight five forms of global value chain (GVC) governance by their leading companies, determined by the complexity of the transactions involved, the ability to encode the technical knowledge of the good or service to be exchanged, and the suppliers' productive and technological capabilities. Low-asymmetry market relations occur in exchanges of goods or services of low technical complexity, high codifiable knowledge and from suppliers with good techno-productive capabilities. In modular relations, the complexity of transactions increases, and standards tend to unify the specifications of products and components, so that they can be produced in modules[3]. As the ability to encode technical knowledge is low in relational value chains (with a usually integral and not divisible into independent modules product architecture), the need for supplier-customer productive and technological interaction increases. As for captive value chains, the complexity of the

(3) In product architecture (the physical and functional decomposition of products, according to Muniz; Belzowski, 2017), *modularity* represents a one-to-one correspondence between functional and structural elements. Thus, components can be developed and produced independent from each other. Conversely, an *integral* architecture lacks such a one-to-one correspondence, thus requiring a lot of coordination to adjust and optimise the different components for product completeness. At the same time, the interfaces between these components can be open standards for the entire industry, associated with a modular architecture; or closed standards, where such interfaces are firm specific. Closed interfaces can be presented in both a modular and integral architecture (Fujimoto, 2017).

transactions and the possibility of codifying the technical knowledge involved remains high, as in modular chains. However, the techno-productive capabilities of suppliers are low, requiring greater control of it by the leading company, which usually confines the supplier to a low number of less complex activities (such as assembly), increasing the asymmetry of the relation. Finally, in this context of complex transactions and low supplier capabilities, if the capacity to encode technical knowledge involved is also low, leading companies tend to vertically integrate the productive activity to make technical knowledge transmission effective and to control process and product quality.

Humphrey and Schmitz (2002), in turn, relate the GVC concepts with those of local clusters to focus on their interactions and on how clusters can potentially generate upgrading in the value chain. GVC theorists highlight upgrading via learning processes linked to interactions with the chain leading company, and the ability to incorporate more complex tasks into the value chain (called *functional upgrading*) (Humphrey and Schmitz, 2002). However, the authors argue that while captivate insertion into a value chain with high levels of asymmetry allows upgrading in process and product quality, it limits functional upgrading. In such cases, firms should diversify their clients and markets to reduce dependence on the chain leading company. This introduction into new markets requires developing technological and organizational capabilities, in which the cluster and various local elements from the National System of Innovation (NSI) play a key role (Humphrey and Schmitz, 2002).

But not all value chains are global in scale. Regional value chains (Sturgeon, 2001), for example, are mainly concentrated in trade blocks (Nafta, EU, Mercosur, Asean, etc.), among which the automotive chain stands out (Sturgeon et al., 2009).

Although highly internationalised, automotive chains have a propensity to structure regional value chains (Sturgeon et al., 2009). These are coordinated by the automotive leading firms, with a highly concentrated offering in a few transnational corporations (TNCs) originating mainly from Western developed countries, Japan, and South Korea. This supply structure has generated price discrimination in different markets by these companies, as in Europe (Goldberg; Verboven, 1998; Lutz, 2004).

In general, these firms locate vehicle terminals near the final markets to exploit tax incentives and to circumvent trade protectionism, among other reasons (Cantarella et al., 2017). At the same time, auto parts companies are usually located near the terminals, facilitating technology transfer, conducting collaborative research and development (R&D) projects, avoiding high transportation costs, and achieving *just-in-time* provision of parts and components. Various auto parts companies (especially those in the chain's first tier[4]) became "global suppliers" of leading TNCs, assuming a prominent role in productive terms and accompanying the allocation of investments by terminal firms (Sturgeon et al., 2009). This allows them to exploit the technological externalities of automotive R&D activities (Peters; Becker, 1997; Motohashi; Yuan, 2010).

(4) Disregarding the auto parts aftermarket, first-tier firms produce complete systems that supply terminals directly; whereas second-tier ones produce complete parts (and sell them to first-tier firms), and third-tier firms produce components and supplies for those complete parts (Cantarella et al., 2017).

At the microeconomic level, terminal TNCs and their auto parts suppliers tend to establish relational or captive relations (Sturgeon et al., 2009), depending on the degree of asymmetry between them. Terminal TNCs concentrate an important part of the design activities, located mainly in their headquarters. At the same time, the low modularity and low use of open standards in parts and components, which tend to be firm and model-specific, increase the coordinating power of terminals, and reduce the autonomy and economies of scale of auto parts firms (Sturgeon et al., 2009; Cabigiosu et al., 2013). Moreover, this low modularity increases the need for technology transfer and collaborative R&D projects between terminals and auto parts suppliers. Which, in turn, requires that terminals retain technological capabilities in various auto parts production activities to achieve effective leadership of these projects (Cabigiosu et al., 2013). But the increasing use of platforms to produce vehicles has allowed both terminals and auto parts firms to exploit greater economies of scale and scope (Muniz; Belzowski, 2017)[5].

3 Brief comparison of automotive chain attributes in Argentina, Brazil, and the EU

A superficial analysis of the current state of the automotive chain in Argentina, Brazil and the EU28 shows strong asymmetries between them. First, production mix is heterogeneous among the partners: while the production of pickup trucks predominates in Argentina, the EU and Brazil specialise in automobiles (Table 1). However, the powertrain of these productions present certain differences: while the production of flex-fuel vehicles (which can burn different combinations of ethanol and gasoline) stands out in Brazil, they account only for 0.1% of the passenger car fleet produced in the EU (ACEA, 2020). As shown in Graph A.1 of the Annex, this technology has been developing for decades in Brazil, starting with ethanol-fuelled engines, which saw a significant boom in the 1980s. Amidst the oil crises of the 1970s, which increased its price, the scarcity of conventional oil in Brazil, which forced importations and generated tensions in the balance of payments, led the State to exploit the country's large supply of sugar cane as a fuel resource, catapulting it from a local production (Saravanan et al., 2020). Under the 1975 Alcohol Program, ethanol vehicles and ethanol fuel for consumers received tax cuts, among other measures. Once the price ratio between gasoline and ethanol fell again in the 1990s, ethanol vehicles became less competitive, causing demand and production to drop (see Graph A.1 in the Annex). In this context, flex-fuel engine technology matured, allowing greater flexibility by consuming different fuels, a major reason why it became the predominant technology in the Brazilian automotive market (Brito et al., 2019). Importantly, Brazil occupied a relevant place in the race to develop this technology, in which tier 1 global auto parts companies such as Magneti Marelli, Bosch and Delphi competed (Yu et al., 2010).

Second, production volume in the EU and its main automotive producing countries is vastly higher than that of Mercosur partners, even in per capita terms.

(5) A platform is a subset of assets (especially components, generating a sub-assembly) common to a variety of products. In the automotive industry, a platform usually concerns the underbody and suspensions of vehicles, including motorization in certain cases. These platforms allow companies to exploit economies of scope, which arise from using the same resources to produce a variety of products (Muniz; Belzowski, 2017; Cantarella et al., 2017).

Table 1
Analysis of selected productive and international trade variables of the automotive chain in Argentina, Brazil, and the EU 28

Economic Sector	Variable	Argentina	Brazil	EU 28	Germany	France	Italy	Spain	Czech Republic	Hungary
Automotive industry	Vehicle production (units) (year 2018)	466.649	2.879.809	19.205.095	5.642.732	2.269.600	1.060.068	2.819.565	1.345.041	430.988
	Automobiles (% of total)	*45%*	*83%*	*86%*	*91%*	*78%*	*63%*	*80%*	*100%*	*100%*
	Pickups and utility vehicles (% of total)	*55%*	*12%*	*11%*	*6%*	*22%*	*31%*	*18%*	*0%*	*0%*
	Others (% of total)	*0%*	*5%*	*3%*	*3%*	*0%*	*6%*	*2%*	*0%*	*0%*
	Vehicle production per 1000 inhabitants (units) (year 2018)	10	14	43	68	34	18	60	127	44
	Imports / Consumption (units) (year 2018) (1)	76%	9%	24%	86%	n.d.	96%	90%	n.d.	n.d.
	Exports / Production (units) (year 2018) (1)	39%	22%	32%	92%	n.d.	93%	82%	n.d.	n.d.
	Trade balance (USD million) (year 2018) (1) (2)	-2.525	607	100.368	97.752	-12.841	-14.066	17.425	18.321	6.620
Auto parts industry	Trade balance (USD million) (year 2018) (1) (3)	-3.851	-3.825	48.811	40.598	-2.315	9.605	-6.423	3.983	5.955
	Average imports of auto parts per produced vehicle (year 2018) (1) (3)	10.685	3.501	3.049	13.288	13.487	17.460	9.420	12.733	26.018

Source: Author's own elaboration based on OICA, ACEA, United Nations, ADEFA, ANFAVEA, ANFAC, ANFIA and World Bank.

n.d. = no data.

(1) Note: In European countries, this variable includes intra-EU28 trade. At the same time, in Argentina and Brazil it includes intra-MERCOSUR trade.

(2) Note: Includes buses and coaches (HS02 8702), automobiles (HS02 8703), and motor vehicles for the transport of goods (HS02 8704).

(3) Note: Includes transmission belts (HS02 4010), new tires (HS02 4011), gasoline engines (HS02 8407), diesel engines (HS02 8408), engine parts (HS02 8409), drive shafts (HS02 8483) , electric accumulators (HS02 850710) and other auto parts (bumpers, safety seat belts, brakes, gearboxes, shock absorbers, radiators, clutches, steering wheels, exhaust pipes, etc; belonging to HS02 8708).

We also observe important differences in production scale at firm level. Despite incorporating flexible methods of production since the 1970s, economies of scale have remained significant in the sector (Husan, 1997; Coriat, 2004). Table 2 shows that vehicle production by large automotive groups in the EU in 2016 (latest year available with complete and detailed information) was several times higher than that of Brazil and, especially, Argentina. This difference is even more important when European automotive groups such as Volkswagen, PSA, Renault, Daimler, and Fiat are analysed.

Differences in average production per plant also favour the EU, which presented an average vehicle production per plant of 116.811 units in 2016 (see table 2). Conversely, Brazil produced 82.937 vehicles per plant on average; and Argentina only 52.738, less than half of what the EU produced. However, differences between the automotive groups, determined by origin of the capital, explain the weight that the European plants have in its globally spread production network. Thus, while the average production scale of Volkswagen, PSA and Renault plants in the EU is double or triple that of these companies in Brazil or Argentina, Toyota or General Motors have much smaller differences, where their average production per plant in the EU never exceeds that of South American countries by more than 70%. A counterexample is the case of Fiat in Brazil, whose plants in Betim (Minas Gerais) and Goiana (Pernambuco) produced more vehicles on average than its EU-based plants. According to Balcet and Ietto-Gillies (2020), the Betim factory is the largest Fiat production plant globally. In 2014, this factory produced more than all of Fiat production plants located in Italy, which could be explained both by endogenous factors in Italy (macroeconomic, etc.) and by the internationalization strategy adopted for Fiat production capacity. This internationalization affected

the weight of the production in its country of origin within the group's global production (Balcet; Ietto-Gillies, 2020)[6].

Table 2
Analysis of selected productive variables of the automotive firms in Argentina, Brazil, and the EU 28

Group (Year 2016)	Argentina				Brazil				EU 28				EU 28 / Argentina		EU 28 / Brazil	
	Production (Units)	Plants	Production / Plant	Production Share (%)	Production (Units)	Plants	Production / Plant	Production Share (%)	Production (Units)	Plants (**)	Production / Plant	Production Share (%)	Production (Units)	Production / Plant	Production (Units)	Production / Plant
Volkswagen	66.184	1	66.184	14%	324.128	4	81.032	15%	4.944.095	23	214.961	26%	75	3,2	15	2,7
PSA	59.391	1	59.391	13%	85.026	1	85.026	4%	2.130.716	12	177.560	11%	36	3,0	25	2,1
Renault	61.071	1	61.071	13%	208.352	2	104.176	10%	1.774.495	10	177.450	9%	29	2,9	9	1,7
Daimler	1.899	1	1.899	0%	n.d.	n.d.	n.d.	n.d.	1.739.370	8	217.421	9%	916	114,5	n.c.	n.c.
Fiat	35.738	1	35.738	8%	387.715	2	193.858	18%	1.299.188	9	144.354	7%	36	4,0	3,4	0,7
Ford	85.547	1	85.547	18%	219.519	3	73.173	10%	1.111.362	4	277.841	6%	13	3,2	5,1	3,8
Hyundai	0	0	0	0%	161.756	1	161.756	8%	702.461	2	351.231	4%	n.c.	n.c.	4,3	2,2
Nissan	0	0	0	0%	45.490	2	22.745	2%	628.953	3	209.651	3%	n.c.	n.c.	14	9,2
Toyota	97.809	1	97.809	21%	175.901	2	87.951	8%	508.604	4	127.151	3%	5,2	1,3	2,9	1,4
GM	55.003	1	55.003	12%	334.447	3	111.482	16%	191.797	2	95.899	1%	3,5	1,7	0,6	0,9
Honda	12.003	1	12.003	3%	120.585	1	120.585	6%	133.875	1	133.875	1%	11	11,2	1,1	1,1
Others (*)	0	0	0	0%	93.437	5	18.687	4%	3.641.728	83 (***)	43.876	19%	n.c.	n.c.	39	2,3
Total (Year 2016)	474.645	9	52.738	100%	2.156.356	26	82.937	100%	18.806.644	161	116.811	100%	40	2,2	9	1,4

Source: Author's own elaboration based on OICA, ACEA, ADEFA (2018), ANFAVEA (2017), y https://europe.autonews.com.
(*) Note: Includes Leyland Trucks, Suzuki and Tata in the EU 28; Navistar in Brazil; BMW, Geely (Volvo), and Paccar (with production in both partners), others not indentified, and errors and omissions.
(**) Note: The plants that belong to joint ventures of different groups (such as those of Sevel in the case of Fiat and PSA) were considered as one plant in each of them.
(***) Note: Corresponds to plants belonging to other companies in 2020.
n.c. = not calculated.
n.d. = no data.

Differences in vehicle production volume between the EU, Argentina and Brazil reflect both differences in domestic market size and per capita vehicle use (see table 3), as well as in the export orientation of both regions. In 2018, while Argentina exported 39% of its production and Brazil 22% (including intra-Mercosur exports, which accounted for more than 60% of the total, see Dulcich et al., 2019), EU extra-regional exports accounted for 32% of its automotive production (see Table 1). As for individual European countries, such as Germany, Italy, or Spain, the exports-to-production ratio (including intra-EU exports) exceeded 80%.

As for import penetration, the EU falls somewhere between the strong import openness of Argentina (where imports accounted for 76% of vehicle sales) and the closed Brazilian market (9% ratio of imports to vehicle consumption), as in the EU imports accounted for 24% of vehicle sales.

The EU's significant extra-regional export orientation, greater than its import penetration, in a context of much higher production volume than Argentina and Brazil, is reflected in the EU's superlative trade surplus in vehicles, which exceeds USD 100.000 million (see table 1). In comparison, Brazil has a meagre surplus, and Argentina has a large trade deficit.

Regarding auto parts, the EU once again shows an important extra-regional competitiveness, contrasting with the trade deficits of Argentina and Brazil. The integration of imported auto parts per vehicle produced is similar in the EU28 and Brazil (USD 3.000 – 3.500 of auto parts imports per vehicle produced), and much higher in Argentina's disintegrated automotive industry (USD 10.685 of imports per vehicle produced).

(6) Importantly, Ford recently announced the closure of its three production plants in Brazil. For more details, see https://media.ford.com/content/fordmedia/fsa/ar/es/news/2021/01/01/ford-avanza-en-la-reestructuracion-de-sudamerica--cesara-sus-ope.html. Last accessed: Feb. 23, 2021.

When analysing the automotive and auto parts trade of the EU's major automotive producing countries, we observe both their strong competitiveness in extra-EU trade in many products, and an important specialization within the region, which is reflected in its intra-EU trade. Table A.1 in the Annex shows Germany's high extra-EU competitiveness in almost all vehicles and auto parts, as well as some specific cases, such as Austria's and Italy's extra-EU trade surpluses in engines. An interesting aspect, however, is the significant intra-EU specialization. France, Austria, and Hungary stand out as regional engine suppliers. Austria and Hungary also stand out as suppliers of different auto parts within the EU, along with the Czech Republic, Slovakia, and Romania. In turn, Spain, the Czech Republic, Slovakia, and, to a lesser extent, Hungary stand out for their surpluses in vehicles in their intra-EU trade, especially for automobiles. In this regard, PSA and Renault had their highest vehicle production volumes outside of France in 2017, in Spain, and the Hyundai Motor Group's only EU automotive production are in the Czech Republic and Slovakia (OICA, 2020). In fact, 2014 data show that the Czech Republic has received the largest FDI stock within the Central and Eastern European automotive industry (Pavlínek et al., 2017). This reflects the importance acquired by countries of the so-called European automotive periphery (Domański; Lung, 2009) to the detriment of traditional regional production cores, such as France and Italy, since European integration.

The dynamics of domestic vehicle markets presents favourable characteristics to Mercosur partners. The EU domestic market, much larger than Mercosur's in volume, presents one of the highest motorization rates in the world, which is four times the world average (see table 3), and has stagnated in the last decade[7]. Considering this high motorization rate and the new trends regarding shared and connected mobility (car-sharing, ride-hailing, Mobility as a Service, etc., see Becker et al., 2020), which are replacing the private vehicle and advancing rapidly in developed societies, the EU domestic vehicle market shows lower growth expectations than those of Argentina and Brazil[8]. This is also because these countries have had significant growth in their vehicle sales in the last decade, and have lower motorization rates, which determines a greater potential for domestic vehicle market growth. In fact, motorization rates in Argentina and Brazil have grown faster than the world average in the last decade.

(7) After the 2009 international crisis, the EU focused on overcapacity in the European automotive industry, and some global automakers (like Ford, GM, and PSA) faced plant closures (Pavlínek et al., 2017). More recently, in May 2020, Nissan announced the closure of its production plant in Barcelona. For more details, see https://www.elespanol.com/invertia/empresas/20200528/produccion-nissan-barcelona-asumida-plantas-renault/493450945_0.html. Last accessed: Feb. 24, 2021.

(8) For example, a survey conducted in Brazil and segmented by age found no significant generational differences (baby boomers, generation X, generation Y, and generation Z) regarding the preference for private car as a means of transport, which is around 40%. Moreover, the survey shows no significant differences on whether the car will be the main means of transport in the future, to which between 61% and 70% of those surveyed adhere, depending on the generation. Only 34% of the respondents foresee shared mobility as the future of the automobile, which most associate with the development of mobile applications (Anfavea, 2018).

Table 3
Evolution of the motorization rate and vehicle sales worldwide and in Argentina, Brazil, and the EU 28

Year	World		EU 28		Brazil		Argentina	
	Motorization rate	Sales (units)	Motorization rate	Sales (units)	Motorization rate	Sales (units)	Motorization rate	Sales (units)
2005	137	65.923.794	603	17.719.106	124	1.714.644	180	402.690
2006	141	68.353.376	613	18.039.188	128	1.927.738	183	460.478
2007	144	71.563.399	611	18.353.301	135	2.462.728	195	564.926
2008	147	68.315.495	622	16.900.754	143	2.820.350	211	611.770
2009	149	65.568.829	624	15.802.106	153	3.141.240	221	487.142
2010	153	74.971.523	631	15.174.562	164	3.515.064	248	698.404
2011	157	78.170.420	639	15.123.397	176	3.633.248	266	883.350
2012	161	82.129.138	643	13.806.642	187	3.802.071	275	830.058
2013	165	85.606.136	647	13.604.259	198	3.767.370	295	963.917
2014	170	88.338.098	652	14.466.054	206	3.498.012	313	613.848
2015	175	89.684.608	662	15.885.920	209	2.568.976	318	644.021
2016	n.d.	93.856.388	665	16.993.841	209	2.050.321	324	709.482
2017	n.d.	95.660.606	678	17.347.614	210	2.172.738	320	862.332
2018	n.d.	95.055.937	690	17.472.462	212	2.468.434	317	773.641
2005-2018 linear growth	2,4% (*)	3,3%	1,0%	-0,6%	4,8%	1,0%	5,2%	4,5%

Source: Author's own elaboration based on OICA, ACEA, ANFAVEA, ADEFA and World Bank.
Note: The motorization rate represents the number of vehicles in use per thousand inhabitants.
(*) Note: Corresponds to 2005-2015 linear growth
n.d. = no data.

4 Previous publications on the subject and methodology used in this research

The potential outcomes of the Mercosur-EU Agreement have been explored in depth for many years, mainly using Computable General Equilibrium (CGE) models to quantify the impacts of market access measures under negotiation (see e.g. Diao et al., 2003; Monteagudo; Watanuki, 2003; Laens; Terra, 2006; Laborde; Ramos, 2007; Flôres; Watanuki, 2008; Burrell et al., 2011; LSE, 2020; Suárez-Cuesta; Latorre, 2021).

LSE research (2020) states that the agreement will generate an increase in production and employment in the EU automotive value chain, as opposed to a drop in these variables in Argentina and Brazil. As for foreign trade, the EU will see an expansion of both exports and imports of the automotive value chain, which will be of similar magnitude. Such expansion will also occur in Brazil, except that imports will grow two to four times more than exports. In turn, Argentina will see a drop in exports and an increase in imports of the automotive value chain.

Suárez-Cuesta and Latorre (2021) project a drop in production and exports of the automotive value chain in Brazil and, especially, Argentina. At the same time, imports of vehicles and auto parts will increase in both countries due to the agreement. In contrast, the authors estimate an expansion in production and exports of the EU automotive value chain, as well as a slight growth in imports, but much lower than that estimated for Argentina and Brazil.

A literature review suggests that the CGE models (GTAP, AMIDA, GLOBE, and others) used by the studies reviewed present several limitations to analysing the impacts of the Mercosur-EU Agreement in the automotive value chain. First, they usually aggregate the automotive industry,

hindering distinctions between very different goods (and their dissimilar market structures) such as cars, pickup trucks, heavy trucks, and buses. Worse, they tend to aggregate the automotive and auto parts industries, which have very different attributes, into a single modelized sector. The GLOBE model even aggregates the "manufacture and machinery" sector (see Burrell et al., 2011), making it impossible to trace these effects even in the automotive chain. Finally, some models (like the GTAP) usually suppose perfect competition in the modelized industry markets, which are far from the oligopoly market structures seen in the automotive industry.

Thus, our methodological approach will focus on a descriptive analysis of the disaggregated trade balances of the automotive chain's different subsectors, to predict the static effects of trade liberalisation proposed by the Mercosur-EU agreement on trade flows between partners.

To determine these static impacts on trade between partners global trade balances by sector and partner will be analysed[9], reflecting their revealed comparative advantages[10].

When one partner has a global surplus and the other a deficit, this suggests that at the bilateral level, the former's trade balance will increase relative to the latter with trade liberalisation, except that a bilateral trade deficit already exists for the former[11], where the effect will remain undetermined. If both partners present a global surplus or deficit, the bilateral trade balance will determine the static effect, amplifying its magnitude. Table A.2 in the Annex summarises these effects.

As a corollary to these analyses, we will determine the static effects of the trade liberalisation of the Mercosur-EU agreement's trade liberalisation on bilateral automotive trade between Argentina and Brazil. When both Argentina and Brazil expand their trade balances with the EU, no significant bilateral effect is observed between them[12]. A similar effect happens if one country increases its trade balance with the EU and the other reduces it, where the latter's higher imports from the EU should displace extra-Mercosur partners. If both Argentina and Brazil see their trade balance with the EU decrease due to the agreement, the static effect of trade between them is determined by the bilateral trade balance: if Argentina has a surplus with Brazil, its exports to that market will be displaced by the EU; if it runs a deficit, Argentina's imports from the EU will displace those of Brazilian origin[13].

(9) As already discussed, Sturgeon et al. (2009) highlight that the automotive chain tends to generate regional production and trade structures, determined in part by FTAs. Thus, using only extra-regional trade balances to identify comparative advantages has been ruled out for Brazil and Argentina, since a substantial part of their international trade in the automotive chain would be left out and consequently hinder reflecting the real conditions of production and trade. In fact, the methodological pretension of capturing comparative advantages through non-preferential international trade in the automotive chain (eliminating the trade diversion effect generated by FTAs and other regulations) alone would imply ignoring not only the Argentina-Brazil bilateral flow but also the preferential automotive trade between Argentina and Mexico, Brazil and Mexico, the EU and Korea, the EU and Türkiye, EU and Mexico, etc. It would also imply disregarding a large part of the Mercosur-EU agreement partners' automotive international trade and distancing the analysis even further from the real conditions of automotive production and international trade in each country.

(10) Trade balance is the main determinant of comparative advantages in indices such as Lafay (1992), which adjusts to eliminate the short-term macroeconomic effects that affect trade balances. However, we chose it to approximate comparative advantages only with the sectoral trade balance, since its volume is considered relevant and indirectly allows us to approximate the export, import, and production values involved.

(11) This may occur, for example, due to the significant heterogeneity of products within the subsector under analysis.

(12) These statements are "corner solutions" that would require a mathematical formalization for precise quantification, which is impossible to accomplish with the available models due to the high level of aggregation they present for the automotive chain, among other limitations already discussed.

(13) Meaning that the trade diversion generated by bilateral regulation of the automotive chain between Argentina and Brazil will be eliminated regarding imports from the EU.

If one partner shows an increase in its trade balance with the EU due to the agreement, and the other has an indeterminate static effect, bilateral trade between the two will not show significant changes. The other possible cases represent an indeterminacy of the static effect on bilateral trade between Argentina and Brazil. Table A.3 in the Annex summarizes these effects.

The main advantage of this methodology is its high level of sectoral disaggregation, which allows us to generate hypotheses about the static effects of the Mercosur-EU agreement at the product level. As for its limitations, as a partial equilibrium exercise (general equilibrium effects, linked to the factor market and markets for goods outside the automotive chain are not considered), it does not include dynamic effects (investments, learning process, etc.). In this regard, the present research, based on a novel methodology, complements studies based on CGE models, especially due to its potential to provide detailed results at the product level.

5 Market access measures of the Mercosur-EU Agreement and its potential impact on the automotive value chains in Brazil and Argentina

The Mercosur-EU agreement establishes an import tariff reduction for inter-bloc trade in the automotive chain, which will enjoy a seven-year grace period once the agreement comes into force, during which a quota of 50.000 units will benefit from a 50% import duty reduction. An accelerated import tariff reduction will then be implemented until the fifteenth year of entry into force, when sectoral free trade will be reached between blocks[14].

Based on the methodology previously described, the next sections analyse the potential static impacts of the Mercosur-EU agreement on different products of the automotive chain.

5.1 Import duty reduction and its potential impact on the automotive industry

Starting with the automotive industry, table 4 shows that the agreement would increase the deficit of Argentina and Brazil with the EU in almost all vehicle segments, with two exceptions. First are buses, segment in which the EU has a significant deficit and Brazil could increase its trade balance. Argentina, which also has a deficit in buses, shows an indeterminate effect, since the balanced bilateral trade with the EU in this segment does not allow us to predict future trade flows.

The second exception is the pickup truck segment in Argentina. Despite the country's global surplus and the EU's significant deficit, the bilateral flow is favourable to the EU (even though import duties applied in Argentina are much higher), which does not allow us to determine the effect trade liberalisation will have on this segment.

In the bilateral Argentina-Brazil trade, the agreement will generate a substitution of origin of imports from Brazil (which has trade surpluses in most vehicle segments) to the EU in Argentina for most segments, except for pickup trucks and buses. Given Argentina's surplus of pickup trucks compared with Brazil, the effect of EU competition on the Brazilian market cannot be determined, in parallel to the indeterminacy of this effect on the Argentina-EU flow. Since Brazil is very competitive in the bus segment, and the EU has a deficit, the agreement would not affect Brazilian exports to Argentina.

(14) For more details, see https://cancilleria.gob.ar/acuerdo-mercosur-ue/resumen-de-contenidos-del-pilar-comercial. Last accessed: Mar. 9, 2020).

Finally, note that the applied methodology disregards the existence of a differential preference in favour of the EU, since the import duties Argentina and Brazil apply on these products are substantially higher than those applied by the EU (see Table 4)[15]. This could even reverse the few existing opportunities for Mercosur countries and generate substantial impacts were the EU to expand its trade balances with South American countries.

Table 4
Analysis of the potential static effect of import duty reduction in subsectors of the automotive industry

HS 2017	Description	2017-2018 average trade balance (U$S millions)						Expected static effect (*)			2017 Average MFN applied import duties (%) (**)		
		Argentina - Brazil	Argentina - World	Brazil - World	EU 28 - World	EU 28 - Argentina	EU 28 - Brazil	Trade balance Argentina - EU 28	Trade balance Brazil - EU 28	Intraregional trade flows Argentina from/to Brazil	Argentina - Brazil (a)	EU 28 (b)	EU 28 differential preferences (c) = (a) - (b)
8701	Tractors	-229	-278	1.369	7.074	29	23	↓	↓	**IOS**	16	5	12
8702	Public passenger transportation vehicles	-23	-28	198	-604	0	1	**?**	↑	**No effect**	33	12	21
8703	Motor cars	-1.699	-2.311	2.332	97.035	414	598	↓	↓	**IOS**	34	10	24
870421/31	Pickups and light trucks (total weight with maximum load less than or equal to 5 tonnes)	875	1.293	-882	-2.184	17	3	**?**	↓	**?**	35	14	21
8704 - Others	Other vehicles for the transport of goods	-187	-216	1.034	7.001	21	6	↓	↓	**IOS**	29	12	17
8705	Special purpose motor vehicles (e.g. breakdown lorries, road sweeper lorries, etc.)	-2	-36	15	3.448	29	7	↓	↓	**IOS**	30	4	26
8706	Chassis fitted with engines	-44	-44	624	793	0	21	↓	↓	**IOS**	28	10	18
8707	Bodies (including cabs) for motor vehicles	-11	-13	248	706	2	35	↓	↓	**IOS**	30	5	25

Source: Author's own elaboration based on World Trade Organization and United Nations.

Note: In each row (for each product), the higher the trade surplus with the world, the higher the green shading. Similarly, the higher the trade deficit with the world, the higher the red shading.

(*) Note:

↑	*Argentina / Brazil - EU 28 trade balance increases*
↓	*Argentina / Brazil - EU 28 trade balance decreases*
?	*Unknown effect*
IOS	*Import origin substitution from Brazil to EU 28*
DOE	*Displacement of exports to Brazil by EU 28*

(**) Note: Includes only ad valorem tariffs. The averages are simple average of the tariff lines belonging to each 4-digit classification of the Harmonized System 2017 (HS 2017). If the average MFN applied import duties of Argentina and Brazil differ due to a perforation of the Mercosur common external tariff, a simple average was taken between both values.

5.2 Import duty reduction and its potential impact on the auto parts industry

As for the Mercosur auto parts sector, the perspectives are not promising either. Table 5 shows that the EU would expand its trade balances with Argentina and Brazil in almost all auto parts products, except for tyres, engine parts, bumpers and gear boxes.

Brazil is competitive in the tyre segment whereas the EU has a global deficit, but also presents surplus in bilateral trade (see table 5), which hinders determining the effect of the agreement for this segment. Regarding engine parts, both partners have a global trade surplus, but Brazil has a trade surplus with the EU, which would increase its bilateral trade balance due to the FTA. As mentioned in the previous section, however, the average import duty of 9% that Brazil applies to these products, against the EU's 2%, would render this preference towards Brazilian engine parts marginal.

(15) Incorporating these variables into the analysis and quantifying their effects requires a detailed partial equilibrium model for the automotive chain including all products analysed, which does not help to investigate the impact of these types of agreements, as already discussed.

As for bumpers and gear boxes, the EU has a global surplus in the segment whereas Argentina shows a trade deficit, but also a slight bilateral trade surplus (see Table 5), thus the effect of the agreement cannot be estimated. However, the differential preference is once again favourable to the EU, since Argentina applies average import duties of 18% to bumpers and 13% to gear boxes, against the EU' average of 4%. As such, it is difficult to see a potential increase in Argentina's trade balance with the EU for these products. Overall, as in the automotive industry, there exists a significant differential preference favourable to the EU in all products of the auto parts industry. This could result in impacts of significant magnitude where the EU would expand its trade balances with Argentina and Brazil, which according to the methodology adopted are almost all auto parts products.

Table 5
Analysis of the potential static effect of import duty reduction in subsectors of the auto parts industry

HS 2017	Description	2017-2018 average trade balance (U$S millions)						Expected static effect (*)			2017 Average MFN applied import duties (%) (**)		
		Argentina - Brazil	Argentina - World	Brazil - World	EU 28 - World	EU 28 - Argentina	EU 28 - Brazil	Trade balance Argentina - EU 28	Trade balance Brazil - EU 28	Intraregional trade flows Argentina from/to Brazil	Argentina Brazil (a)	EU 28 (b)	EU 28 differential preferences (c) = (a) - (b)
4010	Conveyor or transmission belts	-2	-22	-76	658	13	24	↓	↓	IOS	14	7	8
4011	New pneumatic tyres of rubber	-86	-131	218	-1.919	20	31	↓	?	?	15	4	11
8407	Internal combustion engines	-61	-125	-30	4.637	38	120	↓	↓	IOS	14	3	11
8408	Diesel or semi-diesel engines	84	-226	-347	9.146	248	290	↓	↓	DOE	13	3	10
8409	Parts of engines	-26	-142	344	3.407	38	-54	↓	↑	No effect	9	2	6
8483	Transmission shafts, gear boxes and other speed changers	-17	-137	-513	5.503	99	326	↓	↓	IOS	14	4	10
850710	Electric accumulators	-30	-37	80	323	2	6	↓	↓	IOS	18	4	14
870810	Bumpers	-7	-15	-33	711	-2	32	?	↓	?	18	4	14
870821	Safety seat belts	-12	-18	-14	434	6	14	↓	↓	IOS	18	4	14
870829	Parts and accessories of vehicles bodies, other than safety seat belts	-82	-273	-608	4.845	137	467	↓	↓	IOS	15	4	11
870830	Brakes	-62	-95	-122	1.562	33	111	↓	↓	IOS	17	4	13
870840	Gear boxes	85	-154	-1.646	5.654	-6	323	?	↓	?	13	4	9
870850	Drive-axles with differential	-21	-102	-310	1.645	50	173	↓	↓	IOS	13	4	9
870870	Road wheels	-33	-66	-27	-770	14	33	↓	↓	IOS	16	4	12
870880	Suspension systems and parts thereof (including shock-absorbers)	-23	-40	-58	1.060	4	38	↓	↓	IOS	18	4	14
870891	Radiators	-7	-20	-37	159	12	35	↓	↓	IOS	18	4	14
870892	Silencers (mufflers) and exhaust pipes	-2	-11	-47	274	10	26	↓	↓	IOS	18	4	14
870893	Clutches	-17	-30	6	891	16	40	↓	↓	IOS	18	4	14
870894	Steering wheels, steering columns and steering boxes	-21	-72	-229	1.485	50	96	↓	↓	IOS	16	4	12
870895	Safety airbags with inflater system	-12	-29	-164	480	14	43	↓	↓	IOS	10	4	6
870899	Other vehicle parts and accessories	-70	-180	-191	8.145	144	623	↓	↓	IOS	9	4	5

Source: Author's own elaboration based on World Trade Organization and United Nations.

Note: In each row (for each product), the higher the trade surplus with the world, the higher the green shading. Similarly, the higher the trade deficit with the world, the higher the red shading.

(*) Note:

↑	*Argentina / Brazil - EU 28 trade balance increases*
↓	*Argentina / Brazil - EU 28 trade balance decreases*
?	*Unknown effect*
IOS	*Import origin substitution from Brazil to EU 28*
DOE	*Displacement of exports to Brazil by EU 28*

(**) Note: Includes only ad valorem tariffs. The averages are simple average of the tariff lines belonging to each 4-digit classification of the Harmonized System 2017 (HS 2017). If the average MFN applied import duties of Argentina and Brazil differ due to a perforation of the Mercosur common external tariff, a simple average was taken between both values.

In bilateral trade between Argentina and Brazil, this adverse scenario mainly determines a substitution of the origin of imports from Brazil (which has trade surpluses with Argentina in almost all segments) to the EU in Argentina (see table 5). The exceptions are tyres, bumpers, and gear boxes,

for which the bilateral effect remains undetermined parallel to the effect of the agreement. At the same time, in the event of an increase in Brazil's engine parts trade balance with the EU, the agreement would have no effect on the Brazilian competitiveness in the Argentine market. Finally, regarding diesel engines, the only auto parts segment in which Argentina has a trade surplus with Brazil, the higher imports from the EU generated by the FTA would outperform Argentine exports in the Brazilian market[16].

5.3 Rules of origin of the Mercosur-EU Agreement and its potential impact on the automotive value chains in Brazil and Argentina

Rules of origin are the criteria needed to determine in which country or region a product was made, so that one can establish the preferences of trade agreements. In regional integration processes, this is especially relevant for FTAs since, unlike customs unions, there is no common external tariff. On extreme cases, without the rules of origin (and without transport costs), input imports would move to partners with lower external tariffs, to be then re-exported to those with higher tariffs but exploiting the preferences of the agreement. Overall, the rules of origin seeks to prevent producers of goods with little processing from benefiting excessively from the preferences of the agreement. Certainly, rules of origin can protect different industries from the liberalisation effects implied by the FTA and end up providing important protection for their input suppliers (Krishna, 2005).

In practice, rules of origin can be defined in four ways. The first focuses on domestic content requirements, which are usually defined in terms of domestic value added. The second is based on a change in the tariff heading: if the input underwent a process that altered the tariff heading, it is determined as originating from where the process took place. The third consists in the requirement that specific production processes, which are defined for each case, be fulfilled. The fourth is the claim that the product is "substantially transformed," which results in defining this transformation based on any of the previous definitions, or a combination of them (Krishna, 2005).

Its effects are multiple and mainly affect trade and investment. On the one hand, rules of origin tend to affect trade in the short term, protecting the local industry from a hypothetical FTA without rules of origin. On the other, they can increase the price of local inputs, which see increased demand to complete certification of origin and access the FTA preferences. Finally, in the medium and long term they affect investment decisions, which are reoriented to meet the origin requirements (Krishna, 2005).

ECA 14, which regulates automotive trade between Argentina and Brazil, establishes, in its 38th and 44th Additional Protocols, that vehicles will be considered as originating from these countries if they incorporate a minimum regional Mercosur content of 50%. The regional content index (RCI) is calculated as the weight complement of the customs value of non-originating inputs on the FOB export value of the product. As a regional content index, it presents bilateral accumulation

(16) The high dependence of Argentina's automotive chain on the Brazilian market means that potential displacements by EU suppliers could have important effects on Argentine production, as has already happened in face of the recession in the Brazilian market in recent years (Bekerman et al., 2020).

of origin: inputs originating in Argentina are considered as originating inputs if they are incorporated into a production process in Brazil, and vice versa.

As for auto parts, ECA 14 determines that the rules of origin defined in ECA 18, which regulate Mercosur in general, must be followed. ECA 18, especially in its 77th Additional Protocol and its amendments, establishes various ways of proving origin, among which three are most relevant for the auto parts industry. One focuses on the production process generating a change in the tariff classification (at 4 digits of the nomenclator) of the good in question regarding the non-originating inputs used in its manufacture[17]. The second consists in observing that the CIF value of third country inputs does not exceed 40% on the FOB export value of the manufactured product. Lastly, a significant number of auto parts (brakes, gear boxes, drive axles with differential, road wheels, and steering wheels) are excluded from the previous definitions and determined by product-specific rules of origin. Accreditation of origin for these products requires corroborating 60% of the regional added value defined as the weight complement of the customs value of non-originating inputs on the FOB export value of the product.

In turn, the Mercosur-EU agreement determines specific rules of origin for each sector, including the automotive chain. Vehicles (Harmonized System code 87.01-87.07) will originate from Mercosur or the EU when the non-originating inputs value does not exceed 45% of the total value of the product. For auto parts (HS 87.08) this limit is extended to 50%. In this regard, note that the ECA 14, in its 44th Protocol, establishes that as of 2027 the rules of origin for auto parts will be product-specific and lists these requirements in an Appendix. For HS 87.08 auto parts, for example, origin is determined by a 50% RCI, complying with the criterion defined by the Mercosur-EU agreement.

Moreover, the general provisions of the Mercosur-EU agreement rules of origin establish a bilateral accumulation of origin, thus products originating in Mercosur must be considered as originating in the EU if they are incorporated as inputs into a production process in the EU, and vice versa.

In short, the Mercosur-EU agreement implies significant modifications in the rules of origin of the automotive chain. On the one hand, while the limit on using non-originating inputs is slightly stricter for vehicles (45% in Mercosur-EU vs. 50% in ECA 14), that for auto parts is laxer (50% in Mercosur-EU vs. 40% in ECA 14/18 until 2027)[18]. As many auto parts are assemblies and complete systems, this will allow a greater import of auto parts supplies from third markets. This is especially relevant considering the much lower tariffs applied by the EU to auto parts imports compared with Mercosur, stemming from lower MFN tariffs (see table 5) and from the greater number of FTAs it has signed with other trade partners, some of which relevant auto parts producers (such as Japan, South Korea and Mexico, see Panigo et al., 2017). In parallel, the bilateral accumulation of origin

(17) However, if the CIF value of all non-originating inputs belonging to the same tariff classification as the manufactured product does not exceed 10% of the FOB export value of the latter, it will also be considered a Mercosur originating product (benefit of which some auto parts are excepted).

(18) Although the coefficients are comparable based on the similar design of their formulas, they will have a very different incidence. Bilateral accumulation of origin, in a context of significant imports of EU auto parts by Mercosur, will mean that these imports will no longer be considered non-originating, and that these coefficients will be covered by imports from third markets, which will therefore be less constrained by rules of origin. This topic requires a specific analysis that exceeds the scope of this article.

implies that these rules of origin will not generate any hidden protection for the Mercosur auto parts industry; rather, it will be exposed to the strong competitiveness of the European auto parts industry.

5.4 Technical barriers to trade as a potential limitation for market access

Technical Barriers to Trade (TBTs) are regulations adopted by governments on products or production processes that seek to meet different objectives, such as healthcare, environmental protection, ensuring user safety, or improving consumer access to information, among others. TBTs can be technical norms (which are compulsory), standards (issued by entities responsible for establishing rules and recommendations for production processes and products, which are optional), and conformity assessment procedures (used to verify if technical norms or standards have been met). The guiding principles of the WTO TBTs Agreement are non-discrimination between local and foreign companies in applying TBTs (or between foreign companies from different countries), avoiding unnecessary barriers to trade (for which the use of international standards is encouraged, among other initiatives), and promotion of transparency when implementing these measures. This is achieved by generating space for notifying and discussing measures, and then establishing a six-month period between its publication and entry into force, among others (WTO, 2014). Despite pursuing legitimate purposes, these measures can be used in a protectionist manner, which has increased since the 2009 international crisis (Horj et al., 2014).

As vehicles present important implications for public health, safety and the environment, the automotive industry is a main target of TBTs. In fact, several international agreements focus on this segment, such as the 1958 Agreement and the 1998 Agreement, both proposed by the World Forum for Harmonization of Vehicle Regulations (WP.29), from the United Nations Economic Commission for Europe. The 1958 Agreement, with 50 members (41 European countries), prescribes standards for the systems, parts and equipment that make up vehicles, and for the reciprocal recognition of approvals granted under the Agreement. The 1998 Agreement, led by the European Community, the US and Japan, defines a procedure to develop global technical standards on safety, environmental impact and energy consumption of vehicles and their parts, among others, and has 33 members. Both agreements are signed by the EU, but not by Argentina or Brazil (CEPE, 2012).

The Mercosur-EU Agreement's chapter on TBTs ratifies the WTO TBT Agreement commitments and establishes some additional measures, especially regarding transparency, dialogue between stakeholders, and incorporation of "good regulatory practices" (Ghiotto; Echaide, 2020).

Towards the end, the mentioned chapter brings a specific Annex for vehicles and auto parts, where it emphasises that Mercosur countries will not necessarily adopt the WP.29 UN Regulations (Article 3 of the Annex)[19]. However, it states that for regulations from a non-member country of the 1958 Agreement (such as Argentina or Brazil), but which adopts some of these regulations in its national legislation, the test reports issued under the UN type approval system will be accepted to certify their compliance. The relevant regulations will be listed by country in Appendix 1 of the Annex (Article 4, section 1). At the same time, when a non-member country accepts the certificates issued under the UN system to confirm compliance with its internal regulation, these will be listed

(19) Nevertheless, many of the regulations in both countries are based on the WP.29 UN Regulations, especially in Argentina (Cepeda et al., 2017).

for each country in Appendix 2 of the Annex (Article 4, section 2). Importantly, Appendices 1 and 2 appear empty in the published version of the Agreement, with the commitment to be filled out by the Mercosur members by May 2020[20].

In this scenario, we cannot predict what effects the Agreement will have in the Mercosur countries regarding dissemination of UN / EU regulations. However, some considerations can be made based on their status.

First, as shown in Graph A.2 of the Annex, the EU notified, under the TBT Agreement, a higher quantity of TBTs for vehicles and auto parts than Argentina or Brazil. After the US and China, the EU market reports the highest number of TBTs together with Japan. Scenario amplified when one considers the TBTs applied by the member states (which complement regional TBTs), of which the Netherlands and Sweden lead the list of most regulated markets.

These quantitative differences suggest that the EU regulations aiming at public health, safety, and the environment usually imply more rigorous requirements than those applied by Mercosur countries. In terms of safety, for example, in 2018 Brazil and Argentina failed to regulate electronic stability control (UN regulation 13H or equivalent) or pedestrian protection (UN regulation 127 or equivalent), contrary to the EU countries (WHO, 2018). Such discrepancy can be observed even in areas for which both regions have regulations, so these differences do not appear on TBT notification statistics. One such case is heavy vehicle emissions: in 2010, while Argentina and Brazil applied the Euro III standard to all heavy vehicles sold in those markets, the EU already had the Euro V in force[21]. Currently, Argentina and Brazil apply the Euro V, and the EU the Euro VI (Miller; Braum, 2020); thus, although reduced, the regulatory gap persists.

In short, the EU market demands higher requirements than Mercosur in its technical standards for safety, public health, and the environment, among others. Thus, considering that the automotive companies active in Mercosur also have installed capacity in the EU (like many tier-one auto parts companies that have become global suppliers), such regulatory asymmetries create disincentives to export vehicles or auto parts from Mercosur to the EU in the short term. In doing so, they should generate an upgrading of capacities in Mercosur (with its consequent investments) to meet these technical requirements—capacities which are already accumulated in the EU. On the other hand, neither does the regulatory gap affect the incentives generated by the Agreement for Mercosur to import from the EU, nor will these incentives be counteracted if Mercosur countries intensify the requirements of their technical standards and align them with those of the EU.

6 The Mercosur-EU agreement in the context of transition to electric mobility

Despite presenting greater productive and technological dynamics than that of conventional vehicles (Dulcich et al., 2019), electric cars accounted for only 2.6% of global automobile sales in 2019 (IEA, 2020), showing a global transition to electric vehicles (EVs) still in development. This incipient transition, compounded by the scarce geographical and temporal information available for

(20) For more details, see https://www.cancilleria.gob.ar/es/acuerdo-mercosur-ue/obstaculos-tecnicos-al-comercio (last accessed 17/02/2021).

(21) The Euro standards regulate the emission limits for nitrogen oxides, carbon monoxide and particulate matter, among others, that can be emitted by vehicles sold in the EU.

its analysis, hinders making precise conjectures about its interaction with the Mercosur-EU Agreement. Thus, we outline below some general hypotheses concerning the potential impact of the Agreement on the transition to electric mobility in both regions.

First, note that the transition to electric mobility is much more advanced in the EU than in Argentina and Brazil. EV production is still incipient in these countries, and their market share is marginal, supplied mainly by imports. Conversely, the EU stands out as a leading region on EV technological development and production, with some of its member countries having the highest EV market shares globally (such as Sweden or the Netherlands). This difference is explained by different factors, such as the income gap between both regions (EVs remain pricy when compared with conventional vehicles), differences in incentives for developing these technologies and for purchasing and using these vehicles, the dissimilar deployment of charging infrastructure, etc. (Dulcich et al., 2019). In Brazil, the capacities and resources accumulated in flex-fuel engine technology, the important primary production on which it is sustained (ethanol and the growing extraction of offshore oil from "Pre-Salt" reserves), as well as the vested interests around them (oil companies, agribusiness, automakers, etc.) could be creating a lock-in in flex-fuel engine technology and threatening the transition to EVs (De Mello et al., 2013).

Given this scenario and considering the high technological and market uncertainty that this transition still presents, once the agreement is in force, automakers will hardly relocate the EV production capacity to Mercosur in the short term, especially since the installed capacity they have in the EU is just now maturing. Most likely, they will exploit the agreement's preferences to supply the Mercosur market with EV imports from the EU.

In the medium and long term, production and interregional trade will be dictated by international competitiveness, probably presenting patterns like those of conventional vehicles in most automotive and auto parts products, since the production capabilities needed are not altered significantly. The main exception is the powertrain. Given the substantial differences between an internal combustion motor vehicle and an electric one, this is where the greatest innovations could appear.

On the one hand, the electric motor presents less technical complexity than an internal combustion engine, thus reducing the barriers to enter this activity, dominated by global automakers, and associated with brand identity (Altenburg, 2014). However, for at least the next ten years the powertrain will continue to be based on lithium-ion batteries (IEA, 2018), an abundant natural resource in Argentina and around which the country has certain scientific capabilities, but has yet to transform into a scale production of battery cells (López et al., 2019). Conversely, the EU has important investment announcements in this segment (Dulcich et al., 2019), launching the European Battery Alliance program in 2017 to promote the entire production chain of EV batteries within the region (IEA, 2020). In late 2020, it launched the European Raw Materials Alliance to avoid supply risks of critical raw materials for new technologies, such as lithium for EV batteries (European Commission, 2020).

Thus, we cannot predict the net effect of these processes under the Mercosur-EU agreement. A priori, it can be argued that the quality and scope of the fiscal incentives involved will be relevant

in determining them, as is usually the case in technological development processes, which incur in several market failures (Martin and Scott, 2000).

7 Discussion and conclusions

As discussed in this article, the potential effects generated by the Mercosur-EU agreement on the automotive chain would imply important benefits for the EU in terms of increasing bilateral trade balances across the automotive and auto parts subsectors, based on their strong international competitiveness. On the other side, this phenomenon would reduce the bilateral trade balances of Argentina and Brazil with the EU, generating trade deficits in most subsectors. Moreover, higher EU imports will displace intra-regional trade in Mercosur, mainly affecting Brazil due to its trade surplus in most automotive and auto parts products from its bilateral trade with Argentina. These effects are likely to affect the automotive and auto parts production of South American countries, strongly dependent on import tariff protection and regional regulation.

These results are in line with those obtained by recent studies on the topic using CGE models, such as those by LSE (2020), which highlight that the Mercosur-EU agreement will increase the bilateral automotive trade deficit for Mercosur countries, generating a pernicious effects in the region's production and employment.

Suárez-Cuesta and Latorre (2021) reach similar conclusions. The authors point to a reduction in automotive exports from Argentina and Brazil despite a slight increase in imports from the EU automotive value due to the agreement. These phenomena, among other factors, would suggest a strong retraction of bilateral automotive trade between Argentina and Brazil, displaced by EU imports. However, the distribution of this impact within the Mercosur partners does not agree with the present analysis. According to Suárez-Cuesta and Latorre (2021), exports will be reduced to a much greater extent in Argentina than in Brazil; in the present study, Brazilian automobile exports to Argentina were shown to be more affected than pickup truck exports from Argentina to Brazil, due to the EU's increased international competitiveness in the segment. As for the auto parts industry, as a net supplier of Argentina in most products, Brazil's net exports will be displaced to a greater extent by EU imports. Similar considerations can be made about the LSE results (2020), who even propose (together with a reduction in exports from Argentina) an increase in automotive exports from Brazil due to the agreement. These differences demonstrate the limitations of CGE models, especially in terms of sectoral aggregation, which does not discriminate between the automotive and auto parts industries, nor does it differentiate the segments and products contained within them.

Historical experience also shows that, under certain conditions, trade liberalisation, in general and FTA-induced, can substantially affect automotive production. One such example is Australia, where trade liberalisation (including an FTA signed with a regional automotive hub such as Thailand) combined with the exchange rate appreciation practically determined the disappearance of the country's automotive production in recent years (Truett; Truett, 2018).

Moreover, the potential effects generated by the substantially greater international competitiveness of the EU under the agreement would be aggravated by several attributes of the automotive value chain and its regulation in both regions.

First, the import tariffs applied to vehicles and auto parts by Mercosur countries are substantially higher than those applied by the EU, indicating an important asymmetry in the preferences granted to these sectors under the agreement.

Second, production scale in the EU is several times larger than in Argentina or Brazil, even at the level of average vehicle production per plant. These differences are exacerbated in automotive groups of European origin (except for Fiat in Brazil). Thus, considering the existing economies of scale in the automotive industry, they might have the greatest incentives to substitute automotive production in Mercosur for EU imports. A potential partial protection of South American automotive production, however, is its production specialisation: while Argentina increasingly specialises in pickup trucks, Brazil focuses on flex-fuel engines vehicles – both products in which the EU is less specialised.

Third, with one of the highest motorisation rates in the world, the EU has a saturated domestic automotive market, where vehicle sales have been practically stagnant for the last 15 years. As a developed region, the EU leads the new trends in mobility, with consumers switching from private vehicle to public transport, shared mobility and/or rental, in different forms and combinations. Conversely, Argentina and Brazil have much lower motorization rates, are less affected by new mobility trends and, thus, have greater potential for domestic automotive market growth. Again, the Mercosur-EU agreement presents an incentive for firms to exploit the opening of the Mercosur automotive market by exporting their surplus vehicles and increasing the use of installed capacity in their European factories, in detriment of the Mercosur production.

Fourth, given the accumulation of origin between both regions, the rules of origin will not generate a hidden protection for the Mercosur automotive chain. At the same time, this may favour the entry into Mercosur of third market suppliers that are incorporated into European production, since the EU applies much lower tariffs to auto parts and has signed FTAs with important auto parts producers.

Fifth, the EU applies a significant number of TBTs in the automotive industry, especially because it does so at the regional and national levels. Importantly, these TBTs tend to raise the quality standards that products must meet to enter the market. Since automakers and many tier-one auto parts companies that have become global suppliers have installed capacity in both regions, they will hardly choose to transfer the necessary technology for complying with these standards and accessing the EU market to Mercosur, when they already have those capacities in Europe.

What this presence of the same automotive companies and many auto parts companies in both regions suggests is that the agreement will promote an interregional reallocation of resources for each company, guided mainly by static efficiency, rather than a dynamic process of technology adoption and learning, as would be the case in more atomised markets with less intra-firm interregional trade.

In this scenario, if the agreement is ratified and the Mercosur countries wish to continue promoting their automotive and auto parts industry, one can propose transforming the commercial protection of these activities (which will be eliminated by the FTA in the medium term) by productive promotion policies. This has the advantage, in theory, of encouraging production without affecting consumption, contrary to trade protection, which increases the price of goods. Thus, if car companies

engage in practices such as price discrimination (benefiting from the significant supply concentration), the elimination of EU import duties would not necessarily lead to a significant drop in the domestic price of vehicles in Mercosur. If so, most of the surplus that is no longer taxed as tariffs would be appropriated by automakers, and not by consumers.

Productive promotion policies, however, are also very restricted by both regional commitments and multilateral agreements, such as those enforced by the WTO. WTO regulations prohibit export subsidies but consider production subsidies actionable. Actionable subsidies are subject to challenge, either by multilateral dispute settlement or by countervailing action, if they cause adverse effects to the interests of another Member. Although they are not immediately appealed, the institutional fragility of such incentives means that agents do not incorporate them into their medium and long term planning, so they would not significantly affect their investment decisions. One example was the adverse result from the WTO Panel initiated by the EU and Japan against Brazil for giving tax exemptions to automotive producers for purchasing local auto parts under the Inovar-Auto plan, among others (Ornelas; Puccio, 2020).

In face of these limitations, a better proposal would be to replace commercial protection with subsidised technological capabilities, such as training specialised human resources and financing research and development projects. Given their medium-term effects, these policies must be implemented before trade liberalisation. However, they cannot completely replace the effect of the high trade protection that Mercosur presents, even in the medium term. Finally, these policies might be more effective in promoting automotive and auto parts production for sectors in which Argentina and Brazil are more specialised than the EU (such as pickup trucks in Argentina and flex-fuel vehicles in Brazil).

In conclusion, if the agreement is ratified, the automotive chain in Mercosur will face substantial challenges due to the significant incentives to increase EU imports, which could affect its production and employment. This paper sought to conducted a detailed analysis of the sectors potentially affected by the agreement, identify a few niches with opportunities for Mercosur and outline some policy proposals to mitigate the potential negative effects for the automotive chain in Argentina and Brazil.

References

ACEA. *Making the transition to zero-emission mobility. 2020 progress report.* European Automobile Manufacturers Association (ACEA), 2020. Available at: https://www.acea.be/uploads/publications/ACEA_progress_report_2020.pdf. Last accessed: Dec. 21, 2020.

ALTENBURG, T. *From combustion engines to electric vehicles*: a study of technological path creation and disruption in Germany. Bonn: Deutsches Institut für Entwicklungspolitik (DIE), 2014. (Discussion Paper, n. 29).

ANFAVEA. *Anuário da Indústria Automobilística Brasileira 2019*. São Paulo: Associação Nacional dos Fabricantes de Veículos Automotores (Anfavea), 2019.

ANFAVEA. *Mobilidade através das gerações*. Associação Nacional dos Fabricantes de Veículos Automotores (Anfavea) y SPRY, 2018. Available at: https://anfavea.com.br/docs/apresentacao_final_07_11_18.pdf. Last accessed: Feb. 24, 2021.

BALASSA, B. *The theory of economic integration*. R.D. Irwin, 1961.

BALCET, G.; IETTO-GILLIES, G. Internationalisation, outsourcing and labour fragmentation: the case of FIAT. *Cambridge Journal of Economics*, v. 44, n. 1, p. 105-128, 2020.

BALDWIN, R. *21st Century regionalism*: filling the gap between 21st Century Trade and 20th Century Trade Rules. Centre for Economic Policy Research, 2011. (CEPR Policy Insight, n. 56).

BALDWIN, R.; VENABLES, A. Regional economic integration. *Handbook of International Economics*, v. 3, p. 1597-1644, 1995.

BECKER, H.; BALAC, M.; CIARI, F.; AXHAUSEN, K. Assessing the welfare impacts of Shared Mobility and Mobility as a Service (MaaS). *Transportation Research Part A: Policy and Practice*, n. 131, p. 228-243, 2020.

BEKERMAN, M.; DULCICH, F.; GAITE, P. La caída de las exportaciones industriales a Brasil, ¿cuánto afectó a la producción argentina? *Economia e Sociedade*, v. 29, n. 2, p. 609-638, 2020.

BRITO, T.; ISLAM, T.; STETTLER, M.; MOUETTE, D.; MEADE, N.; DOS SANTOS, E. Transitions between technological generations of alternative fuel vehicles in Brazil. *Energy Policy*, v. 134, 2019.

BURRELL, A.; FERRARI, E.; MELLADO, A. G.; HIMICS, M.; MICHALEK, J.; SHRESTHA, S.; VAN DOORSLAER, B. *Potential EU-Mercosur free trade agreement*: impact assessment. V. 1: Main results (n. JRC67394). Joint Research Centre (Seville site), 2011.

CABIGIOSU, A.; ZIRPOLI, F.; CAMUFFO, A. Modularity, interfaces definition and the integration of external sources of innovation in the automotive industry. *Research Policy*, v. 42, n. 3, p. 662-675, 2013.

CAETANO, G.; POSEE, N. Sus impactos en el Uruguay desde una perspectiva de historia política. In: ACUERDO de Asociación UE–Mercosur, Friedrich Ebert Stiftung, Bruselas, 2020.

CANTARELLA, J.; KATZ, L.; MONZÓN, N. Argentina: factores que debilitan la integración de autopartes locales. In: PANIGO et al. (Coord.). *La encrucijada del autopartismo en América Latina*. UNDAV, Avellaneda, 2017.

CEPE. *Foro Mundial para la Armonización de la Reglamentación sobre Vehículos (WP.29). Funcionamiento. Participación.* Comisión Económica para Europa (CEPE), Naciones Unidas, Ginebra, 2012.

CEPEDA, H.; ROZEMBERG, R.; HURTADO, E. *Convergencia regulatoria del complejo automotor del MERCOSUR para impulsar la integración*. Inter-American Development Bank, 2017. Available at: http://www.unsam.edu.ar/escuelas/politica/ideas/documentos/Sectores%20Productivos/Complejo%20automotor.pdf. Last accessed: Mar. 26, 2021.

CORIAT, B. *El taller y el robot*: ensayos sobre el fordismo y la producción en masa en la era de la electrónica. 5. ed. en español. Siglo XXI editores, 2004.

DE MELLO, A. M.; MARX, R.; SOUZA, A. Exploring scenarios for the possibility of developing design and production competencies of electrical vehicles in Brazil. *International Journal of Automotive Technology and Management*, v. 13, n. 3, p. 289-314, 2013.

DIAO, X.; DÍAZ-BONILLA, E.; ROBINSON, S. Scenarios for trade integration in the Americas. *Économie internationale*, n. 2, p. 33-52, 2003.

DOMAŃSKI, B; LUNG, Y. The changing face of the European periphery in the automotive industry. *European Urban and Regional Studies* v. 16, n. 1, p. 5-10, 2009.

DULCICH, F.; OTERO, D.; CANZIAN, A. Evolución reciente y situación actual de la producción y difusión de vehículos eléctricos a nivel global y en Latinoamérica. *Asian Journal of Latin American Studies*, v. 32, n. 4, p. 21-51, 2019.

EUROPEAN COMMISSION. *Action Plan on Critical Raw Materials – Factsheet*. European Commission, 2020. Available at: https://ec.europa.eu/docsroom/documents/42852. Last accessed: Feb. 10, 2021.

FLÔRES, R.; WATANUKI, M. *Integration options for Mercosur*: a quantitative analysis by the AMIDA model. Institute for the Integration of Latin America and the Caribbean (INTAL), Inter-American Development Bank, 2008. (Working Paper, n. 36).

FUJIMOTO, T. An architectural analysis of green vehicles-possibilities of technological, architectural and firm diversity. *International Journal of Automotive Technology and Management*, v. 17, n. 2, p. 123-150, 2017.

GEREFFI, G.; HUMPHREY, J.; STURGEON, T. The governance of global value chains. *Review of International Political Economy*, v. 12, n. 1, p. 78-104, 2005.

GHIOTTO, L.; ECHAIDE, J. *El acuerdo entre el Mercosur y la Unión Europea*: estudio integral de sus cláusulas y efectos. Consejo Latinoamericano de Ciencias Sociales, 2020.

GOLDBERG, P. K.; VERBOVEN, F. *The evolution of price dispersion in the European car market*. National Bureau of Economic Research, 1998. (Working Paper, n. 6818).

GROSSMAN, G.; Y HELPMAN, E. *Technology and trade*. National Bureau of Economic Research, 1994. (Working Paper, n. 4926).

HABERLER, G. Some problems in the pure theory of international trade. *The Economic Journal*, v. 60, n. 238, p. 223-240, 1950.

HORJ, A.; PEKARSKAYA, M.; HEAL, A. *Technical barriers to trade*: evidence from the Republic of Korea's automotive sector. United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), 2014. (Trade Insights, n. 1).

HUMPHREY, J.; SCHMITZ, H. How does insertion in global value chains affect upgrading in industrial clusters? *Regional Studies*, v. 36, n. 9, p. 1017-1027, 2002.

HUSAN, R. The continuing importance of economies of scale in the automotive industry. *European Business Review*, v. 97, n. 1, p. 38-42, 1997.

IEA. *Global EV Outlook 2018*: towards cross-modal electrification. International Energy Agency, 2018.

IEA. *Global EV Outlook 2020*: entering the decade of electric drive? International Energy Agency, 2020.

KRISHNA, K. *Understanding rules of origin*. National Bureau of Economic Research, 2005. (Working Paper, n. 11150).

KRUGMAN, P. A model of innovation, technology transfer, and the world distribution of income. *Journal of Political Economy*, v. 87, n. 2, p. 253-266, 1979.

LABORDE, D.; RAMOS, M. Will regionalism survive multilateralism? The EU-Mercosur example. In: ANNUAL CONFERENCE ON GLOBAL ECONOMIC ANALYSIS. Assessing the Foundations of Global Economic Analysis, 10. West Lafayette, USA: GTAP, Purdue University, 2007.

LAENS, S.; TERRA, M. *La agenda externa del MERCOSUR*: el impacto de negociaciones con el ALCA, la UE y la OMC. Documento de Trabajo/FCS-DE; n. 3/06, 2006.

LAFAY, G. The measurement of revealed comparative advantages. In: DAGENAIS, M. G.; MUET, P. A. (Ed.). *International trade modelling.* London: Chapman & Hill, 1992.

LÓPEZ, A.; OBAYA, M.; PASCUINI, P.; RAMOS, A. *Litio en la Argentina*: oportunidades y desafíos para el desarrollo de la cadena de valor. Banco Interamericano de Desarrollo, 2019. (Monografía del BID, n. 698).

LSE. *Sustainability impact assessment in support of the association agreement negotiations between the European Union and Mercosur*. London School of Economics and Political Science, 2020.

LUTZ, M. Pricing in segmented markets, arbitrage barriers, and the law of one price: evidence from the European car market. *Review of International Economics*, v. 12, n. 3, p. 456-475, 2004.

MARTIN, S.; SCOTT, J. The nature of innovation market failure and the design of public support for private innovation. *Research Policy*, v. 29, n. 4-5, p. 437-447, 2000.

MILLER, J.; BRAUN, C. *Cost-benefit analysis of Euro VI heavy-duty emission standards in Argentina*. ICCT White Paper, International Council on Clean Transportation, 2020.

MONTEAGUDO, J.; WATANUKI, M. Regional trade agreements for Mercosur: a comparison between the FTAA and the FTA with the European Union. *Économie Internationale*, n. 2, p. 53-76, 2003.

MOTOHASHI, K.; YUAN, Y. Productivity impact of technology spillover from multinationals to local firms: Comparing China's automobile and electronics industries. *Research Policy*, v. 39, n. 6, p. 790-798, 2010.

MUNIZ, S.; BELZOWSKI, B. Platforms to enhance electric vehicles' competitiveness. *International Journal of Automotive Technology and Management*, v. 17, n. 2, p. 151-168, 2017.

ORGANISATION INTERNATIONALE DES CONSTRUCTEURS D'AUTOMOBILES – OICA. *World Motor Vehicle Production*: 2017 Statistics, Groups PSA, Renault and Hyundai. 2020. Available at: https://www.oica.net/category/production-statistics/2017-statistics/. Last accessed: Dec. 22, 2020.

ORNELAS, E.; PUCCIO, L. Reopening Pandora's box in search of a WTO-compatible industrial policy? The Brazil –Taxation Dispute. *World Trade Review*, v. 19, n. 2, p. 249-266, 2020.

PANIGO, D. T.; GÁRRIZ, A.; SCHORR, M.; LAVARELLO, P. *La encrucijada del autopartismo en América Latina*. Buenos Aires: UNDAV Ediciones, 2017.

PAVLÍNEK, P.; ALÁEZ-ALLER, R.; GIL-CANALETA, C.; ULLIBARRI-ARCE, M. *Foreign direct investment and the development of the automotive industry in Eastern and Southern Europe*. European Trade Union Institute, 2017. (Working Paper, n. 03).

PETERS, J.; BECKER, W. Vertical corporate networks in the German automotive industry: structure, efficiency, and R&D spillovers. *International Studies of Management & Organization*, v. 27, n. 4, p. 158-185, 1997.

SARAVANAN, A. P.; PUGAZHENDHI, A.; MATHIMANI, T. A comprehensive assessment of biofuel policies in the BRICS nations: implementation, blending target and gaps. *Fuel*, v. 272, 2020.

SECRETARÍA DE POLÍTICA ECONÓMICA – SPE. *Informes de cadenas de valor*: automotriz y autopartista. 2018. Available at: https://www.economia.gob.ar/peconomica/docs/2018/SSPMicro_Cadenas_de_valor_Automotriz.pdf. Last accessed: Aug. 26, 2019.

STURGEON, T. How do we define value chains and production networks? *IDS bulletin*, v. 32, n. 3, p. 9-18, 2001.

STURGEON, T.; MEMEDOVIC, O.; VAN BIESEBROECK, J.; GEREFFI, G. Globalisation of the automotive industry: main features and trends. International *Journal of Technological Learning, Innovation and Development*, v. 1, n. 1, p. 7-23, 2009.

SUÁREZ-CUESTA, D.; LATORRE, M. *A general equilibrium assessment of the EU-Mercosur Association Agreement.* 2021. Available at: https://ssrn.com/abstract=3973010. Last accessed: Jun. 9, 2022.

TRUETT, L.; TRUETT, D. A requiem for the Australian motor vehicle industry. *Applied Economics*, v. 50, n. 40, p. 4343-4359, 2018.

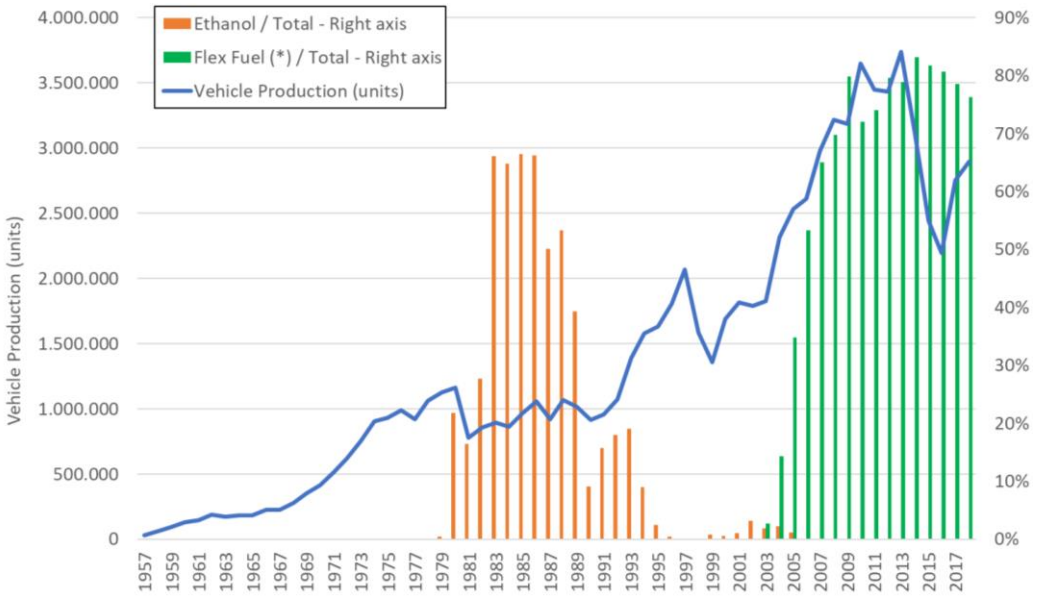
WORLD HEALTH ORGANIZATION – WHO. *Global status report on road safety 2018*. 2018.

WORLD HEALTH ORGANIZATION – WHO. *The WTO Agreements Series*: technical barriers to trade. Switzerland: World Trade Organization, Geneva, 2014.

YU, A.; DE SOUZA NASCIMENTO, P.; NIGRO, F.; FREDERICK, B.; VARANDAS, A.; VIEIRA, S.; ROCHA, R. The evolution of flex-fuel technology in Brazil: the Bosch case. In: IEEE. *PICMET 2010 Technology Management for Global Economic Growth*. 2010. p. 1-11.

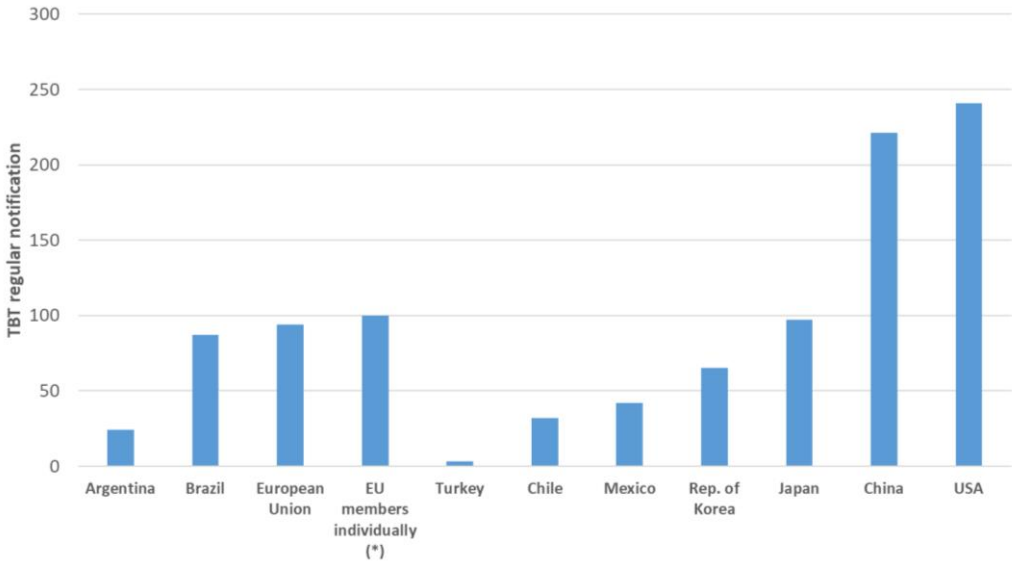
Statistical Annex

Graphic A.1
Evolution of automotive production and incidence of alternative powertrains in Brazil



Source: Author's own elaboration based on ANFAVEA (2019).
(*) Note: Flex fuel vehicle is a vehicle with an internal combustion engine designed to run on ethanol fuel blended with gasoline.

Graphic A.2
Accumulated TBT regular notifications applied to the automotive value chain by country or region



Source: Author's own elaboration based on World Trade Organization.
Note: Includes notifications corresponding to the Harmonized System chapter 87, ICS 43 ("road vehicle engineering") or with the word "vehicle" in the product definition.
(*) Note: Is the sum of Netherlands (35 TBT regular notifications), Sweden (14), Czech Republic (11), France (6), Slovak Republic (6), Belgium (5), Italy (5), Denmark (4), Spain (4), Croatia (3), United Kingdom (3), Finland (2), Hungary (1), and Slovenia (1).

Table A.1

Intra-EU and extra-EU trade balance for the automotive and auto parts industry subsectors in selected European countries. 2017-2018 average in millions of USD.

Economic Sector	HS 2017	Description	GERMANY		FRANCE		AUSTRIA		ITALY		SPAIN		CZECHIA		HUNGARY		SLOVAKIA		ROMANIA		EU28 - OTHERS	
			Extra - EU28	Intra - EU28	Extra - EU28	Intra - EU28	Extra - EU28	Intra - EU28	Extra - EU28	Intra - EU28	Extra - EU28	Intra - EU28	Extra - EU28	Intra - EU28	Extra - EU28	Intra - EU28	Extra - EU28	Intra - EU28	Extra - EU28	Intra - EU28	Extra - EU28	Intra - EU28
Vehicles and platforms	8701	Tractors	2.530	3.806	573	-140	132	96	462	-445	101	-363	-25	-532	-37	-366	-16	-284	-24	-633	3.381	886
	8702	Public passenger transportation vehicles	47	324	-239	-375	-200	-64	-208	-452	27	-22	14	599	-27	-39	-9	-73	-53	-27	43	234
	8703	Motor cars	67.257	33.271	-1.004	-11.682	1.247	-5.292	3.735	-18.043	886	12.819	3.169	14.500	1.098	4.329	5.406	10.771	459	1.559	14.715	-38.801
	8704	Vehicles for the transport of goods	3.423	1.351	255	556	707	-230	-161	2.237	537	3.054	10	-637	24	-634	5	-157	-116	-454	115	-6.766
	8705	Special purpose motor vehicles (e.g. breakdown lorries, road sweeper lorries, etc.)	1.906	1.368	186	-299	194	24	358	562	78	-149	1	-63	20	22	0	-27	-2	-82	701	-550
	8706	Chassis fitted with engines	95	-45	-2	-93	-1	-24	7	-8	63	-122	19	7	0	1	0	-3	-1	-22	611	-251
	8707	Bodies (including cabs) for motor vehicles	680	-86	20	-12	30	-6	42	92	265	-3	232	-106	1	15	74	222	48	-3	-690	-299
Auto parts	4010	Conveyor or transmission belts or belting of vulcanised rubber	370	144	43	-133	7	-27	54	54	6	2	6	-44	16	17	11	-3	7	63	138	14
	4011	New pneumatic tyres of rubber	-76	-1.008	93	-1.117	-40	-586	-448	-259	80	494	336	890	81	879	284	867	273	857	-2.452	-517
	8407	Internal combustion engines	2.507	-1.359	-201	1.061	735	1.357	317	82	534	-1.264	17	-762	160	3.036	-134	-596	203	406	510	-511
	8408	Diesel or semi-diesel engines	3.301	-1.137	312	1.285	391	1.351	1.432	-336	236	-896	-17	-1.385	312	1.629	9	-351	-180	-288	3.351	270
	8409	Parts of engines	2.732	4.231	117	-738	53	-1.099	127	138	-55	-220	97	253	-58	-1.048	-294	-128	22	-120	659	-3.088
	8483	Transmission shafts, gear boxes and other speed changers	3.787	2.931	137	-298	147	-619	486	1.193	395	-296	-32	-131	-84	-605	-64	704	-9	-111	732	-1.762
	850710	Electric accumulators	427	175	34	-502	4	196	0	113	140	372	60	294	7	-26	-3	-69	5	-3	-349	-332
	870810	Bumpers	643	249	6	-81	0	-88	-2	70	6	-123	18	172	12	-40	-5	-135	6	-8	27	-447
	870821	Safety seat belts	356	-622	-12	-57	1	-9	9	-16	-3	-192	-2	274	1	301	-1	-55	58	482	26	-94
	870829	Parts and accessories of vehicles bodies, other than safety seat belts	4.285	-2.741	63	-343	28	-273	153	494	-37	-972	-84	2.212	14	369	-143	-1.949	255	319	309	-3.196
	870830	Brakes	1.175	-159	181	-367	1	-170	229	950	79	217	86	560	6	170	-69	21	103	-119	-231	-424
	870840	Gear boxes	7.374	1.188	-372	137	24	-203	125	41	-214	-1.146	-144	-114	-138	-1	-347	-618	128	910	-485	-3.704
	870850	Drive-axles with differential	1.436	857	103	-84	30	313	214	804	-24	-324	-94	-372	-7	42	-153	-103	108	-97	34	-998
	870870	Road wheels	31	47	-50	-123	-55	129	-103	499	-130	-37	-8	237	47	164	-8	-290	-15	-18	-480	-114
	870880	Suspension systems and parts thereof (including shock-absorbers)	1.044	794	35	-149	-10	-81	10	-201	54	334	49	144	-5	-10	-3	241	20	-27	-136	-321
	870891	Radiators	216	-331	5	56	-74	52	2	-39	-5	53	-6	340	-9	-97	6	188	23	57	1	199
	870892	Silencers (mufflers) and exhaust pipes	295	473	10	-204	-4	173	31	88	11	-49	-39	393	0	-96	-23	-162	10	-32	-16	483
	870893	Clutches	801	858	75	-144	21	-48	0	-96	-2	-16	-12	-42	53	420	-15	279	1	-110	-31	-399
	870894	Steering wheels, steering columns and steering boxes	1.623	-597	-132	524	20	-77	-6	-132	-24	-523	24	100	128	424	-132	-231	53	681	-71	-9
	870895	Safety airbags with inflater system	451	-46	27	18	-24	30	-2	-43	31	-184	1	-124	-16	14	-1	-98	-19	585	32	486
	870899	Other vehicle parts and accessories	2.771	-64	839	-836	37	-237	1.317	1.447	1.568	-4.511	165	696	15	-864	-42	-520	202	-25	1.267	-3.441
Automotive chain - Total			114.871	45.561	1.120	-12.598	3.466	-5.434	7.278	-11.866	3.646	5.618	3.793	17.443	1.602	7.880	4.354	7.463	1.535	3.679	19.868	-62.153

Source: Author's own elaboration based on EuroStat and World Bank.

Note: In each row (for each product), the higher the trade balance, the higher the green shading. Similarly, the higher the trade deficit, the higher the red shading.

Table A.2
Taxonomy to analyse the static effects of the Mercosur-EU agreement on bilateral automotive trade between Argentina / Brazil and the EU

Expected sectoral static effect for Argentina / Brazil				Argentina / Brazil - World	
				Trade surplus	Trade deficit
EU 28 - World	Trade surplus	EU 28 - Arg/Bra	Trade surplus	↓	↓
			Trade deficit	↑	?
	Trade deficit	EU 28 - Arg/Bra	Trade surplus	?	↓
			Trade deficit	↑	↑

Source: Author's own elaboration

Note:

↑	*Argentina / Brazil - EU 28 trade balance increases*
↓	*Argentina / Brazil - EU 28 trade balance decreases*
?	*Unknown effect*

Table A.3
Taxonomy to analyse the static effects of the Mercosur-EU agreement on bilateral automotive trade between Argentina and Brazil

Intraregional trade flows Argentina from/to Brazil (*)		Trade balance Argentina - EU 28		
		↑	↓	?
Trade balance Brazil - EU 28	↑	**No effect**	**No effect (Higher Argentine imports from the EU 28 displace extra-regional suppliers)**	**No effect**
	↓	**No effect (Higher Brazilian imports from the EU 28 displace extra-regional suppliers)**	**Arg-Bra: (X-M) > 0 → DOE Arg-Bra: (X-M) < 0 → IOS**	**?**
	?	**No effect**	**?**	**?**

Source: Author's own elaboration

(*) Note:

↑	*Argentina / Brazil - EU 28 trade balance increases*
↓	*Argentina / Brazil - EU 28 trade balance decreases*
?	*Unknown effect*
IOS	*Import origin substitution from Brazil to EU 28*
DOE	*Displacement of exports to Brazil by EU 28*