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DOCUMENTO DE TRABAJO N° 280

Octubre de 2023

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Citar como:

González, Germán y Victoria Giordano (2023). Gravity Approach to the Impact of Crises on MERCOSUR Trade. *Documento de trabajo RedNIE N°280.*

Gravity Approach to the Impact of Crises on MERCOSUR Trade

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This version: September 18, 2023¹

Comments are welcome.

Abstract

The proliferation of regional trade agreements (RTAs) and the contagion of crises characterised the pre-pandemic global economy. Both are crucial for developing countries. This paper aimed to provide evidence on the impact of crises on RTAs by studying the behaviour of trade flows and using MERCOSUR as a case study. We based our empirical strategy on a traditional gravity approach, differentiating according to the origin of the crises and the type of exported goods. We confirm that MERCOSUR has been able to mitigate external and domestic shocks, but has exacerbated the effects of regional ones. Our findings point to the difficulties in consolidating the industrialisation process in the context of macroeconomic vulnerability and volatility, even despite the existence of RTAs.

1. Introduction

Two critical components characterise today's global economy. Regional trade agreements (RTAs) are the first. They account for a large share of global trade and are a stabilising factor in international relationships. These agreements promote growth and foreign direct investment. In addition, RTAs increase the volume of intra-regional and intra-industry trade between developed countries with a similar level of income. However, given their dependence on the world economic cycle, the impact of these agreements on less developed economies seems to be different.

RTAs between less developed nations are likely to produce few significant results (Viego & Corbella, 2017), and the economies involved have been much more competitive than

¹ There is a previous version of this paper in Spanish (*Aproximación mediante un modelo gravitacional a los efectos de las crisis económicas internas y externas en el MERCOSUR*), presented by Victoria Giordano at the *LVII Reunión Anual de la Asociación Argentina de Economía Política*, November 2022. The authors are grateful for the comments made by the participants and those of Maria Isabel Restrepo (UdeA, Colombia). This new version includes a reconsideration of the empirical strategy and results. The authors acknowledge the financial support of the General Secretariat of Science and Technology of the Universidad Nacional del Sur (this research was conducted as part of Projects PGI 24/E157 and PGI 24/E170). E-mail: ghgonza@uns.edu.ar

complementary (Rodríguez, 2018). In addition, countries with intermediate comparative advantages between themselves and the rest of the world benefit from RTAs, while the opposite is true for members with highly concentrated or extreme comparative advantages (Venables, 2003). Then, smaller nations tend to worry about the industrialisation process in the context of large asymmetries (Sanguinetti et al., 2009; Bekerman & Rikap, 2010)

The other critical feature is the greater capacity of local crises to have a significant global impact. Since the beginning of the 20th century, both developing and developed economies have been significantly affected by crisis contagion. Linking these two aspects of the world economy, Tortul and Corbella (2018) argued that, depending on their origin, economic crises could be a boost or an obstacle to integration. Specifically, it is expected that crises originating abroad strengthen economic integration, while the regional ones decelerate this process. Regionalism seems to be able to alleviate the impact of an external shock (Balkay, 2014). RTAs are therefore a viable tool for achieving economic independence from the global economic centre (Quiral Rojas, 2009). However, these statements are not obvious. The scarce empirical literature shows ambiguous results, as seen in the following section.

We aimed to add further evidence to the study of the effects of economic crises on RTAs. We focused on trade flows and used the Southern Common Market (MERCOSUR, as per its initials in Spanish) as a case study. The choice of MERCOSUR is due to its recurrent experience of domestic instability and the relevant impact of global crises on its economy. To this end, we formulated a series of hypotheses and tested them using an appropriate specification of the gravity model of trade, considering the origin of the crisis, the destination of the exports and the type of goods exported. The conclusions have implications for identifying conditions conducive to progress in regional interregional negotiations.

The paper is organised as follows. Section 2 presents the hypotheses after a review of previous research. Section 3 outlines the empirical specification and data sources. Section 4 provides the results and their discussion, while Section 5 concludes.

2. Previous Research

2.1 Regional Integration and Crisis

Growing interdependence is not limited to RTAs. Interdependence refers to the reciprocal dependence between nations. It has been on the rise globally over the last three centuries, despite some temporary setbacks such as the World Wars of the 20th century and the recent COVID-19 pandemic.

Interdependence is crucial for RTAs, because it determines their likelihood of survival by increasing the cost of breaking the agreement and the probability of contagion of economic crises without adequate countercyclical policies. When intra-regional trade is substantial, regional interdependence is high. Then, during an economic downturn, the risk of conflict between the members grows if uncoordinated domestic policies affect trade flows.

Crises can significantly influence intra-regional trade. Following Rose and Spiegel (2010), trade linkages play a crucial role in transmitting the impact of crises across countries and regions. Nonetheless, this theoretical notion has been empirically debatable. The literature has varied regarding the importance of trade in the transmission of crises. For instance, Eichengreen and Rose (1999), Glick and Rose (1999), and Forbes and Rigobon (2000) presented comparable findings, indicating that strong trade relationships between two nations substantially increase the probability of contagion. However, Baig and Goldfajn (1999), who studied the East Asian crisis, and Masson (1998), who did so for the Mexican and Asian cases, contended that trade volumes between countries are not causing contagion factors.

Contagion seems to be regional rather than global due to the intra-regional nature of trade (Dornbusch et al., 2000). Nevertheless, there is no empirical consensus on how the crisis affects the direction of trade flows within an RTA. As an illustration, Elliott and Ikemoto (2004) analysed the effects of the Asian crisis on the Association of Southeast Asian Nations (ASEAN). Their findings showed that the agreement stimulated economic activity and intra-regional imports during this situation. However, Kahouli (2016) examined six RTAs and found that economic crises reduce export growth and bilateral capital flows. This is in line with the evidence obtained by Ma and Cheng (2005) and Brambila-Macias et al. (2011).

In South America, intra-regional trade reached its highest levels in the periods of World Wars and the Great Depression, contributing to regional stability (Carreras-Marín et al., 2013). During the 2001 regional crisis, MERCOSUR members reoriented their exports towards external markets but intensified intra-regional trade with the extra-regional crises of 1994 and 2008 (Tortul & Corbella, 2018). Similarly, Fojtíková (2010) claimed that, in the 2008 crisis, the European Union (EU) suffered more in terms of exports in intra-EU trade than in extra-EU one.

Two notable observations emerge from the preceding paragraphs: the need to have more evidence of the impact of the crisis on MERCOSUR trade and to consider both the origin of the crisis and the direction of trade in the evaluation.

2.2 MERCOSUR

The end of the so-called ‘golden age’ or ‘apogee’ of MERCOSUR is closely linked to the devaluation of the Brazilian real in 1999 (Bouzas, 2001). Since then, all member governments adopted unilateral decisions and security measures or conducted bilateral negotiations (Delbianco et al., 2021; González & Cabrera Romero, 2019). Unfortunately, according to Caetano (2011), these economies did not have the political bonus to redirect the integration process. The author argued that the convertibility crisis in Argentina and the resulting one in Uruguay in 2002 showed governments the strong interdependence between MERCOSUR members and the need to coordinate policies and create regional political-economic instruments.

Despite attempts to strengthen the regional partnership between 2002 and 2006, MERCOSUR suffered a major setback from 2007 onwards (González & Delbianco, 2021). In this sense,

Malamud (2008) noted that, while governments were able to reach agreement during periods of low interdependence, this was very difficult in contexts of high interdependence.

In purely commercial terms, from the Treaty of Asuncion until 1995, intra-MERCOSUR trade flows grew rapidly, especially exports, which went from 11.1% to 20.4% (Inter-American Development Bank [IDB], 1996). During this period, Argentina and Brazil accounted for almost 90% of these exports, and this was due to the growth in aggregate demand in Brazil and the economic recovery in Argentina. Although extra-zone investment flows were not significant, the sectors with the largest number of affiliates of transnational companies experienced a process of productive complementation and rationalisation. This was particularly the case in manufacturing sectors such as automobiles, food and beverages, petrochemicals and textiles. The IDB (1998) highlighted the progress of trade integration among the partners, the growing interdependence of the economies, and the failure of the bloc to improve its integration into the world market.

With the Asian crisis in 1997, both intra- and extra-regional trade, which had been growing at rates above 20% and 10%, respectively, fell sharply (IDB, 1999). Although the MERCOSUR economies, especially Brazil, suffered an economic slowdown due to the international scenario, the impact on extra-regional trade was worse. The devaluation of the real in 1999 and the ensuing economic recession created the conditions for the sharpest decline in trade to that date: intra-regional trade fell by 25%, while trade with the rest of the world decreased by 9.4%. In addition, the consequent shrinking of markets because of the contraction of regional demand, the change in exchange rates and the steep fall in international prices of commodities and tradable goods led Brazil and Argentina to a conflict between the end of 1998 and mid-2000s.

The ‘caipirinha effect’ (a name used to refer to the contagion of the Brazilian economic crisis to other countries, especially Argentina) caused a stagnation in intra-regional trade, in contrast to exports to the rest of the world that continued to grow thanks to the recovery in Asia and the incipient rise in export prices. This trend in intra-regional trade worsened with the crises of the other MERCOSUR members, widening the gap between intra- and extra-regional trade in 2002 (IDB, 2002).

Intra-MERCOSUR exports have almost halved since the boom of the 1990s, particularly in the case of medium- and high-tech manufactured goods. As a result, the share of intra-regional exports fell to 11.5% at the end of the period, similar to that observed in 1991.

In the following years, MERCOSUR trade showed a positive evolution. In 2003, trade flows began to recover, and in 2004, exports reached a new historical high (IDB, 2004). In relation to the period between 2003 and 2005, exports increased their value at an average annual rate of 22.6%, driven by the rise in the prices of raw materials and industrial products (IDB, 2005). This upward trend continued through 2008. The growth of extra-MERCOSUR trade flows was the best since its creation (IDB, 2009).

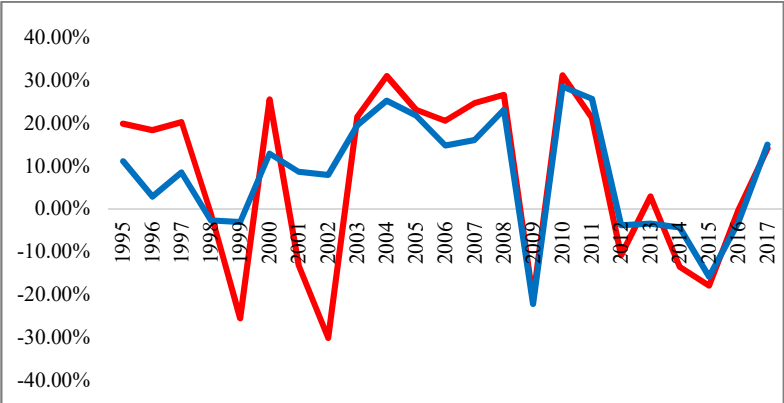
In the first half of 2009, the subprime mortgage crisis hit the region. Intra-MERCOSUR trade contracted by 29.9% year-on-year, while extra-MERCOSUR trade fell by 25.4%. After a

recovery between 2010 and 2011, regional trade had another bad year in 2012. Intra-regional exports decreased more than those to the rest of the world, partly due to the reduction in trade between Argentina and Brazil. This was the first time that intra-MERCOSUR trade declined while member countries grew (IDB, 2013).

Between 2013 and 2016, there was a slowdown in demand from the main trading partners and, consequently, the prices of the main exported products, such as soybeans, iron and oil, lowered (IDB, 2015). Only at the end of 2016, there were signs of an incipient recovery, reinforced in 2017 by the dynamism of Asian economies and the reversal of commodity price trends. Intra-regional exports grew faster than extra-regional ones, mainly due to demand from the smaller MERCOSUR members.

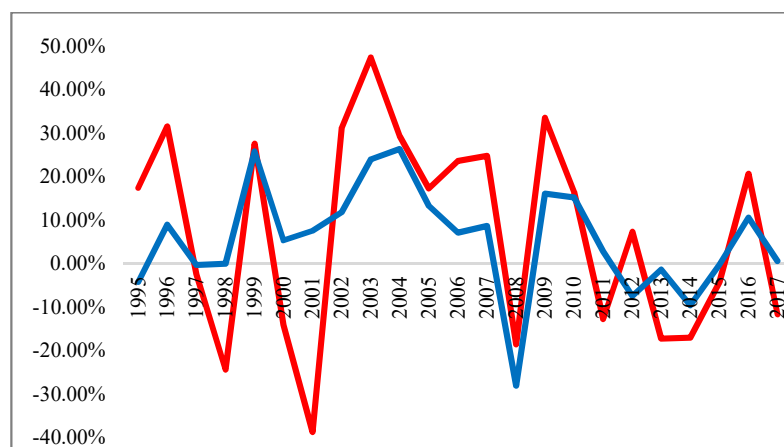
Figure 1 shows the behaviour of total MERCOSUR exports in terms of their year-to-year variation by destination. In absolute terms, intra-regional trade is more volatile than extra-regional one, even in unfavourable situations. This observation is more controversial in Figure 2, which evidences the same indicator for manufactured exports. To identify the items to include in this characterisation, we used the classification proposed by Delbianco et al. (2021).

Figure 1. Variation in total exports by destination: Region (red) vis-à-vis World Market (blue)



Source: Prepared by the authors based on COMTRADE.

Figure 2. Variation in Manufactured Exports by Destination: Region (red) vis-à-vis World Market (blue)



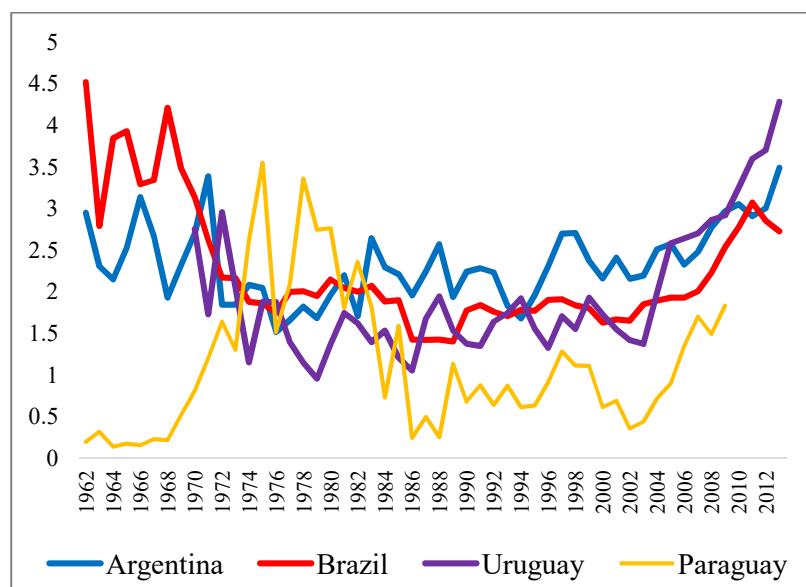
Source: Prepared by the authors based on COMTRADE.

The crisis that began in Brazil and spread to Argentina in 2001 left much of the installed capacity of the Argentine industry idle. Although the production of primary products, such as food, oil, steel and chemicals, recovered soon, the structural change necessary to redefine the specialisation profile did not occur (Ortiz & Schorr, 2009). Brazil, for its part, maintained an industrial profile that lasted until the 1990s (Mattos & Fevereiro, 2014). However, after the crisis, the weight of industrial products declined. This behaviour continued in the following years due to Chinese demand for raw materials, which lowered the relative prices of manufactured goods.

On the other hand, Uruguay and Paraguay have shown signs of industrialisation in their exports. During the 2000s, Paraguay's industrial exports increased thanks to trade agreements. However, with the global crisis of 2008, this growth slowed sharply, especially in destinations outside the region. Uruguay's exports were mostly primary products but included some high- and medium-technology manufactured goods.

Delbianco et al. (2021) provided evidence of the existence of a U-shaped geographical bias in manufactured exports —measured by the ratio of the manufactured component in regional exports and the same indicator in world exports— during the years under study. This means that the greatest intra-regional trade coincided with the period in which the weight of manufacturing in extra-regional exports was greater than that in intra-regional ones. Figure 3 shows this behaviour. According to their results, the combination of the volatility of the 1990s and the boom in commodity prices in the following decade would explain the setback in the industrialisation process and the predominance of exports of natural resource-based products.

Figure 3. Geographical Bias in Manufactured Exports: Region vis-à-vis World Market



Source: Prepared by the authors based on Delbianco et al. (2021).

2.3 Hypotheses

Considering the above description of MERCOSUR trade, and following Delbianco et al. (2021) on MERCOSUR industrialisation, we formulated five hypotheses on the relationship between external, regional and domestic crises and intra- and extra-regional, manufactured and primary exports.

During periods of greater external difficulties, MERCOSUR members' exports to their partners and the rest of the world tend to decline. However, the trading bias towards members increases (Hypothesis H1). In the context of economic crises, both manufactured and primary exports are negatively affected. Nevertheless, within this dynamic, the manufactured content of intra-regional exports tends to increase, while the bias towards primary goods in extra-regional exports decreases (Hypothesis H2). In times of less external difficulties, the opposite sign prevails.

In the scenario of greater regional problems, MERCOSUR members' exports tend to fall, and this happens with intra- and extra-regional ones. However, the trading bias towards MERCOSUR members decreases (Hypothesis H3), and there is a redirection of both manufactured and primary goods to extra-regional markets. This reduces the manufactured goods bias of intra-regional trade and increases the primary goods bias of extra-regional trade (Hypothesis H4).

Finally, when the difficulties are domestic, all the expected effects on intra- and extra-regional exports and those by type of goods are negative. Therefore, the usual effects of an economic crisis are expected, and all the initial biases persist (Hypothesis H5). Table 1 summarises the hypotheses proposed.

Table 1. Hypotheses by Crisis Scenario

Fact	Scenarios defined by crisis origin		
	External	Regional	Domestic
Trading bias towards MERCOSUR members	increases (H1)	decreases (H3)	persists
Primary goods bias of extra-regional trade	decreases	increases	persists
Manufactured goods bias of intra-regional trade	increases (H2)	decreases (H4)	persists (H5)

Source: Prepared by the authors

When the overall scenario (regional and global) is favourable, there is no definite result regarding the share of manufactures in intra-MERCOSUR exports. According to Delbianco et al. (2021), the effect depends on the domestic conditions in previous periods. In short, the share of manufactures in extra-regional exports would be subject not only to current global and regional factors, but also to domestic ones in the immediately preceding periods. There is no hypothesis on this conjecture, as it is beyond the scope of this paper.

3. Methods and Data

3.1 Specification and Expected Results

The traditional specification of the gravity equation of trade assumes a directly proportional relationship between the size of the economies involved and the trade between them and an inversely proportional relationship with the frictions to trade. The usual frictions are the costs associated with logistics and transport and the restrictive trade policies of the countries of origin and destination. Then, expression (1) is the model that we used as a control:

$$\begin{aligned} \ln X_{odt}^k = & \alpha + \eta_1 \ln GDP_{ot} + \eta_2 \ln P_{ot} + \eta_3 \ln GDP_{dt} + \eta_4 \ln P_{dt} + \eta_5 K_{odt} \\ & + \eta_6 \ln(|PGDP_{ot} - PGDP_{dt}|) + \eta_7 \ln D_{odt} + \eta_8 ADJ_{odt} + \eta_9 RTA_{djt} + \ln \mu_{odt} \end{aligned} \quad (1)$$

where o , d , and t denote origin, destination, and time unit, respectively. Since only MERCOSUR was considered as origin, X_{odt}^k represents the exports of good k originated in the MERCOSUR member o and destined to d in year t .

The variables GDP , P and $PGDP$ represent the gross domestic product, population and per capita GDP , respectively. While product and population were used to capture the effects of the

size of supply and demand, the difference in product per capita allowed us to test Linder's hypothesis (i.e., the greater the similarity in the level of economic development of the partners, the greater the trade, mostly intra-industry one). On the other hand, the variable K is the Krugman index and captures the similarity in production structures, with the greater the differences in their specialisation patterns, the greater the inter-industrial trade:

$$K = \sum_{k=1}^n \left| \frac{X_{od}^k}{X_{od}} - \frac{X_{do}^k}{X_{do}} \right| \quad (2)$$

Therefore, if the result of K is close to zero, countries trade similar goods and, therefore, their production structures are more analogous. In contrast, the higher the value, the greater the differences between the export baskets and, consequently, the greater the complementarities and inter-industry trade.

The variable D is the distance between origin and destination, taken from the capital cities, and ADJ is a dichotomous variable that takes a unit value if these economies are adjacent. To complete the trade friction approach, we added the dichotomous variable RTA , which takes a unit value if the destination belongs to a regional trade agreement j . The regional blocs other than MERCOSUR included in the study are the European Union (EU)², the North American Free Trade Agreement (NAFTA)³, and the Association of Southeast Asian Nations (ASEAN)⁴.

Expression (3) represents our main model, which adds a new set of variables and interaction terms to the vector Z formed by the control model variables:

$$\begin{aligned} \ln X_{odt}^k = & \alpha + \eta_z Z + \beta_1 MCS_t + \beta_2 Crisis_{ot} + \beta_3 Crisis_{ot} \cdot MCS_t + \beta_4 Crisis_{dt} + \\ & + \beta_6 Crisis_{wt} + \beta_7 Crisis_{wt} \cdot MCS_t + \beta_8 Manuf_t^k + \beta_9 Manuf_t^k \cdot MCS_t + \\ & + \beta_{10} Manuf_t^k \cdot Crisis_{ot} + \beta_{11} Manuf_t^k \cdot Crisis_{ot} \cdot MCS_t + \beta_{12} Manuf_t^k \cdot Crisis_{dt} + \\ & + \beta_{13} Manuf_t^k \cdot Crisis_{dt} \cdot MCS_t + \beta_{14} Manuf_t^k \cdot Crisis_{wt} + \\ & + \beta_{15} Manuf_t^k \cdot Crisis_{wt} \cdot MCS_t + \ln \varepsilon_{odt} \end{aligned} \quad (3)$$

The variable MCS_t is a dichotomous variable that takes a unit value if the destination country is Argentina, Brazil, Paraguay, or Uruguay. The variables $Crisis_{ot}$, $Crisis_{dt}$, and $Crisis_{wt}$ indicate whether the origin country, the destination country, or the world economy are in crisis in year t , respectively. While the first two are dichotomous variables with a unit value when a crisis is present, the third is a continuous variable defined between zero and one, representing the level of 'world economic distress' (Delbianco et al., 2019). Finally, $Manuf_t^k$ is a dichotomous variable with a unit value if the exported good k falls into the manufactured category according to the classification provided by Delbianco et al. (2021).

2 The countries that constitute the EU are Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

3 United States of America, Canada and Mexico.

4 ASEAN members are Burma, Brunei, Cambodia, Indonesia, Laos, Malaysia, the Philippines, Singapore, Thailand and Vietnam.

We defined the main model in terms of exports from country o to country d , where d may or may not belong to MERCOSUR. Then, the expected signs relate to how crises affect the direction of (manufactured) exports of MERCOSUR members.

3.2 Data and Software

The databases used are CEPII/Gravity (Conte et al., 2021) and CEPII/BACI (Gaulier & Zignago, 2010). As Magerman et al. (2016: 15) indicated, BACI is a clean, ‘mirrored’ version of the UN COMTRADE database, which records product-level trade at the Harmonised System six-digit level for almost all countries in the world.

The variable *Manuf* is based on Delbianco et al. (2021). A detailed table is provided in the annexe. For the dummy variables $Crisis_o$ and $Crisis_d$, we used the characterisation of Laeven and Valencia (2020). The variable $Crisis_w$ was obtained through the methodology of Delbianco et al. (2019).

Table 2. Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
LnX	3 281 198	2.104	3.157	-6.908	16.826
LnGDPo	3 281 198	20.241	1.267	15.66	21.63
LnGDPd	3 281 198	18.553	1.902	11.246	23.234
LnPo	3 281 198	11.358	1.196	8.086	12.251
LnPd	3 281 198	9.675	1.501	3.77	14.159
LnD	3 281 198	8.64	.935	5.371	9.885
Ln(PGDPO –PGDPd)	3 281 198	1.643	1.339	-6.908	4.74
ADJ	3 281 198	.224	.417	0	1
K	3 281 198	1.288	.439	0	2
EU	3 281 198	.199	.399	0	1
NAFTA	3 281 198	.048	.214	0	1
ASEAN	3 281 198	.041	.199	0	1
MCS	3 281 198	.131	.337	0	1
MANUF	3 281 198	.816	.388	0	1
Crisis_o	3 281 198	.099	.299	0	1
Crisis_d	3 281 198	.08	.271	0	1
Crisis_w	3 281 198	.163	.209	0	.553

Source: Prepared by the authors

We estimated pooled and fixed effects panel data using Stata 14. The analysis period ranges from 1995 to 2017 due to data availability. Table 2 shows the descriptive statistics of the variables.

4. Results and Findings

4.1 Control Model

We considered three different methods for estimating the control model, the results of which are shown in Table 3. The second column corresponds to the pooled model, while the others provide the results when time dummies were added to the regression, and both time and exporter fixed effects (FE) were included. Random effects results are not displayed, because the null hypothesis (differences between models are significant) is not rejected. In all cases, White's standard errors were used.

Table 3. Gravity Results for the Control Model

	Pooled model	Time FE	Time and exporter FE
LnGDPO	0.00 (0.00)	0.13*** (0.01)	0.19*** (0.01)
LnGDPd	0.26*** (0.00)	0.31*** (0.00)	0.31*** (0.00)
LnPo	0.28*** (0.00)	0.17*** (0.01)	1.20*** (0.12)
LnPd	0.10*** (0.00)	0.06*** (0.00)	0.06*** (0.00)
ln PGDPO – PGDPd	-0.02*** (0.00)	-0.04*** (0.00)	-0.04*** (0.00)
IK	-0.09*** (0.00)	-0.03*** (0.00)	-0.02*** (0.00)
LnD	-0.30*** (0.00)	-0.31*** (0.00)	-0.32*** (0.00)
ADJ	0.68*** (0.01)	0.60*** (0.01)	0.62*** (0.01)
EU	-0.25*** (0.01)	-0.33*** (0.01)	-0.33*** (0.01)
NAFTA	-0.26*** (0.01)	-0.33*** (0.01)	-0.32*** (0.01)
ASEAN	0.29*** (0.01)	0.30*** (0.01)	0.31*** (0.01)
Constant	-4.41*** (0.05)	-5.07*** (0.07)	-19.86*** (1.45)
Observations	3 269 507	3 269 507	3 269 507
Adjusted R^2	0.068	0.081	0.082

Time FE	No	Yes	Yes
Exporter FE	No	No	Yes

The dependent variable is exports of good k from country o to country d in the natural logarithm. Standard errors are in parentheses. Model specifications are Pooled OLS, Time FE, and Time and Exporter FE. P -values: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The main model is time and exporter FE. The coefficients were interpreted as follows. The estimated coefficients represent the average impact of the variables of interest on the values of exports from country o to country d , holding all other variables constant and setting all dummies to zero. For example, 1% increase in the GDP of the destination country leads, on average, to 0.31% growth in exports from o to d .

All variables have coefficients significant at 1% and with the expected signs. Country size is relevant for exports, the Linder's hypothesis is not rejected, and the differences in the basket of exportable goods do not favour bilateral trade. The result for the distance variable indicates that for every 1% increase, exports decrease by 0.32%. In the extreme case that countries share a border, exports grow by almost 86%⁵ on average.

Finally, the dichotomies relating to regional agreements show that, when the destination country belongs to the EU or NAFTA, the effect on MERCOSUR members' exports is negative, while the opposite is true when the destination country belongs to the ASEAN. This result evidences that the latter region is more permeable to MERCOSUR goods. By moving the ASEAN dummy from zero to one, holding all other variables constant, exports increase by 36% on average. A negative variation of similar magnitude is observed for the other identified regions.

The value of the constant has no meaning in itself. However, the negative sign of the regression constant deserves a brief digression. Assuming that (i) the target market does not belong to these blocs, (ii) the origin and destination are not bordering countries, and (iii) both the development levels and the production structures of the nations are similar, the average export performance of the MERCOSUR members was poor, regardless of any consideration of economic size.

4.2 Hypothesis Testing

Table 4 shows the results of the hypothesis testing. We excluded the control variables, as there were no differences in sign and significance concerning what was mentioned in the previous section. The indicator of global economic distress did not produce consistent results,

⁵ The elasticity from the dummy coefficient was calculated as $(e^\beta - 1) * 100$.

so the third and fifth columns are complementary to our analysis, which is based on the dichotomous crisis variables (second and fourth columns).

Table 4. Gravity Results for the Complete Model

	All	All	By type	By type
MCS	0.39*** (0.01)	0.36*** (0.01)	-0.62*** (0.02)	-0.63*** (0.02)
Crisis_o	-0.04*** (0.01)	-0.02*** (0.01)	-0.09*** (0.02)	-0.07*** (0.02)
Crisis_o • MCS	-0.43*** (0.01)	-0.43*** (0.01)	-0.42*** (0.03)	-0.44*** (0.03)
Crisis_d	-0.12*** (0.01)		0.05*** (0.02)	
Crisis_d • MCS	-0.18*** (0.02)		-0.36*** (0.04)	
Crisis_w		0.22 (0.00)		0.26 (48.27)
Crisis_w • MCS		0.01 (0.03)		-0.22*** (0.06)
Manuf			-1.66*** (0.01)	-1.67*** (0.01)
Manuf • MCS			1.11*** (0.01)	1.09*** (0.02)
Manuf • Crisis_o			0.08*** (0.02)	0.07*** (0.02)
Manuf • Crisis_o • MCS			-0.02 (0.04)	0.01 (0.04)
Manuf • Crisis_d			-0.21*** (0.02)	
Manuf • Crisis_d • MCS			0.21*** (0.04)	
Manuf • Crisis_w				-0.06** (0.03)
Manuf • Crisis_w • MCS				0.27*** (0.07)
Constant	-15.49*** (1.00)	-14.73*** (0.90)	-9.34*** (0.96)	-8.52*** (0.96)
Observations	3 269 507	3 269 507	3 268 177	3 268 177
Adjusted R^2	0.082	0.082	0.119	0.119

The dependent variable is exports of goods k from country o to country d in the natural logarithm. Standard errors are in parentheses. The model specification is time and exporter FE. ‘All’ means without discrimination of type of exported good, while ‘By type’ implies that the dummy *Manuf* was used. P-values: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The second and third columns do not differentiate by type of product. The null hypothesis that the coefficient of the MCS is zero is rejected with a statistical significance above 99%. Thus, we observe a bias in exports in favour of MERCOSUR members. The magnitude of the coefficient value indicates that bilateral exports increase by almost 48% if both origin and destination countries belong to MERCOSUR ($\beta_1=0.39$).

If the destination in crisis does not belong to MERCOSUR, the effect on exports is significantly negative as expected ($\beta_4=-0.12$). However, hypothesis H1 formulated in terms of trading bias is not verified, because $Crisis_w \cdot MCS$ are not statistically significant, and we cannot affirm that if the world is in crisis, exports will be redirected to the region. Instead, the results confirm hypothesis H3: The pro-MERCOSUR bias tends to disappear when the destination country in crisis belongs to that regional trading bloc ($\beta_1+\beta_4+\beta_5=0.09$).

When distinguishing by type of goods (fourth column), the base case corresponds to primary goods exports to the rest of the world (i.e., non-MERCOSUR members). Therefore, the significantly negative sign of the dichotomous variables $Manuf$ ($\beta_8=-1.66$) confirms the primary goods bias of extra-regional trade. Additionally, the significantly negative sign of MCS ($\beta_1=-0.62$) and the significantly positive sign of $Manuf \cdot MCS$ ($\beta_9=1.11$) verify the manufactured goods bias of intra-regional trade. Moreover, the sum of the coefficient values of $Manuf$, MCS , and $Manuf \cdot MCS$ is negative, -1.17, which is less than the value of the $Manuf$ coefficient taken alone. This indicates that the difficulty in exporting manufactured goods is lower in MERCOSUR than in the rest of the world.

An unexpected result emerges when addressing the impact of the crises on exports of primary goods. Primary exports seem to be positively affected by external crises ($\beta_4=0.05$). When the indicator of world economic distress replaces the crisis dummy, the positive sign prevails but is not statistically significant. Instead, the bias against manufactured goods in extra-regional trade increases in the context of the external crisis. The sum of the coefficient values of $Manuf$, $Crisis_d$ and $Manuf \cdot Crisis_d$ ($\beta_8+\beta_4+\beta_{12}=-1.82$) confirms the bias. Although the sum is smaller when we replaced $Crisis_d$ with $Crisis_w$ (-1.47), the coefficient of $Manuf \cdot Crisis_w \cdot MCS$ is significantly positive, 0.27, indicating that manufactured exports are reoriented towards MERCOSUR in the face of world crisis. In consequence, hypothesis H2 is partially verified.

Exports of primary goods are significantly affected when the destination country in crisis belongs to MERCOSUR. The coefficient values of MCS , $Crisis_d$ and $Crisis_d \cdot MCS$ sum -0.93 or -0.59 if we use $Crisis_w$ instead of the crisis dummy. In both cases, the interaction term between crisis and MCS is negative. The impact is greater for manufactured exports, as expected. The total effect is captured by the sum of the coefficient values of MCS , $Crisis_d$, $Manuf$, and all the interaction terms ($\beta_1+\beta_4+\beta_5+\beta_8+\beta_9+\beta_{12}+\beta_{13}=-1.48$). Despite we cannot affirm that there was a reorientation of primary and manufactured exports towards the rest of the world when the crisis is regional, those results confirm hypothesis H4.

When the exporter is in crisis, the effects on extra- and intra-regional exports are significantly negative ($\beta_2=-0.04$ and $\beta_1+\beta_2+\beta_3=-0.08$). By isolating the regional effect ($\beta_1+\beta_3$), the magnitude of the impact is halved, equalising both negative crisis effects on trade. Therefore,

it is not certain that there is a redirection of exports outside of MERCOSUR in the context of a crisis in the origin country.

When distinguishing by type of goods, exports of primary goods are significantly affected if the exporter is in crisis, mainly intra-regional ones ($\beta_2 = -0.09$ vis-a-vis $\beta_1 + \beta_2 + \beta_3 = -1.13$). In the same setting, all the results are negative for manufactured exports and the magnitude is greater for extra-regional exports ($\beta_2 + \beta_8 + \beta_{10} = -1.67$) than intra-regional ones ($\beta_1 + \beta_2 + \beta_3 + \beta_8 + \beta_9 + \beta_{10} + \beta_{11} = -1.62$). The scale and similarity of these values confirm that the difficulties in exporting manufactures are exacerbated in the context of a domestic crisis, regardless of the destination country. In contrast, the negative impact on primary extra-regional exports is significantly smaller in the extra-regional market, consistent with the argument of exploitation of comparative advantages. In addition, column 5 shows similar results and magnitudes for the coefficient values of interest.

When both economies (origin and destination) are in crisis, the negative impact is greater when the destination country belongs to MERCOSUR (-0.38 compared to -0.16). The same phenomenon is observed for manufactured exports (-1.93 compared to -1.83) and primary exports (-1.44 compared to -0.04).

The interpretation of the previous paragraphs allowed us to confirm hypothesis H5: the biases concerning pro-regional exports, primary goods from extra-regional exports, and manufactures from intra-regional trade persist in the context of domestic economic crisis.

5. Final Considerations

This paper aimed to provide evidence on the impact of crises on integration agreements by studying the behaviour of trade flows. The literature is scarce and this paper offers relevant results to fill the gap and motivate further research. MERCOSUR was used as a case study.

We based our empirical strategy on a traditional gravity approach, and hypotheses were contrasted with interaction terms. The crises were differentiated according to their origin, in external —or outside MERCOSUR—, regional, and domestic, and exports were classified according to the type of goods, manufactured and primary.

We confirmed the existence of both an intra-regional bias in manufactured exports and an extra-regional one in primary exports. Our analysis indicates that MERCOSUR was able to mitigate external and domestic shocks due to the possibility of redirecting trade within the region. However, it exacerbated the impact of regional shocks because it did not have an external counterpart to receive its manufactured products in the same way. In contrast, while the crises also affected primary goods exports, the impact was significantly smaller. Thus, we not only verified the importance of considering the different origins of crises, but also the type of traded goods.

In summary, our findings validate the high degree of interdependence within MERCOSUR, as well as the significance of the region for trade in manufactured goods, and the difficulties in

consolidating the industrialisation process in a context of macroeconomic vulnerability and volatility, even despite the existence of RTAs.

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Annexe

Classification between Manufactures and Primary Products based on the Standard International Trade Classification (SITC)

Class	SITC 2-digit	Description	Class	SITC 2-digit	Description
0	0	Live animals	1	53	Dyeing, tanning, and colouring materials
0	1	Meat and meat preparations	1	54	Medicinal and pharmaceutical products
0	2	Dairy products and eggs	1	55	Perfume materials, toilet and cleansing preparat.
0	3	Fish and fish preparations	1	56	Fertilizers, manufactured
0	4	Cereals and cereal preparations	1	57	Explosives and pyrotechnic products
0	5	Fruit and vegetables	1	58	Plastic materials, etcetera
0	6	Sugars, sugar preparations, and honey	1	59	Chemical materials and products, nes
0	7	Coffee, tea, cocoa, spices, and manuf. thereof	1	61	Leather, lthr. Manuf., nes and dressed fur skins
0	8	Feed. stuff for animals, excl. unmilled cereals	1	62	Rubber manufactures, nes
0	9	Misc. food preparations	1	63	Wood and cork manuf. excluding furniture
1	11	Beverages	1	64	Paper, paperboard, and

0	12	Tobacco and tobacco manufactures	1	65	manufactures thereof Textile yarn, fabrics, made-up articles, etcetera
0	21	Hides, skins, and fur skins, undressed	1	66	Non-metallic mineral manufactures, nes
0	22	Oil seeds, oil nuts, and oil kernels	0	67	Iron and steel
0	23	Crude rubber including synthetic and reclaimed	0	68	Non-ferrous metals
0	24	Wood, lumber, and cork	1	69	Manufactures of metal, nes
1	25	Pulp and paper	1	71	Machinery, other than electric
0	26	Textile fibres, not manufactured, and wastes	1	72	Electrical machinery, apparatus, and appliances
0	27	Crude fertilizers and crude minerals, nes	1	73	Transport equipment
0	28	Metalliferous ores and metal scrap	1	81	Sanitary, plumbing, heating, and lighting fixt
0	29	Crude animal and vegetable materials, nes	1	82	Furniture