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Pedro Moncarz[1] / Flavia Rovira[2] / Sebastián Villano[3] / Marcel Vaillant[4]

Montevideo, 2024

Pharos | Academia Nacional de Economía | dECON – Facultad de Ciencias Sociales – UdelaR

Design: Edgardo Taranco Bottero

Printed by Mastergraf SA
Legal Deposit XXXXXX

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ANÁLISIS Y PROPUESTAS DE LA ACADEMIA NACIONAL DE ECONOMÍA

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Índice

Abstract

The multilateralization of regionalism implies the convergence of a set of previous agreements into a single plurilateral agreement with greater liberalization ambitions at both the intensive and extensive margins. The Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) is an example of this phenomenon. After estimating the structural dynamic gravity model of trade proposed by Anderson, Larch and Yotov (2020), four counterfactual scenarios were simulated according to the countries that are members of the agreement: CPTPP as currently constituted, CPTPP+Uruguay, CPTPP+China, and CPTPP+China+Uruguay. A short-run static equilibrium (in which only prices change) and a long-run dynamic equilibrium (with real effects on output and capital stock) were evaluated. In scenarios with China within the agreement, CPTPP members experience greater welfare gains. The economies that benefit the most are those of Southeast Asia that belong to ASEAN (Vietnam, Malaysia and Singapore), for which the extensive margin is related to the agreements with the countries of the Americas and are closer to the large markets of Asia and Oceania (Japan, China and Australia). Uruguay stands out for appearing in fourth place, due to the large effect of trade liberalization. The agreement improves the country's access to South Asia markets (extensive margin) while at the same time deepens trade relations with American countries with which Uruguay already has preferential relations (intensive margin).

Key words: economic integration, investment, growth, CPTPP.

JEL Codes: F10, F15, F43, O40.

1. Introduction

Over the past decade, several changes have occurred around the world that have affected international economic relations, with overlapping forces producing effects in different directions. A milestone in this process was the change of government in the United States in 2017, which led to both the withdrawal from the Trans-Pacific Partnership (TPP) and the beginning of aggressive unilateralism. This policy was focused on trade relations with China, in retaliation for this country's anti-trade behavior[1]. At the root of the conflict lies a dispute over global leadership in technology.

More recently, two additional issues contributed to the changing context. First, a heterogeneous set of climate change mitigation policies that spill over into trade rules, using international trade as a mechanism to discipline the adoption of these policies. This process is driven primarily by the European Union, but also by other OECD countries[2]. On the other hand, there is an intensification of geopolitical local conflicts, with global repercussions. The most prominent of these is Russia's invasion of Ukraine and the economic sanctions that followed. This event was followed by other conflicts around the world. All of these have led to an erosion of the multilateral trading system represented by the WTO rules. As a result, it is possible to observe a path towards a discretionary and unilateralist approach to the application of trade policies. This creates an envi-

1 A detailed description of the key events in the U.S.-China trade war is available at the website coordinated by Chad Bown of the Peterson Institute of International Economics (https://www.piie.com/research/trade- investment/us-china-trade-war).

2 Examples of these policies are: Emissions Trading System (ETS), carbon taxes, production subsidies for clean technologies, Border Carbon Adjustment Mechanism (BCM), export subsidies.

ronment of uncertainty in trade policy and thus in market access conditions[3].

Finally, there are the long-term trends in the international economy regarding the construction of trade rules. East and Southeast Asia and Oceania countries are at the center of this process. These countries are the central players in the multilateralization of regionalism, which involves the nesting of a network of agreements into a single plurilateral agreement with greater ambitions for trade liberalization[4]. Two examples illustrate this process. On the one hand, the Trans-Pacific Partnership agreement without the United States (CPTPP) and with the United Kingdom as a new member. Ratifications have taken place since 2018, leading to 12 countries being already members, while another 6 countries have applied for membership. China and Uruguay are two of these 6 countries requesting access to the CPTPP. In addition, the Regional Comprehensive Economic Partnership[5] (RCEP) came into force in 2022. These changes are expected to have the opposite effects to those mentioned in the previous paragraph, improving market access, deepening trade liberalization and creating a set of rules that increase certainty about access conditions.

This paper applies a state-of-the-art methodology to study the impact of preferential trade agreements (PTAs)[6]. It simulates the effects on the trade costs of CPTPP members and their impact on income and on capital accumulation. Based on this model, an empirical study is carried out to obtain parameter values that are requested as inputs for the simulations. Theoretical contributions related to the heterogeneity of the effects of PTAs

3 See Limão (2023).

4 See Baldwin y Low (2009).

5 Also known as ASEAN+5 because it includes the ASEAN countries plus Korea, Japan, China, Australia and New Zealand. The agreement has not yet been notified to the WTO, although it is in force among members.

6 See the structural dynamic gravity model of trade proposed by Anderson, Larch and Yotov (2020).

were also key, as well as the newly available data derived from a recent study by the World Bank[7].

The paper is divided into this introduction and five other sections. Section two provides a brief characterization of the CPTPP (Appendix A provides details on the construction of the databases). The third section refers to the theoretical model and the mechanisms involved (Appendix B contains an analytical presentation of the model). Section four presents the results of the econometric exercise, both for the determinants of bilateral trade (structural gravity model) and for the income and capital equations corresponding to the dynamic part of the model. In the fifth section, based on the parameters estimated in the previous section, four counterfactual scenarios are considered, with two definitions of equilibrium (static and dynamic). Finally, there is a section of synthesis and conclusions.

7 See Fontagné et al. (2023) and Rocha et al. (2023).

2. CPTPP: a new standard for international economics

The proliferation of preferential trade agreements PTAs since the early 1990s has complemented the process of trade liberalization at the multilateral level. Both by deepening the degree of liberalization of trade barriers and by integrating other disciplines necessary to promote trade and investment. However, this process, while leading to more than three hundred PTAs in force, had prompted to a dispersion of rules that becomes an obstacle to the deepening of trade.

A simple example is the case of rules of origin. Suppose a country is member of several PTAs, each one with different rules of origin. Not only does this make it difficult for the private sector to adapt its production to a dispersed pattern of rules, but it also inhibits the possibility of other movements of goods and services taking advantage of the network of agreements. This leads to what is known as diagonal accumulation of origin. One way to overcome this limitation is to build larger agreements that nest several existing PTAs into a single one. This process is known as the multilateralization of regionalism[8].

A clear example of this phenomenon today is the case of the CPTPP. The agreement was ratified by all its original members in 2022, with the United Kingdom joining in 2023. It is a plurilateral agreement between 12 economies with heterogeneous levels of development, bringing together economies from East and Southeast Asia (Japan, Malaysia, Singapore, Vietnam and Brunei Darussalam) with others from the Americas (Canada, Mexico, Peru and Chile) and, more recently, one from Europe (the United

8 The term regionalism is used as it is understood in multilateral jargon at the WTO level as a synonym for PTAs. This is due to the fact that in their origins they had a distinct regional pattern that was later lost.

Table 2.1. PTAs prior to 2018 for CPTPP member countries, chronological evolution

Agreement	In force
Australia - New Zealand (ANZCERTA)	1982
ASEAN Free Trade Area (AFTA)	1992
North American Free Trade Agreement (NAFTA)	1992
Canada - Chile	1996
UE - Mexico	1997
Japan - Singapore	2002
UE - Chile	2002
Japan - Mexico	2004
Japan - Malaysia	2005
Trans-Pacific Strategic Economic Partnership (TPSEP)	2005
Chile - Japan	2007
Australia - Chile	2008
Peru - Singapore	2008
Canada - Peru	2008
Japan - Vietnam	2008
ASEAN - Australia - New Zealand	2009
Japan - Peru	2011
Chile - Vietnam	2011
Chile - Malaysia	2010
UE - Colombia and Peru	2012
Malaysia - Australia	2012
Japan - Australia	2014
Pacific Alliance (PA)	2014
UE - Canada	2017

Source. World Bank's Deep Trade Agreements database (see https://datatopics.worldbank.org/dta/table.html).

Kingdom). It has created great expectations and there is now a list of aspiring countries that expect to join[9]. It is a deep integration agreement that, in addition to the traditional topics of liberalization of trade in goods and services, adds many other disciplines that cover issues grouped under the heading of "beyond the border" with other non-trade objectives linked to sustainable development (environment, labor issues, civil rights).

9 Six countries have formally indicated their intention to begin negotiations to accede to the agreement: Ukraine (May 2023), Uruguay (December 2022), Costa Rica (August 2022), Ecuador (December 2021), Taiwan (September 2021), China (September 2021).

Table 2.2. PTAs prior to 2018 for China and Uruguay with members of the CPTPP, chronological evolution

Agreement	In force
a) China	
ASEAN - China	2005
Chile - China	2006
China - Singapore	2009
China - New Zealand	2008
Peru - China	2010
Australia - China	2015
b) Uruguay	
MERCOSUR-Chile (ACE35)	1996
Mexico - Uruguay	2003
MERCOSUR-Peru (ACE58)	2005
Uruguay-Chile (ACE73)	2018

Source: World Bank's Deep Trade Agreements database.

Table 2.1 shows the chronological development of PTAs between the current CPTPP members, with the aim of illustrating the degree of simplification proposed by the agreement[10]. It takes into account bilateral relations already liberalized by previous agreements involving CPTPP members. There are 24 previous agreements, including both bilateral and plurilateral PTAs, both intraregional and extraregional. Liberalization started in 1983 with the New Zealand-Australia agreement. The most recent agreement is the one between the EU and Canada, when the United Kingdom was still a member of the EU.

Alternative scenarios are simulated under the assumption that China and Uruguay will join the CPTPP, so it is necessary to know about the previous agreements among CPTPP members, which already liberalized bilateral relations (see Table 2.2). The 24 agreements between CPTPP members have liberalized a large number of bilateral relations, as many of

10 Due to data availability, the exercises in this paper do not include Brunei Darussalam, which is one of the original signatories to the CPTPP.

Table 2.3. Bilateral relations liberalized prior to 2018 between CPTPP members

exp/i	AUS	N	MYS	VNM	S	JPN	CAN	MEX	PER	C	GBR	U	CHN
AUS		ANZCERTA	ASEAN - AU NZL	ASEAN - AU NZL	ASEAN - AU NZL	JPN - AUS				AUS - CHL			AUS-CHN
NZL	ANZCERTA		ASEAN - AU NZL	ASEAN - AU NZL	ASEAN - AU NZL					TPSEP			NZL-CHN
MYS	ASEAN - AU NZL	ASEAN - AU NZL		ASEAN	ASEAN	JPN - MYS				CHL - MYS			ASEAN-MYS
VNM	ASEAN - AU NZL	ASEAN - AU NZL	ASEAN		ASEAN	JPN - VNM				CHL - VNM			ASEAN-CHN
SGP	ASEAN - AU NZL	ASEAN - AU NZL	ASEAN	ASEAN		JPN - SGP			PER - SGP	TPSEP			SGP-CHN
	JPN - AUS		JPN - MYS	JPN - VNM	JPN - SGP			JPN - MEX	JPN - PER	CHL - JPN			
CAN								NAFTA	CAN - PER	CAN - CHL	EU-CAN		
MEX						JPN - MEX	NAFTA		AP	AP	EU-MEX	MEX-URY	
PER					PER - SGP	JPN - PER	CAN - PER	AP		AP	EU-COL&PER	MERCOSUR-PER	PER-CHN
CHL	AUS - CHL	TPSEP	CHL - MYS	CHL - VNM	TPSEP b)	CHL - JPN	CAN - CHL	AP	AP		EU-CHL	MERCOSUR-U	CHL-CHN
GBR							EU-CAN	EU-MEX	EU-COL&PER	EU-CHL			
URY								MEX-URY	MERCOSUR-PER	MERCOSUR-U			
CHN	AUS-C	NZL-CHN	ASEAN-MYS	ASEAN-CHN	SGP-CHN				PER-CHN	CHL-CHN			

Note: ISO3 country nomenclature code is used. Source: own elaboration based on World Bank's Deep Trade Agreement database.

them cover several countries. In fact, as described in Table 2.3, out of 110 possible bilateral relations, 69 have already been liberalized. Many of these have a lower level of liberalization and rules than those associated with the CPTPP. In this sense, the CPTPP implies a change due to the deepening and multilateralization of previous agreements (intensive margin of the CPTPP effect). But there will also be new liberalized bilateral relations (the extensive margin of the CPTPP effect). The latter is particularly evident between the countries of the Americas and Europe and those of the Asia-Pacific region. These account for more than a third of the total bilateral relations concerned.

With respect to the potential new members considered in this paper, Uruguay is in a similar situation to the United Kingdom prior to joining the CPTPP. It holds four previous agreements with countries that are already members. Two of them are within MERCOSUR and two are bilateral. The case of Chile would mean a deepening of an earlier agreement signed by MERCOSUR, which entered into force in October 1996.

Table 2.4. Comparison of areas of CPTPP provisions with selected previous agreements of its members ordered in descending order by the number of provisions (2018)

Provision areas / PTA	CPTPP[a)]	ASEAN - Australia - New Zealand[b)]	ASEAN - Australia - New Zealand[c)]	Canada - Peru	NAFTA	Japan - Australia	ASEAN - Australia - New Zealand[d)]	Malaysia - Australia	Australia - Chile	Japan - Peru	Peru - Singapore	Pacific Alliance[e)]	Pacific Alliance[f)]	Canada - Chile
Trade and customs facilitation	30	33	26	34	21	20	25	25	21	21	23	15	23	15
Anti-dumping and countervailing duties	8	12	10	7	16	6	7	7	4	6	7	5	7	4
Technical barriers to trade	13	16	13	12	15	9	8	8	13	10	13	17	18	7
Sanitary and phytosanitary	50	29	27	35	33	24	27	27	33	22	21	31	30	30
Rules of origin	22	24	21	16	19	16	21	21	16	20	21	27	25	17
Export taxes	31	18	20	23	19	25	20	20	22	16	21	17	11	23
Subsidies	13	15	13	11	19	11	15	15	10	14	14	13	13	11
Services	34	24	28	18	23	17	17	17	13	10	21	33	32	3
Investment	43	25	34	0	0	15	35	35	0	25	0	12	0	0
Competition Policies	27	24	18	19	16	21	17	17	19	19	16	15	23	10
Public procurement	75	42	25	61	52	51	0	0	54	51	51	0	0	59
Intellectual property	93	51	48	36	23	44	54	54	31	42	32	38	30	23
State-owned companies	44	37	42	40	42	37	36	36	41	29	32	40	41	38
Environment regulation	34	6	3	18	23	3	5	5	6	8	4	11	6	13
Labor regulations	16	9	0	17	2	0	3	3	3	1	1	3	13	12
Capital movement	50	51	50	37	40	44	49	49	51	40	42	35	37	34
Visa and asylums	17	16	16	10	18	17	16	16	12	12	11	9	5	8
Total	600	432	394	394	381	360	355	355	349	346	330	321	314	307

[a)] CPTPP in the bilateral version between Australia and Chile;[b)]New Zealand-Singapore version;[c)]Australia-Singapore version; [d)] New Zealand-Malaysia version;[e)] Mexico-Chile version; [f)] Peru-Chile version. Source: own elaboration based World Bank's Deep Trade Agreement database.

China, on the other hand, has agreements with almost all the Asian countries and with Peru and Chile in the Americas, leaving only Canada, Mexico and the United Kingdom[11].

To illustrate the initial situation, it is useful to characterize the nature of the existing agreements, both in terms of the preferences granted and the disciplines covered, as well as the depth of the commitments made in each of them. For this purpose, the World Bank database which typifies 937 different provisions in 17 areas, is used (see Table 2.4)[12]. These areas can be divided into border issues (areas 1-7), cross-border issues (services, complementary materials and factor movement, areas 8-13 and 16-17) and so-called non-trade objectives (labor and environment, areas 14-15). Plurilateral agreements bring together sever-

11 As of 2018, China did not have a PTA with Japan, but since 2022 the ASEAN+5 (ASEAN plus Korea, Japan, China, Australia and New Zealand) called RCEP (Regional Comprehensive Economic Partnership) has been in force. This agreement has not yet been notified at the WTO.

12 For further details and description of the data used in this section and in the rest of the document, see Appendix A.

al bilateral relationships, and not all of them are exactly the same in terms of the provisions they include, there is typically a degree of bilateral heterogeneity. This is also the case with the CPTPP.

The depth of agreements is related to the number of disciplines and the accumulation of provisions within them. However, the mere accumulation of provisions is a rough indicator of the depth of an agreement in terms of the degree of commitment to reciprocal liberalization. In some cases, for example, fewer provisions could imply greater liberalization. Consider the case of the European Union, which has no rules of origin

Table 2.5. APC depth measured by number of total provisions for the CPTPP+

a) 2017

exp/imp	AUS	NZL	MYS	VNM	SGP	JPN	CAN	MEX	PER	CHL	GBR	URY	CHN
AUS		141	355	280	394	360	0	0	0	349	0	0	223
NZL	141		355	280	432	0	0	0	0	280	0	0	270
MYS	355	355		155	155	267	0	0	0	114	0	0	200
VNM	280	280	155		155	279	0	0	0	99	0	0	200
JPN	360	0	267	279	269		0	271	346	260	0	0	0
CAN	0	0	0	0	0	0		381	394	307	n/a	0	0
MEX	0	0	0	0	0	271	381		297	321	140	269	0
PER	0	0	0	0	330	346	394	297		314	418	n/a	278
CHL	349	280	114	99	284	260	307	321	314		322	n/a	149
GBR	0	0	0	0	0	0	n/a	140	418	322		0	0
URY	0	0	0	0	0	0	0	269	n/a	n/a	0		0
CHN	223	270	200	200	256	0	0	0	278	149	0	0	0

b) After 2018

exp/imp	AUS	NZL	MYS	VNM	SGP	JPN	CAN	MEX	PER	CHL	GBR	URY	CHN
AUS		535	614	592	626	593	508	508	508	600	508	508	508
NZL	535		614	592	640	508	508	508	508	573	508	508	508
MYS	614	614		543	543	594	508	514	514	540	508	508	508
VNM	592	592	543		543	596	508	514	514	534	508	508	508
SGP	626	640	543	543		591	508	514	597	576	508	508	508
JPN	593	508	594	596	591		508	577	594	578	508	508	508
CAN	508	508	508	508	508	508		618	604	578	508	508	508
MEX	508	508	514	514	514	577	618		605	604	508	508	508
PER	508	508	514	514	597	594	604	605		599	508	508	508
CHL	600	573	540	534	576	578	578	604	599		508	508	508
GBR	508	508	508	508	508	508	508	508	508	508		508	508
URY	508	508	508	508	508	508	508	508	508	508	508		508
CHN	508	508	508	508	508	508	508	508	508	508	508	508	508

Note: In the case of the United Kingdom (due to lack of data in the World Bank database), and China and Uruguay, this is an imputation using data from Canada. Source: own elaboration based on World Bank Deep Trade Agreements database.

or anti-dumping mechanisms in intra-regional trade. Another limitation of looking only at the number of rules is that there is no indication of their effective enforcement. In the empirical application we carry out in section three, we will resort to the classification of Fontagné et al, (2023) to identify those bilateral relations reached by a deep trade agreement.

In Table 2.4, the CPTPP drives an increase in the number of provisions compared to previous agreements, particularly in the areas of investment, competition, government procurement and intellectual property. Table 2.5 shows the situation before and after the CPTPP and how the

Table 2.6. Applied tariff and preferences as of 2017 for CPTPP+

a) Applied tariff

exp/imp	AUS	NZL	MYS	VNM	SGP	JPN	CAN	MEX	PER	CHL	GBR	URY	CHN
AUS		0.1	1.5	3.2	0.0	2.6	3.0	7.7	3.0	0.5	5.6	10.5	5.0
NZL	0.0		1.8	3.2	0.0	5.6	3.0	7.7	3.0	0.2	5.6	10.5	1.4
MYS	0.2	0.2		0.7	0.0	1.2	3.5	7.1	3.1	0.6	5.4	11.1	1.5
VNM	0.3	0.5	0.2		0.0	1.6	2.8	7.3	3.1	0.9	3.1	11.0	1.6
SGP	0.0	0.1	0.2	0.7		1.3	3.5	7.1	1.1	0.2	3.2	11.2	1.5
JPN	0.6	2.5	1.2	5.0	0.0		3.5	1.2	1.1	0.4	5.4	11.2	11.9
CAN	2.4	0.4	6.2	10.2	0.1	5.1		0.3	0.8	0.5	0.7	10.9	11.8
MEX	2.5	2.2	6.3	10.1	0.1	1.2	0.9		0.7	0.4	1.1	1.0	11.9
PER	2.2	1.9	5.9	10.3	0.0	1.8	1.1	1.4		0.0	0.4	2.0	2.7
CHL	0.2	0.1	2.0	8.0	0.0	1.5	0.9	0.1	0.0		1.3	0.3	1.0
GBR	2.8	2.4	6.4	10.1	0.1	4.7	1.3	1.0	1.4	0.3		11.1	11.9
URY	2.2	2.0	6.0	10.3	0.1	2.9	3.3	1.1	1.2	0.3	5.5		11.8
CHN	0.3	0.2	1.3	2.4	0.0	2.6	3.5	7.1	1.9	0.3	5.4	11.1	

b) Tariff preference (1-applied tariff/ MFN rate)*100

exp/imp	AUS	NZL	MYS	VNM	SGP	JPN	CAN	MEX	PER	CHL	GBR	URY	CHN
AUS		96	72	69	100	57	8	0	0	91	1	0	58
NZL	100		68	69	100	0	8	0	0	96	1	0	88
MYS	93	91		93	100	76	0	0	0	91	1	0	87
VNM	88	81	96		100	69	19	0	0	86	43	0	87
SGP	99	95	97	93		72	0	0	65	96	42	0	87
JPN	81	0	81	51	100		0	82	65	93	1	0	0
CAN	12	85	0	1	14	0		96	75	91	87	0	0
MEX	11	7	0	1	11	75	74		78	94	80	91	0
PER	14	9	1	1	100	70	67	83		100	93	82	77
CHL	94	96	65	23	100	74	72	99	100		76	97	92
GBR	0	0	0	0	9	0	63	86	57	95		0	0
URY	13	9	0	1	21	45	0	86	60	96	1		0
CHN	91	90	79	77	100	44	0	0	40	95	1	0	

Note: the goods that correspond to the agricultural and manufacturing sectors (sectors A, B and D of the ISIC Revision 3 classification) are considered jointly. Source: own elaboration based data provided by Feodora Teti (see Teti (2020)).

number of provisions would change. The previous agreements are highlighted in three levels according to the number of provisions (low - grey, medium - yellow and medium-high - pink). The before-and-after comparison allows a first approximation of the extensive margin effect (new liberalized bilateral relations) and the intensive margin effect (deepening of existing relations).

A complementary perspective is to analyze the case of ad valorem tariff (see Appendix A for the calculation of the applied tariff). Table 2.6 shows the applied tariff and the margin of preference over the MFN tariff at the beginning of the period. The different levels of protection and preferences granted are highlighted by different colors. It should be warned that, in addition to the PTAs, there are other non-reciprocal preferences granted by high-income countries (Japan, United Kingdom, Canada, and Australia). Also this is a partial measure of the level of effective protection, particularly for agricultural products, for which the most protectionist countries, Japan and Canada, base their protection on other instruments (quotas, specific tariffs, technical barriers).

3. The Structural Dynamic Gravity Model of Trade (SDGMT)

The gravity model of trade has its first antecedents in the early 1960s[13]. In the following decades, theoretical developments increased to provide a basis for the empirical determinants to explain bilateral trade flows[14]. But it was not until the beginning of this century, with two seminal contributions, that the gravity model found a strong microeconomic foundation[15]. Anderson and van Wincoop (2003) showed that bilateral flows depend on the bilateral trade costs between two countries with respect to what the authors defined as multilateral resistances (MRs). These MRs are aggregate measures of all bilateral trade costs and summarize their trade geography. Either as an exporter (outward MR) or as an importer (inward MR), in which a country's supply (measured by the value of its output) equals the sum of all countries' demand for that country's output, which necessarily includes internal demand for its own production (domestic trade).

Diagram 3.1 shows a representation of the two networks involved. In the trade network, each node is a country (z) linked to all others by outflows (X_{zj}: exports) and inflows (X_{iz}: imports). In the trade cost network, each node is a country linked to each other by the costs to export (t_{zj}) and to import (t_{iz}). Each country has one size as a supplier ($production_i$) and another as a buyer ($expenditure_j$), which are given.

The SGMT explains bilateral trade flows (X_{ij}) in terms of trade costs (t_{ij}), trade geography summarized by the aggregate prices of selling (Π_i)

13 See Tinbergen (1962) and Pöyhönen (1963).

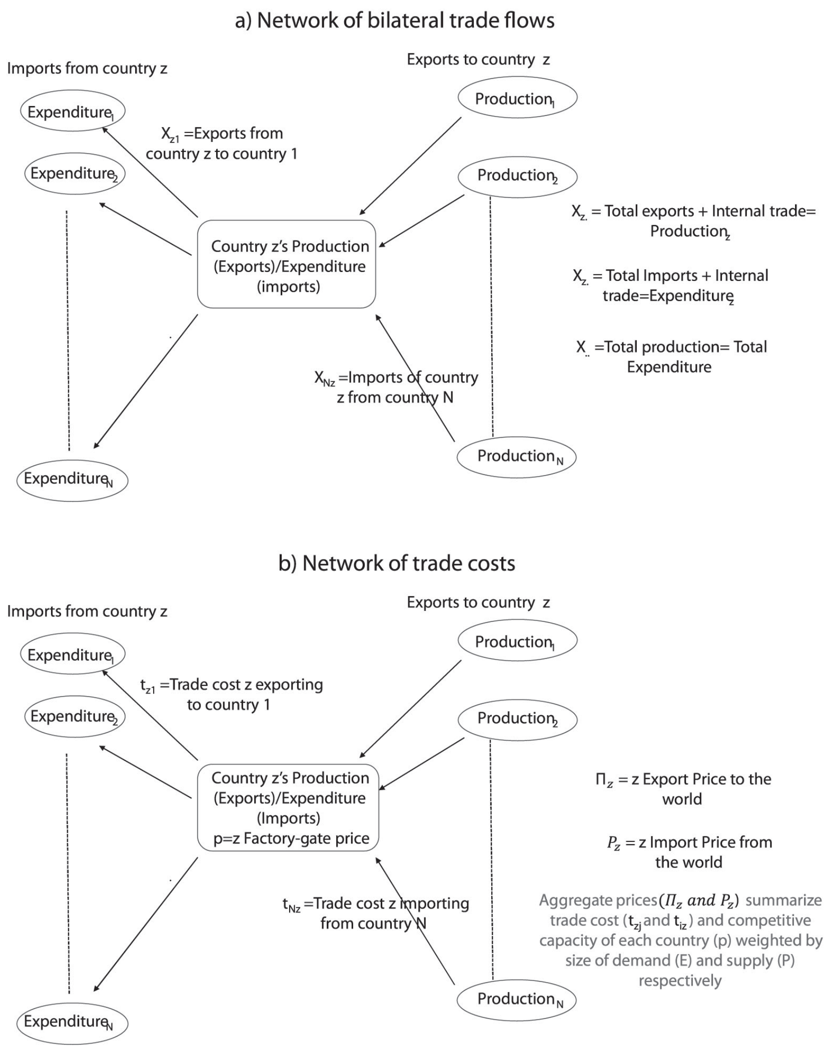
14 See Anderson (1979), Bergstrand (1985 y 1989) and Deardoff (1998).

15 See Eaton y Kortum (2002) and Anderson y van Wincoop (2003).

and buying (P_j), and the sizes of the economies that sells (*production*$_i$) and that buys (*expenditure*$_j$). The three systems of equations that characterize the model are included in Appendix B. There are NxN bilateral relations (where N is the number of countries), plus 2N equations for the MRs (selling and buying prices).

Anderson, Larch, and Yotov (2020) propose a dynamic transition model (SDGMT) to a new steady state as trade costs and prices change. They suggest a structure of the economy with an equation governing cap-

Diagram 3.1. Trade and trade costs



ital accumulation from which optimal behavior can be derived (see Appendix B). This mechanism endogenizes the size of the economy on both the production and consumption sides.

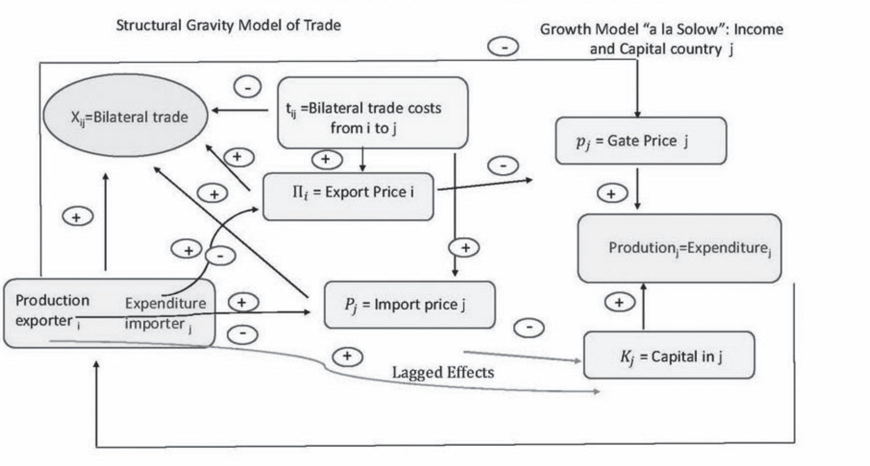
When trade costs change, prices change, and through the competitiveness channel (output/producer price) income and capital accumulation are affected. The model is a highly interconnected analytical structure that must be solved by numerical calculations.

This specification follows a long tradition in growth models linked to the degree of openness of the economy. In this sense, the authors provide a microfoundation of this empirical relationship between growth and the degree of openness of an economy, which has long been proposed in the empirical literature[16].

Diagram 3.2 summarizes all the relationships in the model, as detailed in Appendix B. On the one hand, there is the structural gravity model, in which trade costs negatively affect bilateral trade, while the size of the economies positively affects it. The aggregate measures of trade costs, as seller and buyer, have a positive impact on trade between two countries, given the bilateral costs between them. The central link to the macroeconomic growth model is production (and expenditure), along with aggregate prices. The competitiveness of the economy is summarized in its output (producer) price, which is the exporter's factory-gate price before trade costs. More production (more supply) leads to lower output price, although this effect is marginal for small countries since it depends on their participation in world supply. Lower export prices (associated with lower trade costs) imply an increase in factory-gate prices. The increase in output prices translates into an increase in income, which affects capital accumulation. The latter is also affected by the aggregate import price (which includes the trade costs), lower buying prices means more capital accumu-

16 See Frankel and Romer (1999).

Diagram 3.2. Interaction mechanism in the SDGMT



lation. This set of interactions occurs simultaneously, except for the effect on capital, which occurs with a one-period lag. This mechanism explains the dynamic transition to a new steady state when trade costs are modified. The equation that summarizes this result is the steady state equilibrium whose derivation is presented in Appendix B.

The dynamics of the capital stock depends on the dynamics of income, which is the conjunction of the terms-of-trade effect (factory-gate price relative to consumption and capital prices) and a real effect on the level of production, which can also be expressed as a function of these relative prices (see equations B.9 to B.11 in Appendix B). The insight of the model is simple: when trade costs are reduced, the country increases its level of openness associated with the change in the terms of trade, which in the dynamic setting of the model generates greater incentives for capital accumulation and production expansion.

4. Estimates of econometric effects: trade, investment, and income

4.1. Empirical model

The SGMT derives a function that explains bilateral trade flows, as a function of the relative size of the two economies and the bilateral trade costs relative to the so-called multilateral resistances, which are nothing but an aggregate measure of the ease/difficulty that each economy faces in trading with the different economies of the world, including the country's trade with itself[17]:

$$X_{ijt}=\frac{(Y_{it}E_{jt})}{Y_t}\left(\frac{t_{ijt}}{\Pi_{it}P_{jt}}\right)^{1-\sigma} \tag{4.1}$$

where: X_{ijt} is bilateral trade from origin country i to the destination country j, at time t; Y_{it} is the exporter i's size measured by its production, at time t; E_{jt} is the importer j's size measured by its expenditure, at time t; Y_t is world production, that equals world expenditure, at time t; t_{ijt} are bilateral trade costs between origin i and destination j, at time t; Π_{it} is the multilateral resistance of the exporter (outward MR), at time t; P_{jt} is the multilateral resistance of the importer (inward MR), at time t; and finally σ is the elasticity of substitution between the varieties produced at different origins.

A challenge in estimating the SGMT is that multilateral resistance terms are endogenous to trade costs, so the empirical literature suggests the use of origin-time and destination-time fixed effects (which also control for economy size effects) to control for them. Trade costs are decomposed into two components, one time invariant controlled by origin-destination fixed effects, and a second time-varying component controlled by

17 See more details in Appendix B.

countries' trade policies. Following the literature on the SGMT, we adopt the following specification:

$$X_{ijt}=exp(\eta_{it}+\xi_{jt}+\psi_{ij}+\beta_1 DTA_{ijt}+\beta_2 NRBL_{ijt}+ \beta_3 \ln(1+AT_{ijt})+\beta_4 CC_{ijt}+\omega_t IT_t)+\mu_{ijt} \quad (4.2)$$

where:

η_{it}, $\xi_{jt,}$ and ψ_{ij} are, respectively, origin-time, destination-time, and origin-destination fixed effects;

DTA_{ijt} is a dummy variable equal to 1 when at time t countries i and j are related by a deep trade agreement[18];

$NRBL_{ijt}$ is the product of the number of preferential bilateral relationships that countries i and j have at time t. A preferential bilateral relationship is one that is equivalent to a free trade area type or with a broader coverage of disciplines and instruments (e.g., customs union, common market, economic union, etc.);

AT_{ijt} is the tariff applied by importer j to imports originating from exporter i, at time t;

CC_{ijt} is a variable that measures the degree of trade complementarity between country i's export structure and country j's import structure;

IT_t is a dummy variable equal to 1 when X_{ijt} corresponds to an international flow at time t, i.e. when $i \neq j$. The set of variables IT_t , for t = 1995, ..., 2017, controls for globalization effects that have a worldwide impact on trade flows, e.g. the decline experienced during the 2009 global crisis.

Following the standard empirical literature, we use a pseudo maximum likelihood Poisson estimator (Santos Silva and Tenreyro (2006) and

18 Deep trade agreements are considered to be those catalogued by Fontagné et al. (2023) when using the classification obtained by means of the k-means++ clustering algorithm, with a subsequent recategorization of some agreements that the authors define as "borderline PTAs".

Correira, Guimarães and Zylkin (2020)), in addition to applying the correction of Weidner and Zylkin (2021).

The specification of trade costs has some innovations. First, the discrete variable measuring the effect of PTAs builds upon the proposal of the World Bank work to identify the effects of deep PTAs (Fontagné et al., 2023). The remaining variables used to control for time-varying trade costs follow the specification of Moncarz et al. (2023) in that trade costs are asymmetric ($t_{ijt} \neq t_{jit}$).

Anderson, Larch and Yotov (2020) extend the SGMT to allow for capital accumulation, and derive a dynamic gravity model (SDGMT)[19]. This extension requires the estimation of two additional equations, one modeling the evolution of income and another one explaining the evolution of capital. As shown by Anderson, Larch and Yotov (2020), the specifications of these two additional equations are as follows:

$$\ln Y_{jt} = \kappa_1 \ln L_{jt} + \kappa_2 \ln K_{jt} + \kappa_3 \ln \Pi_{jt}^{\sigma-1} + \nu_t + \vartheta_j + \varepsilon_{jt} \quad (4.3)$$

$$\ln K_{jt} = \psi_1 \ln E_{jt-1} + \psi_2 \ln K_{jt-1} + \psi_3 \ln P_{jt-}^{\sigma-1} + \nu_t + \vartheta_j + \varepsilon_{jt} \quad (4.4)$$

As discussed by Anderson, Larch and Yotov (2020), equation (4.3) provides a theoretical basis for the reduced-form equation of Frankel and Romer (1999), enabling to test whether there is a causal relationship between trade openness and income. Moreover, given the structural nature of the SDGMT, the estimates of the coefficients in equation (4.3) leads to estimations of the elasticity of substitution, as well as the labor and capital shares in production, given to the following structural relationships: $\hat{\sigma} = -1/\hat{\kappa}_3$, $\hat{\alpha} = \hat{\kappa}_2/(1+\hat{\kappa}_3)$, y $\hat{\kappa}_1 + \hat{\kappa}_2 = 1 + \hat{\kappa}_3$.

Following Anderson, Larch and Yotov (2020) once more, equation (4.4) captures the effect of trade (liberalization) on capital accumulation.

19 Appendix B addresses this derivation with more detail.

Its estimation provides three results: (i) testing whether there is a causal relationship between trade openness and temporary growth; (ii) providing an estimate of the elasticity of substitution; and (iii) providing an estimate of the rate of capital depreciation. Equation (4.4) imposes the following structural relationships: $\psi_1=\delta$; $\psi_2=1-\delta$; and $\psi_3=-\delta/(\sigma-1)$. Thus, to the extent that multilateral resistances as an importer are a measure of general equilibrium trade costs, a significant estimate of ψ_3 supports a causal relationship between trade and capital accumulation.

Finally, Anderson, Larch and Yotov (2020) propose the estimation of a reduced form of the income equation, which takes the following form:

$$\ln Y_{jt} = \kappa_1 \ln L_{jt} + \kappa_2 \ln E_{jt-1} + \kappa_3 \ln K_{jt-1} + \kappa_4 \ln P_{jt-1}^{\sigma-1} + \kappa_5 \ln \Pi_{jt}^{\sigma-1} + \nu_t + \vartheta_j + \varepsilon_{jt} \quad (4.5)$$

with $k_1=(1-\alpha)(\sigma-1)/\sigma$, $k_2=\alpha\delta(\sigma-1)/\sigma$, $k_3=\alpha(1-\delta)(\sigma-1)/\sigma$, $k_4=-\alpha\delta/\sigma$, y $k_5=-1/\sigma$. Equation (4.5) enables to identify the direct effect of trade on income, through trade openness (term $\ln \Pi_{jt-1}^{\sigma-1}$) , as well as the indirect effect of trade on income via the accumulation of capital (term $\ln P_{jt-1}^{\sigma-1}$). It also reveals the elasticity of substitution $\hat{\sigma} = 1/\hat{\kappa}_5$, the capital share in output value $\hat{\alpha} = 1 - \hat{\kappa}_1 \ (1 + \hat{\kappa}_5)$, and the transition rate of the capital stock $\hat{\delta} = \hat{\kappa}_2 \ (\hat{\kappa}_2 + \hat{\kappa}_3)$, subject to the following restrictions: $\hat{\kappa}_2 = (1/\hat{\kappa}_5 + 1) \ \hat{\kappa}_4$ y $\hat{\kappa}_1 = 1 + \hat{\kappa}_5 - \hat{\kappa}_2 - \hat{\kappa}_3$.

The estimation of equations (4.3), (4.4) and (4.5) involve quite a few challenges derived from the potential endogeneity of the explanatory variables. For their estimation we follow Anderson, Larch and Yotov (2020), and use different specifications of estimators with instrumental variables. See Table 4.2 for the list of instruments used in each of the three equations.

4.2. Results

Table 4.1 reports the results of various specifications of the structur-

Table 4.1. Structural gravity equation results.1995-2017

	(1)	(2)	(3)	(4)
DTA_{ijt}	0.232***	0.252***	0.197***	0.210***
$NRBL_{ijt}$			0.0000688***	0.0000739***
$\ln(1 + AT_{ijt})$	-3.503***	-3.625***	-3.630***	-3.802***
CC_{ijt}	1.427***	1.372***	1.345***	1.277***
Bias correction	No	Yes	No	Yes
# Observations	287,638	287,638	287,638	287,638

Robust standard errors.*** p<0.01, ** p<0.05, * p<0.1. In all cases we controlled for globalization effects, and included origin-time, destination-time, and origin-destination fixed effects.

al gravity equation. In all cases the estimates are statistically significant at the usual levels and have the expected signs.

The applied tariff term (AT_{ijt}) aims to identify the effect of the heterogeneous treatment that each country i receives from a given importing country j on bilateral trade flows. The coefficients show, as expected, that imports increase in the face of lower tariffs. An important implication of including applied tariffs is that the (absolute) value of the estimated coefficient is a measure of the elasticity of substitution between varieties produced by different origins, the parameter σ in equation (4.1). The estimated value, which varies between 3.503 and 3.802, falls within the range of values reported in the literature according to Head and Mayer (2014).

Higher levels of openness, often manifested in the signing of preferential trade agreements, may also be associated with other liberalizing trade policies, such as trade facilitation, special regimes or FDI facilitation policies, among others. Based on this assumption, and following Moncarz et al. (2023), we propose to use the number of liberalized bilateral relations of each country as a consequence of the signature of PTAs to assess the preference for openness. This choice is based on the stylized fact that countries with more liberalized bilateral relations have higher levels of trade openness. In particular, the variable we propose $NRBL_{ijt}$ corresponds to the product of the number of preferential bilateral relations that a given country pair ij possesses at a time t. As expected, and as reported in columns (3) and (4) of Table 4.1, positive and statistically significant coefficients are obtained. The same is true for the variable that measures the complementarity between the sectoral structure of country i's exports and that of country j's imports (CC_{ijt}).

As mentioned above, the variable AT_{ijt} controls for the heterogeneity that exists in the tariff treatment that importer j offers to imports from different origins i. This heterogeneity is explained to a greater extent by the existence of preferential trade agreements, but also by the so-called Generalized Systems of Preferences, which include tariff preferences granted unilaterally by developed economies. Within the group of preferential trade agreements, however, there may be important differences. On the one hand, there are agreements with a limited scope, both in terms of the products covered and in the depth of the trade agreement. With regard to the latter, a distinction that is becoming increasingly important in applied analysis relates to the different disciplines included in trade agreements, which have given rise to the concept of deep trade agreements, i.e. those agreements that go beyond tariff preferences and advance on different dimensions of economic relations between countries, such as the homogenization of labor policies, the adoption of common technical criteria, etc. As can be seen in Table 4.1, the fact that a pair ij is linked by a deep trade agreement (DTA_{ijt}=1) increases trade, between 21.7% and 28.7% over what would be expected from the lower applied tariffs associated with the signing of a preferential trade agreement.

Table 4.2 presents the results of equations (4.3), (4.4) and (4.5), which, as mentioned above, correspond to the extension of the structural gravity model to allow for capital accumulation. Columns (1), (3) and (5) report the results of the instrumental variables estimations, while columns (2), (4) and (6) additionally impose the restrictions arising from the structural model as discussed above. Before commenting on the results, let us note that, in the case of the static version of the income equation (equation 4.3) and the capital equation (equation 4.4), the instruments used meet the required conditions, as derived from the results of the Kleibergen-Paap rk LM and the Hansen J tests. However, this is not the case for the dynamic income equation (equation 4.5), where the Hansen J test rejects the null hypothesis that the excluded instruments are correctly excluded.

For the static income equation (equation 4.3), the results show a positive and significant relationship between factor endowments (labor and capital) and income. The negative coefficient for $\ln \widehat{\Pi_{Jt}^{\sigma-1}}$ is explained by the fact that greater trade freedom, which is reflected in lower multilateral resistance as an exporter for liberalizing countries, translates into higher factory-gate price, leading to an increase in the value of output/income. The results of the capital equation (equation 4.4) again show statistically significant estimates, and with the expected signs. In this case, the effect of greater trade openness on capital accumulation is again channeled through an increase in the factory-gate price as well as through the decrease in multilateral resistance as an importer. Higher factory-gate prices incentivize higher investment in countries that are open to international trade, similar to the effect of lower multilateral resistance as an importer, the reduction in $\ln \widehat{P_{Jt}^{\sigma-1}}$ following liberalization. Finally, the coefficients of multilateral resistance as exporter $\ln \widehat{\Pi_{Jt}^{\sigma-1}}$ and as importer $\ln \widehat{P_{Jt}^{\sigma-1}}$ that evidence the effect of trade liberalization in the dynamic reduced form of income (equation 4.5), have the expected negative sign, but are statistically significant only when the restrictions by the structural model are imposed.

As for the values of the structural parameters derived from the equations, they are significant in all cases except for equation (3.5), when no structural constraints are imposed. The values obtained for the elasticity of substitution (σ) are within the range reported in the literature, as discussed in Head and Mayer (2014). For the share of capital in output (α), the values are also within the range reported in the empirical evidence. Finally, the estimates of the depreciation rate (δ) in column (3) seems to be very low, while the values reported in columns (5) and (6) seem somewhat high at first sight. However, the latter can be justified following Anderson, Larch, and Yotov (2022), who point out that in their model the parameter δ combines the depreciation of old capital with the adjustment costs when incorporating the investment in new capital. Given the variability of the values obtained for the different parameters, in the next section an average of the values resulting from the different estimates are used: σ = 3.277; α = 0.503; δ = 0.143. These are similar to the ones used by Anderson, Larch and Yotov (2020).

Table 4.2. Trade, income and capital accumulation, 1995-2017

Equation	Income static (equation 4.3)		Capital (equation 4.4)		Income dynamic (equation 4.5)	
Estimator	IV (1)	IV Rest. (2)	IV (3)	IV Rest. (4)	IV (5)	IV Rest. (6)
$\ln L_{jt}$	0.444***	0.358***			0.4420***	0.1610***
$\ln K_{jt}$	0.291***	0.320***				
$\ln \widehat{\Pi_{jt}^{\sigma-1}}$	-0.181***	-0.322***			-0.2610	-0.2650***
$\ln K_{jt-1}$			0.9790***	0.9920***	0.2110***	0.4520***
$\ln E_{jt-1}$			0.0136***	0.0077***	0.0557	0.1210***
$\ln \widehat{P_{jt-1}^{\sigma-1}}$			-0.0155***	-0.0140***	-0.2000	-0.0428***
# Observations	1,566	1,566	2,090	2,090	1,566	1,566
R^2	0.998	0.998	1.000	1.000	0.999	0.999
Underid. Test – Kleibergen-Paap rk LM statistic	47.93***		73.61***		12.23***	
Hansen J statistic	4.952		1.114		16.55***	
$\hat{\sigma}$	5.525**	3.106***	1.877***	1.549***	3.831	3.774***
$\hat{\alpha}$	0.355***	0.472***			0.402	0.781***
$\hat{\delta}$				0.008***	0.209	0.211***
Instruments	$\ln \tilde{\Pi}_{jt}^{\sigma-1}$; $\ln \tilde{\Pi}_{jt-1}^{\sigma-1}$; $\ln \tilde{\Pi}_{jt-2}^{\sigma-1}$; $\ln \tilde{\Pi}_{jt-3}^{\sigma-1}$; $\ln K_{jt-4}$; $\ln POP_{jt}$; $\tilde{t}_{ijt}^{\sigma-1}$; ND_{jt}; TFP_{jt-5}		$P_{jt-1}^{\sigma-1}$; $P_{jt-2}^{\sigma-1}$; $\ln E_{jt-2}$; $\ln K_{jt-4}$; ND_{jt-1}		$\ln \tilde{\Pi}_{jt}^{\sigma-1}$; $P_{jt-5}^{\sigma-1}$; $\ln K_{jt-}$; $\ln E_{jt-4}$; $\tilde{t}_{ijt}^{\sigma-1}$; ND_{jt-1}; TFP_{jt-4}	

Robust standard errors. *** p<0.01, ** p<0.05, * p<0.1. In all cases, country and time fixed effects were included. $\tilde{\boldsymbol{\Pi}}_{jt}^{\sigma-1}$: inverse of multilateral resistance as exporter, using population data from 1995 as weights and excluding the internal trade component. $\boldsymbol{P}_{jt}^{\sigma-1}$: inverse of multilateral resistance as importer, using population data from 1995 as weights and excluding the internal trade component. $\boldsymbol{POP}_{jt}$: population. $\tilde{\boldsymbol{t}}_{ijt}^{\sigma-1}$: instrument based on the inverse of trade costs estimated with a traditional gravity model without using exporter and importer fixed effects because they would contaminate the IV estimate, since they implicitly take into account income and expenditure. $\boldsymbol{ND}_{jt}$: instrument based on the occurrence of natural disasters. $\boldsymbol{TFP}_{jt-5}$: measure of total factor productivity, obtained from the Penn World Tables.

5. Contrafactual analysis

The counterfactual exercise consists of changing the trade costs and then, according to the SDGMT (see Appendix B), finding the solution for the set of endogenous variables: income, capital, export prices, import prices, and factory-gate price. The starting point is a baseline scenario corresponding to the trade costs estimated in section 4 (see Table 4.1) for the year 2017. The bilateral trade costs are altered according to four scenarios, depending on the countries that are members of the CPTPP:

i. CPTPP according its current composition,
ii. CPTPP including the accession of Uruguay,
iii. CPTPP including the accession of China,
iv. CPTPP including the accessions of China and Uruguay.

For each of the scenarios, the change between the baseline and counterfactual equilibria are analyzed. In the short-run or static equilibrium it is assumed that there is no capital accumulation. In this equilibrium, physical production is constant. The effect of the reduction in trade costs (t_{ijt}) among countries that become members of the agreement affects the average prices of buying (P_{jt}) and selling (Π_{it}). The selling price together with the relative size of the economies $\left(\frac{Y_{jt}}{Y_t}\right)$ affect the factory-gate prices (p_{jt}) and through this mechanism, the nominal output value. The second counterfactual equilibrium is the dynamic equilibrium in a new steady state, for which capital accumulation and production growth are allowed. The steady state equilibrium for capital (K_{jt}) is presented in Appendix B (see equation B.6'). In summary, 2 equilibria for each of the 4 counterfactuals are analyzed.

In order to perform the counterfactual exercises, the estimates in section 4 are used (see Table 4.2). The value of the elasticity of substitution is σ = 3,277, the share of capital in the value of production α = 0,503, and the depreciation rate of capital δ = 0,143[20]. In addition, two other robustness exercises were carried out. Table 5.1 summarizes the values of the parameters used. The results presented next are those corresponding to the Base scenario[21].

Table 5.1. Parameters for counterfactual exercises

	Base (B)	Change α (R1)	Change σ (R2)
Elasticity of substitution (σ)	3.277	3.277	6.000
Capital share (α)	0.503	0.700	0.503
Capital depreciation rate (δ)	0.143	0.143	0.143

Source: own.

The change in welfare is measured as the proportional change in real consumption. This change is also equal to the change in the stock of capital and the change in real income in terms of consumer prices (see equation B.8 in Appendix B). Note that consumer prices include also purchases on the domestic market. In the static equilibrium, this change is purely a relative price effect between the change in the output and the purchase prices. That is, trade liberalization generates a terms of trade effect that translates into a change in openness that is directly related to the change in welfare (see equation B.9 in Appendix B). In the dynamic equilibrium, real output changes in addition to the price change. This second effect is a consequence of the relative price change mentioned above, so the welfare effect is amplified (see equations B.10 and B.11 in Appendix B).

20 For the transitional equilibrium, we use a consumer discount factor β = 0.98, which is standard in the literature.

21 Table C.4 and Graph C.1 in Appendix C report the results for the robustness exercises.

Table 5.2. Welfare change (%)

Group	Scenario	Equilibrium	
		Static	Steady state
Members	CPTPP	0.96	1.81
	CPTPP+U	1.01	1.91
	CPTPP+C	1.21	2.35
	CPTPP+U+C	1.25	2.43
Non-members	CPTPP	0.00	0.03
	CPTPP+U	0.01	0.03
	CPTPP+C	0.00	0.04
	CPTPP+U+C	0.00	0.05
World	CPTPP	0.14	0.28
	CPTPP+U	0.15	0.30
	CPTPP+C	0.38	0.77
	CPTPP+U+C	0.40	0.80

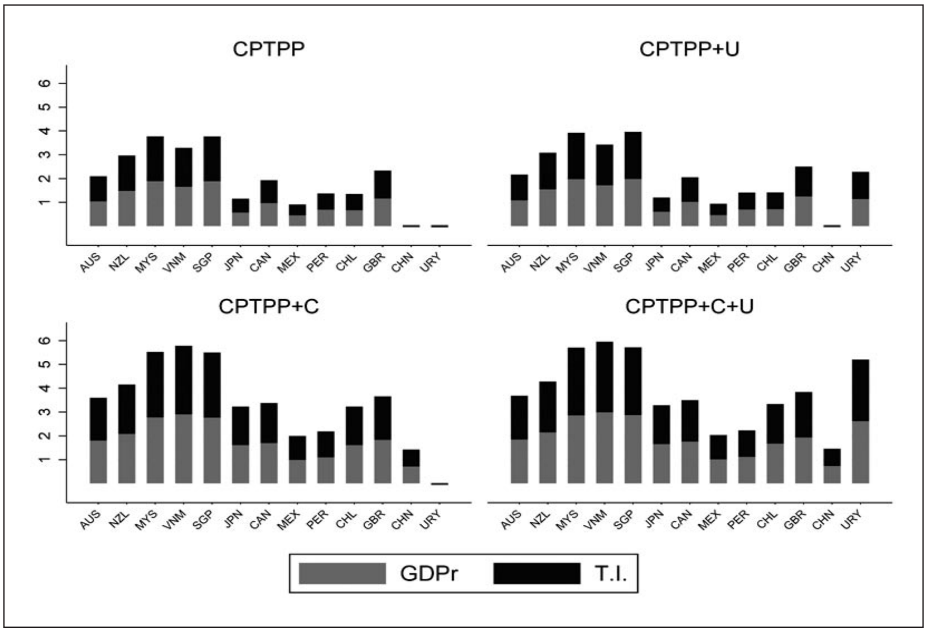
See Table C.1 in Appendix C which include the transitional equilibrium. Source: own.

Table 5.2 shows that the welfare effect for CPTPP members is positive in all counterfactuals, with the largest effects associated with China joining the agreement, with a maximum effect of 2.43% relative to the baseline scenario. In general, the welfare effect in the new steady state –the long-run effect– is larger than in the static equilibrium, almost twice as large for the countries that are members of the agreement. For the group of countries that are not part of the agreement, there are virtually no changes in their welfare, although the effects are generally positive but small. The effect of the agreement on the world as a whole is positive, but of reduced magnitude.

The dynamic equilibrium allows a decomposition of the welfare gains (W) into two components: the increase in real output (GDPr) and the improvement in the terms of trade (T.I.). Equation 5.1 (see Appendix B) summarizes this decomposition, where a country's gains are related to its ability to take advantage of the lower costs of international trade and the mechanisms behind them.

$$w_j = k_j = (\lambda_j)^{1/(1-\sigma)(1-\alpha)} = \underbrace{(\lambda_j)^{1/(1-\sigma)}}_{T.I.}\underbrace{(\lambda_j)^{\alpha/(1-\sigma)(1-\alpha)}}_{GDPr} \quad (5.1)$$

Graph 5.1 Decomposition of the impact on welfare according to the scenario for dynamic equilibrium (%)



See more details in Table C.3 in Appendix C. Source: own.

This relationship is established according to the domestic supply method ($\lambda_{jt} = \frac{X_{jjt}}{Y_{jt}}$), either through greater openness or through domestic production, which is captured by the ratio $\lambda_j = \frac{\lambda_{jC}}{\lambda_{jB}}$ and two of the structural parameters of the model (elasticity of substitution (σ) and the share of capital in the value of production (α)). As Graph 5.1 shows, the terms of trade and real GDPr growth contribute in similar percentages to the increase in welfare.

Equation (5.1) can also be used to interpret the results obtained in the robustness exercises, when the values of the structural parameters are changed. In a context of greater openness (reduction in λ_j), a higher share of capital in income (greater α) amplifies the effect via real output, while a reduction in the level of product differentiation according to its origin (increase in σ) reduces both effects, terms of trade and real output. The results of the robustness exercises for the scenario with Uruguay and China are presented in Annex C, Table C.4.

Table 5.3. Change in welfare for treated countries according to scenario and equilibrium (%)

Scenario	Equilibrium	AUS	NZL	MYS	VNM	SGP	JPN	CAN	MEX	PER	CHL	GBR	URY	CHN
CPTPP	Static	1.08	1.56	2.03	1.76	2.07	0.59	1.06	0.49	0.71	0.72	1.26	-0.01	-0.01
	Dynamic	2.10	2.99	3.81	3.31	3.80	1.16	1.94	0.91	1.38	1.36	2.35	-0.01	0.00
CPTPP+U	Static	1.12	1.62	2.11	1.83	2.17	0.61	1.13	0.50	0.73	0.76	1.35	1.21	-0.01
	Dynamic	2.18	3.10	3.97	3.46	4.00	1.21	2.06	0.94	1.42	1.42	2.52	2.30	0.00
CPTPP+C	Static	1.85	2.16	2.96	3.10	3.00	1.65	1.85	1.07	1.12	1.72	1.97	-0.04	0.71
	Dynamic	3.63	4.20	5.61	5.87	5.58	3.25	3.40	2.01	2.20	3.25	3.69	-0.04	1.43
CPTPP+U+C	Static	1.90	2.23	3.05	3.19	3.13	1.68	1.92	1.09	1.14	1.78	2.07	2.76	0.73
	Dynamic	3.72	4.33	5.79	6.05	5.80	3.32	3.53	2.05	2.25	3.36	3.88	5.27	1.47

Source: own

Table 5.3 disaggregates the results for each member country. The countries are arranged geographically (Oceania, East and Southeast Asia, the Americas, and Europe). Uruguay and China are listed last because they are not currently members. Regardless of the scenario, the countries that benefit most from the agreement in terms of welfare are some Asian countries (Malaysia, Vietnam, and Singapore), followed by New Zealand in Oceania, unless China and Uruguay become members, in which case Uruguay ranks fourth. China and Japan, as well as the American countries (Mexico, Chile and Peru), are the least favored. This heterogeneity is due to the way the extensive and intensive margins work for each country. The scenarios with China produce the largest welfare gains. Considering the dynamic equilibrium, without China the maximum gain is of 4% (Singapore) but when China is included the largest gain is just above 6% (Vietnam).

Graph C.1 in Appendix C shows for each country the time evolution of the capital stock for the different parameter sets, while Table C.2 also reports the results for the transitional equilibrium when a consumer discount factor β = 0.98 is used. The transitional equilibrium reports welfare gains that are about 87% of those obtained for the dynamic equilibrium.

The largest impact on the signatory countries occurs in the trade variable (exports and imports), with rates of change that far exceed the variations in income and welfare. For the sake of simplicity, only the dynamic equilibrium results for the CPTPP+U+C scenario are presented. Note that this is the one with the largest trade effects[22].

In this context, the aggregate exports of all member countries are expected to increase by 11.9% (see Table 5.4), exports of non-member countries also increase in this scenario, although by a much smaller percentage, thus increasing world trade. As a result of the reduction in trade costs, trade between participating countries would increase by 43.3%, while exports to non- participating countries also increase, but only 1.36%. For non-participating countries there would be a decrease in exports to CPTPP members, compensated by an increase in exports to other non- participating countries (see Table C.5 Appendix C).

At the country level, the decline in trade costs would, as expected, lead to a reduction in the importance of domestic sales due to increased competition from foreign goods. As equation (5.1) shows, the countries with the largest declines in domestic sales (as a percentage of GDP) are the countries with the largest welfare gains. But at the same time, the increase in total exports means an increase in total sales. Uruguay, the United Kingdom and Japan are the countries with the largest increases in exports to other members, while Singapore, New Zealand and China are at the opposite extreme. In terms of total exports, Japan, Uruguay, Australia and China are the most favored, while the United Kingdom, Chile, Canada and Mexico experience the smallest increases. The different performance in terms of intra- and total exports is explained by what happens to exports to non-members. For 7 out of 13 members, exports to non-member countries would fall, with Australia, Japan and New Zealand showing the worst performance.

22 The results for the other scenarios are presented in Tables C.5 and C.6 in Appendix C.

(5.1)

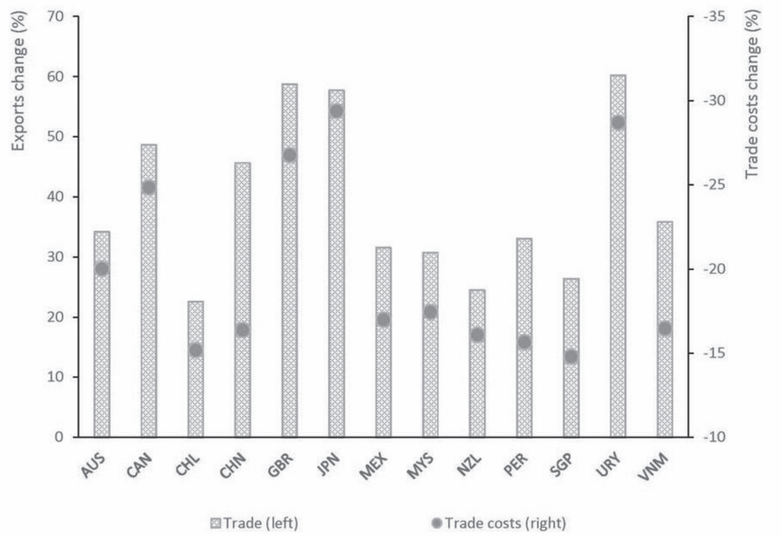
Table 5.4. Variation in internal trade and exports members of the agreement by partner (CPTPP+C+U dynamic)

Country	Internal trade/GDP (p.p.)	Exports destination (%)		
		No partners	Partners	Total
AUS	-4.05	-2.25	34.22	16.01
NZL	-4.68	-2.29	24.53	13.03
MYS	-6.17	-0.6	30.77	12.68
VNM	-6.43	1.62	35.85	13.54
SGP	-6.18	-1.88	26.41	10.48
JPN	-3.62	-2.26	57.72	19.24
CAN	-3.85	0.34	48.67	7.15
MEX	-2.27	1.84	31.58	4.45
PER	-2.48	-0.14	33.11	10.11
CHL	-3.67	-1.81	22.57	8.52
GBR	-4.21	2.51	58.76	8.99
URY	-5.65	0.02	60.22	16.60
CHN	-1.64	3.69	45.67	15.07
Total		1.36	43.32	11.86

Source: own.

For the CPTPP plus China and Uruguay scenario, Figure 5.2 shows the relationship between the variation in each member's exports to the rest of the signatories and the reduction in the average trade costs of accessing the other partners' markets. It can be seen that all the countries involved

Graph 5. 2. Changes in exports and trade costs (CPTPP+C+U dynamic)

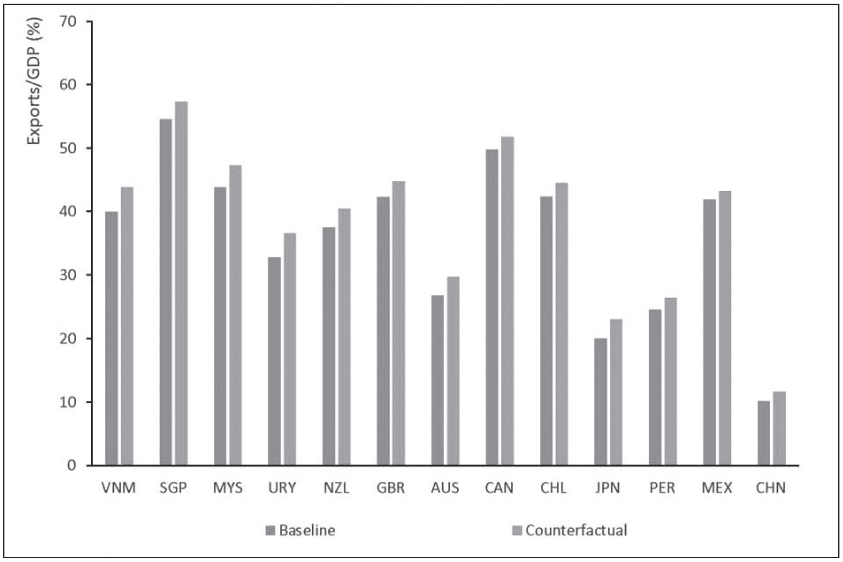


Note: trade costs are obtained as a weighted average using partners' GDP as weights.
Source: own.

experience a reduction in trade costs of at least 15% (Chile), with Japan and Uruguay achieving the largest reductions (around 29%), followed by the United Kingdom in third place. Moreover, there is a strong correlation between the reduction in trade costs and the increase in exports. Countries that achieve a greater reduction in trade costs are those that experience a greater increase in exports. In this sense, Uruguay is in first place, followed by the United Kingdom and Japan.

Figure 5.3 shows the degree of openness of the members of the agreement, i.e. the ratio of exports to GDP. Again, for the CPTPP plus China and Uruguay scenario, a comparison is made between the situation before the agreement (baseline) and after the agreement (counterfactual). The results show that the signing of the agreement leads to an increase in openness for all countries involved. The increases in Vietnam (3.9 p.p.) and Uruguay (3.8 p.p.) stand out.

Graph 5.3. Trade openness of CPTPP members in baseline and counterfactual equilibria (CPTPP+C+U dynamic)



6. Summary and conclusions

The structural gravity model of trade, which analyzes the determinants of bilateral trade flows, relates the economic size of the importer (measured by its expenditures) and the exporter (measured by its output) to the substitution that occurs because of the bilateral relative prices that both economies face. As an economy's trade costs with its trading partners change, both as an importer and as an exporter, aggregate prices as buyer and seller also change. Typically, these prices are reduced when a process of trade liberalization takes place. This change leads to an increase in the factory-gate price and a decrease in the purchase price. In other words, there is an improvement in the terms of trade. The change in welfare (change in real consumption) in the static model is given by the proportional change in the terms of trade before and after the reduction in trade costs. The source of this change is the efficiency gain from the reduction in the amount of spending going to pay trade costs, which allows consumption to expand.

The model of economic growth used in Anderson, Larch and Yotov (2020) is standard in the literature[23]. Given an employment path, the dynamics of income depends on factor productivity and the saving rate. The former is exogenous to the model and is assumed to depend on technical progress, which has its own dynamics. The savings rate is derived from the consumer's optimal intertemporal consumption decisions. The optimal rate of saving implies more or less capital accumulation according with the relative price of own production compared to the price of a consumption basket of domestic and imported goods. This capital accu-

23 See Solow (1956). For a recent application of Eaton y Kortum (2002) model see Alvarez (2017).

mulation determines the level of per capita consumption to which the trajectories of the variables converge in the steady state. In summary, the structural gravity model of trade is combined with a classical Solow growth model. Changes in the terms of trade (p_j / P_j) modify decisions about consumption and savings, and thus capital accumulation, and through this mechanism affect the income of the economy. In this dynamic context, changes in welfare are amplified by the effects on capital accumulation and income. More open economies save more and thus achieve higher per capita income. This analytical framework allows focusing on changes in trade costs and their impact on aggregate variables. It is particularly suitable for analyzing the effects of the CPTPP (twelve members including the United Kingdom) and the inclusion of two new members (China and Uruguay). As described in the first section, the CPTPP is a plurilateral agreement that nests a set of previous PTAs that are deepened (intensive margin) and new ones are added (extensive margin). This phenomenon has been called the multilateralization of regionalism, which deepens trade liberalization and increases certainty about the trade rules of the participating countries. This is a long run evolution of the structure of international trade that counteracts recent processes that are moving in the opposite direction[24].

The applied analysis follows the methodology of Anderson, Larch and Yotov (2020). For the estimation of the structural gravity model, the latest available techniques are used to obtain the determinants of trade costs in order to simulate different scenarios depending on the countries members of the CPTPP.

The gravity equation incorporates the following innovations: a discrete variable identifying the effect of deep PTAs (Fontagné et al. (2023)),

24 Aggressive unilateralism of trade policy, climate change mitigation policies that use trade as a mechanism to discipline their adoption, increase in geopolitical conflicts.

bilaterally applied tariff that allows trade costs to be asymmetric ($t_{ijt} \neq t_{jit}$), a non-discriminatory effect that is diffused to countries not participating in the agreement due to the greater trade facilitation brought about by the growth in the number of liberalized bilateral relations; it also controls for countries' trade complementarity by capturing the influence of different productive specializations (Moncarz et al., 2023). In addition, given the dynamic nature of the model, three equations are estimated that provide the effects of liberalization, which translate into reductions in the selling and purchasing prices (multilateral resistances) of the liberalizing countries, as well as an increase in the factory-gate price, favoring the rate of investment, which in the long run translates into gains in terms of income and capital. The results of the estimations show statistically significant coefficients with the expected signs. As for the values of the structural parameters (elasticity of substitution, capital share in production and depreciation rate), they are within the ranges reported in the literature, in particular in Anderson, Larch and Yotov (2020).

The counterfactual exercise allows estimating the short -and long-term effects of the CPTPP in an international general equilibrium framework. Four scenarios were constructed: CPTPP in its current composition; CPTPP plus Uruguay; CPTPP plus China; CPTPP plus China and Uruguay. Trade liberalization implies a first effect, which is the reduction of trade costs for countries participating in the agreement, and a trade facilitation effect, which also generates reductions with non-partners. The results are measured in two different equilibria: a static equilibrium, where there are no real changes and all the effects occur only through changes in prices; and a dynamic equilibrium, where changes in prices affect real variables (capital stock and income), leading in the long run to a new stationary state.

The overall results are clear and parsimonious. Considering the scenario in which China and Uruguay join the CPTPP, the static equilibrium reports gains for the participating countries as a whole in the order of half compared to the dynamic equilibrium, 1.25% compared to 2.43% respectively. Prices improve with liberalization, there is more trade openness, and welfare gains are amplified when prices are allowed to affect real investment decisions (the stock of capital) and hence the real level of output. This process takes time and there is a dynamic transition in which the world economy converges to a new steady state. The speed of convergence depends on the rate of capital depreciation and the discount rate.

Simple robustness exercises were performed in the parameter space. A higher share of capital in the value of production (higher α) amplifies the effect via real output, while a reduction in the degree of differentiation of products according to their origin (increase in σ) reduces both effects, the terms of trade and real output. The results show heterogeneity among countries, which can be explained by the combination of two factors: the intensity of liberalization for each country according to its starting point (balance between intensive and extensive margin), and the level of structural proximity of the countries to the other members of the agreement (permanent trade costs expressed by bilateral fixed effects ψ_{ij}). Greater liberalization implies greater impact and also greater proximity.

The economies that benefit the most are those of Southeast Asia that belong to ASEAN (Vietnam, Malaysia and Singapore), for which the extensive margin is related to the agreements with the countries of the Americas and because they are also closer to the large markets of Asia and Oceania (Japan, China and Australia). Uruguay stands out for appearing in fourth place, with the result explained by the large effect of trade liberalization that the agreement implies: there is almost a 30% reduction in the average trade costs that Uruguay faces to access the markets of the other members of the bloc, with an increase in exports to those markets of around 60%. This is despite the fact that Uruguay is an economy that is far from the large Asian markets (high permanent trade costs), but the agreement improves access to these markets (extensive margin) and at the same time deepens trade relations with the American countries with which Uruguay already has preferential relations (intensive margin).

References

Álvarez, F. 2017. Capital accumulation and international trade. *Journal of Monetary Economics,* 91, 1-18.

Anderson, J. and van Wincoop, E. 2003. Gravity with Gravitas: A Solution to the Border Puzzle. *The American Economic Review*, 93(1), 170-192.

Anderson, J., Larch, M. and Yotov, Y. 2015. Growth and trade with frictions: a structural estimation framework. *NBER Working Paper* 21377.

Anderson, J., Larch, M. and Yotov, Y. 2020. Transitional Growth and Trade with Frictions: A Structural Estimation Framework. *The Economic Journal*, 130(August), 1583-1607.

Arkolakis, C., Costinot, A. and Rodríguez-Clare, A. 2012. New Trade Models, Same Old Gains? *The American Economic Review*, 102(1), 94-130.

Baldwin, R. and Low, P. 2009. Multilateralizing regionalism: *Challenges for the global trading system*. World Trade Organization, Cambridge University Press.

Bergstrand, J. 1985. The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical. *The Review of Economics and Statistics*, 67, 474-481.

Bergstrand, J. 1989. The Generalized Gravity Equation, Monopolistic Competition, and the Factor- Proportions Theory in International Trade. *The Review of Economics and Statistics*, 71, 143-153.

Correia, S., Guimarães, P. and Zylkin, T. 2020. Fast Poisson Estimation with High-Dimensional Fixed Effects. *The Stata Journal*, 20(1), 95-115.

Deardorff, A. 1998. Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical Framework? In J. A. Frankel (ed.) *The Regionalization of the World Economy*, University of Chicago Press: Chicago.

Eaton, J. and Kortum, S. 2002. Technology, Geography, and Trade. *Econometrica*, 70(5), 1741-1779.

Fernandes, A., Rocha, N. and Ruta, M. (editors). 2023. Beyond Trade. *How Deep Trade Agreements Shape Non-Trade Outcomes*, CEPR and World Bank Group.

Fontagné, L., Rocha N., Ruta M. and Santoni G. 2023. The Economic Impact of Deepening Trade Agreements. *The World Bank Economic Review*, 37(3), 366-388.

Frankel, J. and Romer, D. 1999. Does trade cause growth? *The American Economic Review*, 89(3), 379-99.

Head, K. and Mayer, T. 2014. Gravity equations: workhorse, toolkit, and cookbook. In G. Gopinath, E. Helpman and K.S. Rogoff (eds.), *Handbook of International Economics*, Vol. 4, 131-95. Oxford: Elsevier.

Limão, N. 2023. What can we expect from preferential trade agreements? In A. Fernandes, N. Rocha and M. Ruta (eds.), *Beyond Trade: How deep trade agreements shape non-trade outcomes*, Paris & London: CEPR Press.

Lucas, R. 1987. *Models of Business Cycles*, New York: Basil Blackwell.

Moncarz, P., Flores, M., Villano, S. and Vaillant, M. 2023. Intra- and extra-regional trade costs: A comparative approach to Latin-American performance. *The World Economy*, 46(8), 2248-2284.

Pöyhönen, P. 1963. A Tentative Model for the Volume of Trade between Countries. *Weltwirtschaftliches Archiv (Review of World Economics)*, 90, 93-100.

Santos Silva, J. and Tenreyro, S. 2006. The Log of Gravity. *Review of Economics and Statistics*, 88(4), 641-658.

Solow, R. 1956. A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70(1), 65-94.

Teti, F. 2020. 30 Years of Trade Policy: Evidence from 5.7 Billion Tariffs. *ifo Working Paper*, 334.

Tinbergen, J. 1962. *Shaping the World Economy: Suggestions for an International Economic Policy*. New-York: Twentieth Century Fund.

Weidner, M. and Zylkin, T. 2021. Bias and consistency in three-way gravity models. *Journal of International Economics*, 132, 103513.

Appendix A. Data

Estimation of the structural gravity trade model

The database of bilateral trade flows (including domestic transactions) has a geographical coverage of 113 countries, representing about 94% of world trade during the period 1995-2017, corresponding to the Agriculture, Livestock, Hunting and Fishing (Sector AB) and Manufacturing (Sector D) sectors according to the International Standard Industrial Classification (ISIC, Revision 3). The design of this database is based on Moncarz et al. (2021).

To compile the database it was necessary to develop four separate databases: output in current dollars, total exports in current dollars, domestic transactions in current dollars, and bilateral trade flows in current dollars. These databases were then merged after making the necessary adjustments. The final step was to integrate the bilateral trade flows data with the domestic transactions data.

Aggregate trade data are from CEPII's BACI. An advantage of the BACI database is that it reports trade flows after the harmonization between what is declared by the importing country and what is declared by the exporting country. The data are expressed in FOB values and the original source of information is COMTRADE.

Other data sources used are the UNSTAS National Accounts - Analysis of Principal Aggregates (AMA) database for production and value added; the World Bank's World Development Indicators (WDI) database for value added; and the OECD Input-Output Tables (IOTs), which provide data on production, value added, gross exports and net exports.

The variables on bilateral trade agreements are based on the World Bank's Deep Trade Agreements Database, organized in 18 areas. The typology of agreements includes superficial, medium and deep (Fernandez, Rocha and Ruta, 2023), adjusted by data from the Latin American Integration Association (ALADI) and the World Trade Organization (WTO). The DTA variable used in the econometric model is based on information from Fontagné et al. (2023), which provides a classification of agreements according to their depth and degree of commitment.

To construct the variable product of liberalized bilateral relations, we used information on trade agreements from the Dynamic Gravity Dataset (DGD) prepared for the United States International Trade Commission (USITC), with corrections based on information from ALADI, OAS, WTO and Fontagné et al. (2023).

The commercial complementarity variable was calculated as in Moncarz et al. (2023).

The applied tariff variable comes from Teti (2020) database. First, for each sector AB and D, we have the simple average of the tariffs applied by country j on imports originating in country i. To obtain the tariff applied by country j on imports originating in country i for sectors AB and D together, we calculate the weighted average, using as weights the total exports of exporting country i of goods corresponding to each of the two sectors.

Estimation of income and capital equations and counterfactual exercises

Data on GDP, employment, capital stock, and total factor productivity are from the Penn World Tables (version 10.1).

Following Anderson, Yotov, and Larch (2020), we use Real GDP using national-accounts growth rates (variable rgdpna) for the income and capital equations. Instead, Output-side real GDP at current PPPs (variable cgdpo) was used as the starting level in the counterfactual exercises, which compare the relative productive capacity between countries at a single point in time. Employment is measured in effective units, as the product of the number of persons employed in the labor force (variable emp) and the human capital index (variable hc), based on average years of schooling. The capital stock corresponds to the serie at constant national prices (variable rnna).

Total factor productivity corresponds to the serie TFP at current values corrected by PPPs (variable ctfp).

The occurrence of natural disasters comes from the International Disaster Database. Finally, the standard gravity model variables come from the CEPII Distance Database.

Due to missing data, 3 of the 113 countries were excluded from the counterfactual exercises: Cuba, Samoa, and Tonga.

Appendix B. The model

Anderson and van Wincoop (2003) derive the SGMT in the framework of a monopolistic competition model with products differentiated by origin, for given costs and outputs. The SGMT equations are presented in the system B.1 (NxN equations), B.2 (N equations), and B.3 (N equations).

$$X_{ijt} = \frac{Y_{it}E_{jt}}{Y_t}\left(\frac{t_{ijt}}{\Pi_{it}P_{jt}}\right)^{1-\sigma} \tag{B.1}$$

$$\Pi_{it} = \left[\Sigma_j \frac{E_{jt}}{Y_t}\left(\frac{t_{ijt}}{P_{jt}}\right)^{1-\sigma}\right]^{1/1-\sigma} \tag{B.2}$$

$$P_{jt} = \left[\Sigma_i \frac{Y_{it}}{Y_t}\left(\frac{t_{ijt}}{\Pi_{it}}\right)^{1-\sigma}\right]^{1/1-\sigma} \tag{B.3}$$

where: X_{ijt} is the bilateral trade from origin country i to destination country j at time t, Y_{it} is the output of country i at time t, E_{jt} is the expenditure of country j at time t, Y_t is world output (equal to world expenditure) at time t; t_{ijt} are the trade costs between origin i and destination j at time t[25], Π_{it} is the outward MR (the aggregate selling price) of country i at time t, P_{jt} is the inward MR (the aggregate purchase price) of country j at time t, and σ the elasticity of substitution between the different varieties produced in the different origins.

Anderson, Larch and Yotov (2020) propose a dynamic version of the gravity model (SDGMT) in which the level of expenditure and income are endogenous, using a mechanism that links the prices obtained at the

25 Trade costs are specified as $t_{ijt} = \tau_{ij}\tau_{ijt}$, where τ_{ij} are the permanent trade costs associated with factors such as physical and cultural distance, etc., and τ_{ijt} are the trade costs that change over time and refer to tariff and non-tariff barriers, basically influenced by trade policy.

first level (equations B.1 to B.3) to the dynamics of capital accumulation[26]. The structure of the economy is given by consumers seeking to maximize an intertemporal utility function with an appropriate discount rate[27]. The solution to the problem generates three new equations. Equation B.4 determines output prices that depend negatively on supply $\left(\frac{Y_{jt}}{Y_t}\right)$ and the aggregate selling prices (Π_{jt}). Equation B.5 is the value-added function for each country j. The last equation (B.6) describes the optimal behavior of capital given the second-level maximization problem, which determines the dynamic adjustment to a new steady state.

$$p_{jt} = \frac{\left(\frac{Y_{jt}}{Y_t}\right)^{1/_{1-\sigma}}}{\Pi_{jt}\gamma_{jt}} \text{28} \tag{B.4}$$

$$Y_{jt} = \mathrm{p}_{jt} A_{jt} L_{jt}{}^{1-\alpha} K_{jt}{}^{\alpha} \tag{B.5}$$

$$K_{jt+1} = \left[\frac{\alpha\beta\delta \quad _{jt}}{(1-\beta+\beta\delta)\, P_{jt}}\right]^{\delta} K_{jt}{}^{1-\delta} \tag{B.6}$$

Given a certain trade costs t_{ijt}, an initial stock of capital K_{j0}, and a set of parameter values β, σ, δ, and α, the system B.2-B.6 allows to obtain for each country j the values for the following set of variables: Π_{j1},

26 As a simplifying assumption, which we keep here, trade is balanced and therefore output is equal to expenditure ($Y_{it} = E_{it}$).

27 The consumer's problem is to solve the following maximization problem: $\max_{C_{jt},\Omega_{jt}} \sum_{t=0}^{\infty} \beta^t \ln C_{jt}$, subject to the following restrictions: $K_{jt+1} = \Omega_{jt}{}^{\delta} K_{jt}{}^{1-\delta}$, $Y_{jt} = \mathrm{p}_{jt} A_{jt} L_{jt}{}^{1-\alpha} K_{jt}{}^{\alpha}$, $Y_{jt} = P_{jt}C_{jt} + P_{jt}\Omega_{jt}$. Where: C_{jt} is consumption in country j, at time t, Ω_{jt} is investment in country j, at time t, K_{jt} is the stock of capital in country j, at time t, p_{jt} is the factory-gate Price of country j's production, at time t, A_{jt} is a measure of productivity in country j, at time t, and L_{jt} is the labor endowment of country j, at time t. In addition to the elasticity of substitution (σ), another key parameters are the consumer discount rate (β), the capital depreciation rate (δ), and the share of capital in total output (α).

28 Note that the factory-gate price for each country arises from the following derivation. First the demand function that arises from the first level of optimization for a given income: $X_{jit} = \frac{Y_{it}}{P_{it}{}^{1-\sigma}} \left(\gamma_{jt} p_{jt} t_{jit}\right)^{1-\sigma}$. Then adding up for all destinations: $Y_{jt} = \sum_i X_{jit} = \sum_i Y_{it} \left(\frac{\gamma_{jt} p_{jt} t_{jit}}{P_{it}}\right)^{1-\sigma} = \left(\gamma_{jt}\, p_{jt}\right)^{1-\sigma} \sum_i Y_{it} \left(\frac{t_{jit}}{P_{it}}\right)^{1-\sigma}$. Finally: $\frac{Y_{jt}}{Y_t} = \left(\gamma_{jt} p_{jt}\right)^{1-\sigma} \sum_i \frac{Y_{it}}{Y_t} \left(\frac{t_{jit}}{P_{it}}\right)^{1-\sigma} = \left(\gamma_{jt} p_{jt}\right)^{1-\sigma} \Pi_{jt}{}^{1-\sigma}$, and the factory-gate price is:

$$p_{jt} = \frac{\left(\frac{Y_{jt}}{Y_t}\right)^{1/_{1-\sigma}}}{\Pi_{jt}\gamma_{jt}}.$$

P_{j1}, p_{j1}, Y_{j1} and K_{j1}, after iterating until the system converges to a new steady state. The steady state equilibrium to which the system converges can be easily obtained from equation B.6. With the other 4 equations we can solve for the rest of the endogenous variables in the steady-state equilibrium. The proposed procedure converges to:

$$K_{jS} = \frac{\alpha\beta\delta Y_{jS}}{(1-\beta+\beta\ \ )P_{jS}} \quad \text{(B.6')}$$

where the subscript S refers to the steady-state equilibrium.

We simulate changes in trade costs and obtain the effects on the endogenous variables mentioned above in two different equilibrium contexts. One is a short-run equilibrium in which capital accumulation is absent (static model), and the other is a long-run equilibrium in which capital decisions also become endogenous (dynamic model). In the static equilibrium, only equations B.2-B.5 are required. All changes that occur for a given country j are reflected only in prices (p_{jt}, Π_{it}, P_{jt}) and in the value of income (Y_{jt}). The dynamic equilibrium is as presented in the beginning with equations B.2-B.6.

The effects of trade costs changes are evaluated under different scenarios. The baseline scenario is the one observed before the changes (B). Then, different exercises of changes in trade costs are carried out. This is generally referred to as the counterfactual scenario (C).

$$K_{jB} = \frac{\alpha\beta\delta \mathrm{Y}_{jB}}{(1-\beta+\beta\delta)P_{jB}} \qquad K_{jC} = \frac{\alpha\beta\delta \mathrm{Y}_{jC}}{(1-\beta+\beta\delta)P_{jC}}$$

Taking the ratio K_{jC}/K_{jB} we obtain:

$$k_j = \frac{K_{jC}}{K_{jB}} = \frac{P_{jB}Y_{jC}}{Y_{jB}P_{jC}} = \frac{y_j}{P_j} = \frac{p_j}{P_j}k_j{}^{\alpha} \quad \text{(B.7)}$$

where: $y_j = \frac{Y_{jC}}{Y_{jB}}$; $P_j = \frac{P_{jC}}{P_{jB}}$; $p_j = p_{jC}$ given that $p_{jB} = 1$ is chosen as normalization.

The change in capital is equal to the change in real income $\left(\frac{y_j}{P_j}\right)$, which is a way of computing the change in welfare since its change is equal to the change in real consumption[29].

$$w_j = k_j = \frac{y_j}{P_j} = c_j = \frac{p_j}{P_j} k_j{}^{\alpha} \tag{B.8}$$

where: $w_j = \frac{W_{jC}}{W_{jB}}; c_j = \frac{C_{jC}}{C_{jB}}$.

The same measure of welfare change is possible to derive using the level of openness of the economy measured as the domestic supply of expenditure ($\lambda_{jt} = \frac{X_{jjt}}{Y_{jt}}$). For this purpose and using the gravity equation it can be shown that[30]:

$$(\lambda_{jt})^{1/1-\sigma} = \frac{p_{jt}}{P_{jt}} \tag{B.9}$$

If the degree of openness, given by $(1 - \lambda_{jt})$ increases (falls) is because the terms of trade $(\frac{p_{jt}}{P_{jt}})$ increase (fall). Substituting (B.9) in (B.8):

$$w_j = (\lambda_j)^{1/1-\sigma} k_j{}^{\alpha} \tag{B.10}$$

where: $\lambda_j = \frac{\lambda_{jC}}{\lambda_{jB}}$.

Returning to the change in capital, one can further reduce the expression and see that it depends exclusively on the change in openness, which in turns depend on the change in relative price between the factory-gate price (p_j) and the aggregate prices as buyer (P_j).

$$w_j = k_j = (\lambda_j)^{1/(1-\sigma)(1-\alpha)} = (\lambda_j)^{1/(1-\sigma)} (\lambda_j)^{\alpha/(1-\sigma)(1-\alpha)} \tag{B.11}$$

29 Given: $K_{je} = \frac{\alpha\beta\delta Y_{je}}{(1-\beta+\beta\ )P_{je}} = \frac{\alpha\beta\delta P_{je}(C_{je}+\Omega_{je})}{(1-\beta+\beta\ )P_{je}} = \frac{\alpha\beta\delta(C_{je}+K_{je})}{(1-\beta+\beta\ )}$ with e = B, C. In the steady state it is satisfied that: $\Omega_{je} = K_{je}$. Then, consumption is: $C_{je} = K_{je}\left(\frac{(1-\beta+\beta\delta)}{\alpha\beta\delta} - 1\right) = K_{je}\left(\frac{(1-\beta(1-\delta(1-\alpha)))}{\alpha\beta\delta}\right) = \frac{\alpha\beta\delta Y_{jC}}{(1-\beta+\beta\ )P_{jC}}\left(\frac{(1-\beta(1-\delta(1-\alpha)))}{\alpha\beta\delta}\right) = \frac{Y_{jC}}{P_{jC}}\left(\frac{(1-\beta(1-\delta(1-\alpha)))}{(1-\beta+\beta\delta)}\right)$. The change in consumption is equal to the change in real income and therefore also to the change in capital.

30 Given $X_{jjt} = \frac{(Y_{jt}Y_{jt})}{Y_t}\left(\frac{t_{jjt}}{\Pi_{jt}P_{jt}}\right)^{1-\sigma}$, we have: $(\lambda_{jt})^{1/1-\sigma} = \left(\frac{X_{jjt}}{Y_{jt}}\right)^{1/1-\sigma} = \left(\frac{(Y_{jt})}{Y_t}\right)^{1/1-\sigma}\left(\frac{1}{\Pi_{jt}P_{jt}}\right) = \frac{\left(\frac{(Y_{jt})}{Y_t}\right)^{1/1-\sigma}}{\Pi_{jt}}\left(\frac{1}{P_{jt}}\right) = \frac{p_{jt}}{P_{jt}}$

Changes in prices have a direct impact on welfare $\left((\lambda_j)^{1/(1-\sigma)}\right)$ and another that is generated via increased accumulation and the higher real income it generates $\left((\lambda_j)^{\alpha/(1-\sigma)(1-\alpha)}\right)$. In the static equilibrium only the first mechanism is present while in the dynamic equilibrium the second one is also present. The expression for the change in welfare in (B.11) is similar to the one derived in Arkolakis, Costinot, and Rodriguez-Clare (2012).

Finally, it remains to define a welfare measure for the dynamic transition between the steady states corresponding to the baseline and counterfactual scenarios. The calculation in B.11 assumes an immediate transition to the new steady state. Following what is proposed by Anderson, Larch and Yotov (2020), we use the Lucas (1987) formula that calculates the constant fraction of consumption (ζ) in each year with respect to the level of consumption in the baseline scenario that consumers need to be paid to achieve the same level of utility as in the counterfactual scenario.

$$\Sigma_{t=0}^{\infty} \beta^t \ln C_{jt}^{C} C_{jt}^{c} = \Sigma_{t=0}^{\infty} \beta^t ln(1+\zeta) C_{jt}^{b} \quad \text{(B.12)}$$

from where we obtain[31]:

$$\zeta = \exp\left((1-\beta)\left(\Sigma_{t=0}^{\infty} \beta^t lnC_{jt}^{c} - \Sigma_{t=0}^{\infty} \beta^t lnC_{jt}^{b}\right) - 1\right) \quad \text{(B.13)}$$

31 Given $\Sigma_{t=0}^{\infty} \beta^t lnC_{jt}^{c} = \Sigma_{t=0}^{\infty}\left(\beta^t ln\left(C_{jt}^{b}\right) + \beta^t ln(1+\zeta)\right) = \Sigma_{t=0}^{\infty}\left(\beta^t ln\left(C_{jt}^{b}\right)\right) + ln(1+\zeta)\Sigma_{t=0}^{\infty}(\beta^t)$, then $\Sigma_{t=0}^{\infty} \beta^t lnC_{jt}^{c} - \Sigma_{t=0}^{\infty}\left(\beta^t ln\left(C_{jt}^{b}\right)\right) = \frac{1}{1-\beta} ln(1+\zeta)$. Taking exponential on both sides and solving for ζ gives the equation B.13.

Appendix C. Statistics

Table C.1. Aggregate welfare effects under different integration and equilibrium scenarios. Base Model.

Group	Scenario	Equilibrium		
		Static	Steady state	Transitional
Treated	CPTPP	0.96	1.81	1.59
	CPTPP+U	1.01	1.91	1.67
	CPTPP+C	1.21	2.35	2.04
	CPTPP+U+C	1.25	2.43	2.11
Untreated	CPTPP	0.00	0.03	0.02
	CPTPP+U	0.01	0.03	0.03
	CPTPP+C	0.00	0.04	0.02
	CPTPP+U+C	0.00	0.05	0.04
World	CPTPP	0.14	0.28	0.24
	CPTPP+U	0.15	0.30	0.26
	CPTPP+C	0.38	0.77	0.66
	CPTPP+U+C	0.40	0.80	0.69

Source: own.

Table C.2. Welfare effects by country under different scenarios of integration and equilibrium. Base model

Scenario	Equilibrium	AUS	CAN	CHL	CHN	GBR	JPN	MEX	MYS	NZL	PER	SGP	URY	VNM
CPTPP	Static	1.06	1.08	0.72	-0.01	1.26	0.59	0.49	2.03	1.56	0.71	2.07	-0.01	1.76
	Steady state	1.94	2.10	1.36	0.00	2.35	1.16	0.91	3.81	2.99	1.38	3.80	-0.01	3.31
	Transitional	1.71	1.83	1.19	-0.01	2.06	1.00	0.80	3.34	2.60	1.20	3.35	-0.01	2.90
CPTPP+U	Static	1.13	1.12	0.76	-0.01	1.35	0.61	0.50	2.11	1.62	0.73	2.17	1.21	1.83
	Steady state	2.06	2.18	1.42	0.00	2.52	1.21	0.94	3.97	3.10	1.42	4.00	2.30	3.46
	Transitional	1.81	1.89	1.25	0.00	2.21	1.05	0.82	3.47	2.70	1.23	3.52	2.01	3.02
CPTPP+C	Static	1.85	1.85	1.72	0.71	1.97	1.65	1.07	2.96	2.16	1.12	3.00	-0.04	3.10
	Steady state	3.40	3.63	3.25	1.43	3.69	3.25	2.01	5.61	4.20	2.20	5.58	-0.04	5.87
	Transitional	2.99	3.15	2.85	1.23	3.23	2.82	1.76	4.89	3.65	1.91	4.89	-0.04	5.12
CPTPP+U+C	Static	1.92	1.90	1.78	0.73	2.07	1.68	1.09	3.05	2.23	1.14	3.13	2.76	3.19
	Steady state	3.53	3.72	3.36	1.47	3.88	3.32	2.05	5.79	4.33	2.25	5.80	5.27	6.05
	Transitional	3.10	3.23	2.94	1.27	3.40	2.87	1.79	5.05	3.76	1.95	5.09	4.60	5.28

Source: own.

Table C.3. Welfare breakdown for dynamic equilibrium by country and scenario. Base model

Scenario	Indicator	AUS	CAN	CHL	CHN	GBR	JPN	MEX	MYS	NZL	PER	SGP	URY	VNM
	W	2.10	1.94	1.36	0.00	2.35	1.16	0.91	3.81	2.99	1.38	3.80	-0.01	3.31
CPTPP	GDPr	1.05	0.97	0.68	0.00	1.17	0.58	0.46	1.90	1.49	0.69	1.90	0.00	1.65
	T.I.	1.04	0.96	0.67	0.00	1.16	0.57	0.45	1.88	1.47	0.68	1.87	0.00	1.63
	W	2.18	2.06	1.42	0.00	2.52	1.21	0.94	3.97	3.10	1.42	4.00	2.30	3.46
CPTPP+U	GDPr	1.09	1.03	0.71	0.00	1.26	0.61	0.47	1.98	1.55	0.71	1.99	1.15	1.72
	T.I.	1.08	1.02	0.70	0.00	1.24	0.60	0.47	1.95	1.53	0.70	1.97	1.13	1.70
	W	3.63	3.40	3.25	1.43	3.69	3.25	2.01	5.61	4.20	2.20	5.58	-0.04	5.87
CPTPP+C	GDPr	1.81	1.70	1.62	0.72	1.84	1.62	1.00	2.78	2.09	1.10	2.77	-0.02	2.91
	T.I.	1.79	1.68	1.60	0.71	1.82	1.60	0.99	2.75	2.07	1.09	2.73	-0.02	2.88
	W	3.72	3.53	3.36	1.47	3.88	3.32	2.05	5.79	4.33	2.25	5.80	5.27	6.05
CPTPP+U+C	GDPr	1.86	1.76	1.68	0.74	1.93	1.65	1.02	2.87	2.15	1.12	2.88	2.62	3.00
	T.I.	1.83	1.74	1.66	0.73	1.91	1.63	1.01	2.84	2.13	1.11	2.84	2.59	2.96

Source: own.

Table C.4. Welfare effects: sensitivity to parameter values

Group	Parameters	Equilibrium		
		Static	Dynamic	Transitional
	Base (B)	1.25	2.43	2.11
Members	R1	1.21	3.74	2.86
	R2	0.55	0.51	0.45
	Base (B)	0.00	0.05	0.04
Non-members	R1	0.00	0.15	0.08
	R2	0.00	0.02	0.01
	Base (B)	0.40	0.80	0.69
World	R1	0.38	1.28	0.95
	R2	0.17	0.17	0.15

Parameter values: B: $\sigma = 3.277$; $\alpha = 0.503$; $\delta = 0.143$. R1: $\sigma = 3.277$; $\alpha = 0.7$; $\delta = 0.143$. R2: $\sigma = 6$; $\alpha = 0.503$; $\delta = 0.143$. For the transitional equilibrium we use $\beta = 0.98$. Source: own.

Table C.5. Variation of aggregate trade by CPTPP membership status. Base model and dynamic equilibrium

Exporter \ Importer	CPTPP		CPTPP+U		CPTPP+C		CPTPP+U+C	
	M	NM	M	NM	M	NM	M	NM
M	30.43	0.31	30.78	0.25	48.88	5.58	43.32	1.36
NM	-0.3	-0.28	-0.25	-0.51	-5.29	4.93	-1.34	0.54

M: members, NM: non-members. Source: own.

Table C.6.Export growth by destination. Base model and dynamic equilibrium

	CPTPP			CPTPP+U			CPTPP+C			CPTPP+U+C		
	Internal trade / GDP	No partners	Partners	Internal trade / GDP	No part-ners	Partners	Internal trade / GDP	No partners	Partners	Internal trade / GDP	No partners	Partners
AUS	-2.3	-0.7	29.5	-2.4	-0.7	29.7	-4.0	1.8	39.6	-4.1	-2.2	34.2
NZL	-3.3	-1.6	23.6	-3.4	-1.7	23.8	-4.5	1.8	29.6	-4.7	-2.3	24.5
MYS	-4.1	-0.6	30.9	-4.3	-0.6	31.3	-6.0	3.5	35.9	-6.2	-0.6	30.8
VNM	-3.6	-0.3	33.1	-3.8	-0.3	33.4	-6.3	5.8	41.1	-6.4	1.6	35.8
SGP	-4.1	-1.4	26.2	-4.3	-1.5	26.6	-6.0	2.2	31.3	-6.2	-1.9	26.4
JPN	-1.3	0.2	34.4	-1.4	0.2	34.6	-3.6	1.8	64.1	-3.6	-2.3	57.7
CAN	-2.2	0.3	30.0	-2.3	0.2	30.4	-3.7	4.6	54.5	-3.8	0.3	48.7
MEX	-1.0	0.1	18.8	-1.1	-0.1	19.1	-2.2	6.3	36.7	-2.3	1.8	31.6
PER	-1.5	-0.5	29.9	-1.6	-0.7	30.0	-2.4	4.2	38.4	-2.5	-0.1	33.1
CHL	-1.5	-0.9	18.9	-1.6	-1.1	19.1	-3.6	2.5	27.4	-3.7	-1.8	22.6
GBR	-2.6	1.6	40.8	-2.8	1.6	41.5	-4.0	6.7	64.6	-4.2	2.5	58.8
URY	*0.0*	*-0.2*	*-0.4*	-2.5	1.0	38.7	*0.0*	*5.2*	*3.6*	-5.6	0.0	60.2
CHN	*0.0*	*-0.3*	*-0.3*	*0.0*	*-0.5*	*-0.4*	-1.6	7.9	51.3	-1.6	3.7	45.7

Note: In italics the values for countries that are not part of the CPTPP in the corresponding scenario.
Source: own.

Table C.7. Variation in trade and bilateral trade costs between partner countries of the agreement. Base model and dynamic equilibrium

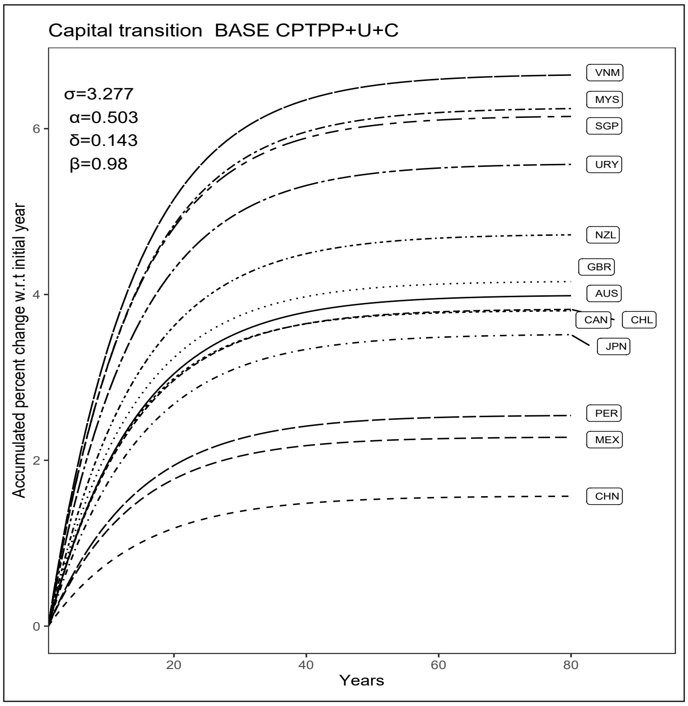
a) Trade

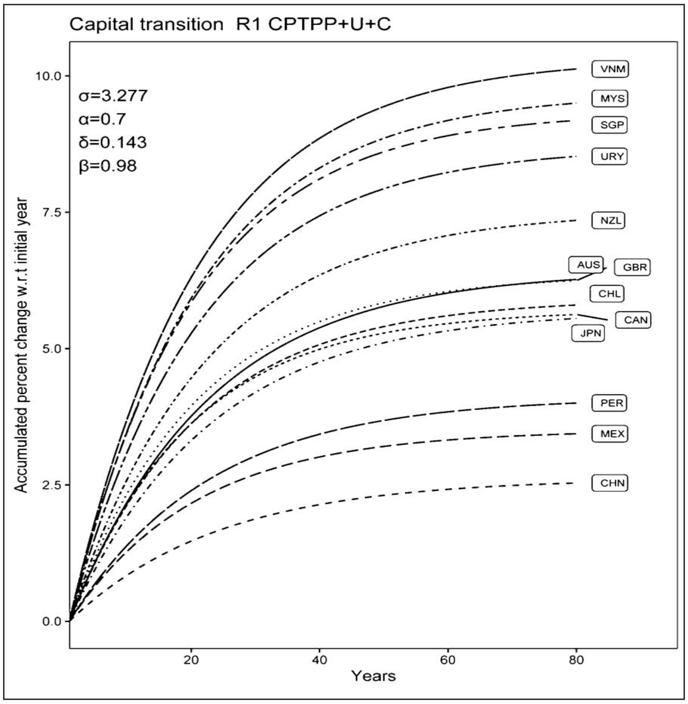
Importer / Exporter	AUS	CAN	CHL	CHN	GBR	JPN	MEX	MYS	NZL	PER	SGP	URY	VNM	Average
AUS		35.8	26.2	40.1	50.2	38.2	58.5	27.4	2.0	37.2	23.0	78.0	31.0	34.2
CAN	41.0		7.1	84.0	31.4	56.0	2.5	56.7	31.1	32.0	28.3	86.2	74.1	48.7
CHL	30.1	7.0		24.5	32.6	11.0	20.5	31.7	30.5	22.9	24.8	29.5	58.5	22.6
CHN	34.5	47.5	33.1		59.1	47.2	64.9	34.3	34.7	39.9	30.8	94.2	35.0	45.7
GBR	46.8	36.3	31.8	88.3		57.4	32.0	60.3	45.3	36.6	30.4	94.7	76.5	58.8
JPN	27.8	38.4	1.9	78.3	49.1		25.2	25.7	37.4	27.7	23.0	82.3	39.8	57.7
MEX	46.9	10.6	30.6	90.5	37.5	40.2		60.6	46.3	32.0	30.5	37.2	77.6	31.6
MYS	29.5	42.8	27.8	26.6	53.1	34.4	57.7		30.0	40.0	25.4	88.0	22.0	30.8
NZL	1.3	35.6	25.1	22.5	50.3	54.0	58.5	28.5		37.5	23.0	77.9	31.0	24.5
PER	41.9	33.8	25.5	34.4	30.1	39.9	29.1	54.2	41.4		26.8	39.3	74.3	33.1
SGP	27.3	41.8	24.5	25.3	39.9	33.7	55.6	22.3	28.2	28.1		86.9	20.6	26.4
URY	38.9	40.1	29.5	81.8	55.1	42.5	29.2	53.7	37.8	32.9	26.9		72.7	60.2
VNM	33.0	42.1	32.1	29.6	43.9	39.5	62.1	26.5	34.1	42.9	28.2	90.9		35.8
Average	31.8	31.8	26.9	56.9	47.7	44.7	43.1	30.8	18.6	32.7	26.9	73.4	35.1	43.3

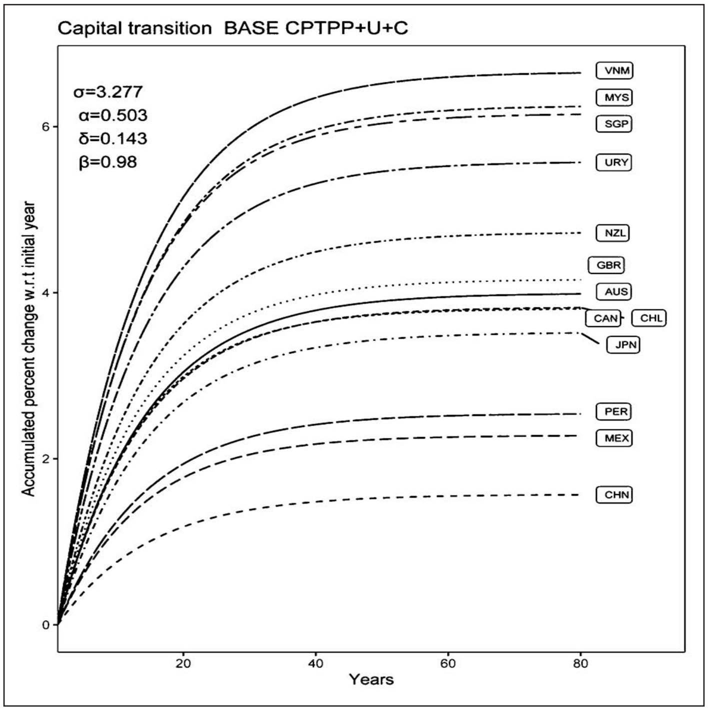
b) Trade costs

Importer / Exporter	AUS	CAN	CHL	CHN	GBR	JPN	MEX	MYS	NZL	PER	SGP	URY	VNM	Average
AUS		-15.6	-11.1	-21.6	-20.7	-16.4	-21.8	-13.4	-0.9	-14.7	-11.6	-23.7	-15.8	-20.0
CAN	-14.2		-3.1	-29.5	-14.4	-19.4	-3.1	-19.5	-10.6	-12.4	-11.1	-24.5	-24.3	-24.9
CHL	-11.5	-4.5		-17.8	-14.8	-4.6	-12.3	-13.1	-10.7	-11.7	-10.2	-12.1	-22.0	-15.2
CHN	-10.9	-16.6	-11.0		-19.8	-15.8	-22.2	-12.4	-10.2	-13.2	-10.9	-24.9	-14.3	-16.4
GBR	-17.1	-16.2	-11.9	-30.9		-20.1	-14.3	-21.0	-14.9	-13.4	-13.0	-26.1	-24.8	-26.8
JPN	-11.5	-16.5	-1.9	-31.8	-19.6		-13.4	-12.6	-13.6	-11.9	-11.3	-24.5	-18.1	-29.4
MEX	-14.6	-4.8	-11.1	-27.7	-14.0	-12.9		-19.1	-13.8	-11.7	-10.7	-12.6	-23.9	-17.0
MYS	-12.7	-17.9	-10.9	-18.4	-21.3	-16.2	-24.3		-11.0	-14.9	-20.5	-25.1	-12.8	-17.5
NZL	-1.0	-16.4	-11.1	-16.2	-21.9	-22.9	-23.6	-14.1		-15.4	-11.5	-24.1	-16.0	-16.1
PER	-13.7	-15.9	-10.9	-16.6	-13.1	-13.8	-13.2	-18.2	-13.2		-10.0	-14.0	-24.3	-15.7
SGP	-11.5	-16.4	-10.0	-15.5	-16.8	-13.5	-21.4	-12.6	-10.6	-11.5		-25.0	-12.3	-14.8
URY	-13.3	-16.2	-12.8	-31.7	-20.7	-14.9	-15.0	-19.2	-12.7	-13.9	-10.9		-25.1	-28.7
VNM	-12.0	-17.0	-11.7	-16.6	-18.3	-17.3	-23.3	-11.6	-11.0	-15.0	-11.7	-25.0		-16.5
Average	-12.0	-13.7	-10.0	-25.3	-18.7	-16.1	-18.6	-13.6	-8.4	-12.3	-12.1	-21.9	-15.2	

Graph C.1. Dynamic transition of the capital stock under different parameters. Scenario CPTPP+U+C.




Capital transition R1 CPTPP+U+C
σ=3.277
α=0.7
δ=0.143
β=0.98
Accumulated percent change w.r.t initial year
Years
VNM
MYS
SGP
URY
NZL
AUS
GBR
CHL
CAN
JPN
PER
MEX
CHN


Capital transition BASE CPTPP+U+C
σ=3.277
α=0.503
δ=0.143
β=0.98
Accumulated percent change w.r.t initial year
Years
VNM
MYS
SGP
URY
NZL
GBR
AUS
CAN
CHL
JPN
PER
MEX
CHN

Institutions that supported this research

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Cámara de Comercio y Servicios del Uruguay

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