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The effect of the Colombian trade liberalisation process on the evolution of its international trade

by

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Resumen:

Una cantidad considerable de literatura se ha publicado sobre los efectos de la liberalización comercial en el comercio internacional y el crecimiento económico, entre otros temas. La mayoría de estos estudios revelan una influencia positiva de la apertura comercial en el crecimiento económico. Lim y Breuer (2019) señalan que este proceso ha promovido la integración económica y ha sido especialmente evidente en los países en desarrollo, donde las políticas de liberalización comercial han incrementado su crecimiento económico. Esto indica que la determinación de Colombia de desarrollar un proceso de apertura comercial como política que promueva su crecimiento económico, con base en la promoción de su comercio internacional, tiene una sólida justificación científica y además que la nación es parte de las tendencias de integración económica internacional.

La literatura existente sobre liberalización comercial es extensa y se enfoca particularmente en el efecto los efectos de los acuerdos comerciales preferenciales (ACP) y, más específicamente, el factor del tratado de libre comercio (TLC) como variable capaz de dinamizar los flujos comerciales. En este sentido, es importante tener en cuenta los diferentes niveles de integración económica que han sido definidos por diversos autores (Wu, 2006) y precisar en este estudio el impacto individual que provocan los TLC en la promoción del comercio internacional en Colombia, ya que la firma de este tipo de acuerdos comerciales ha sido considerada una estrategia clave para impulsar las exportaciones e importaciones de bienes del país. Al respecto, algunos de los autores más destacados en el campo de la economía internacional han encontrado un efecto potenciador de la variable TLC sobre el aumento de los flujos comerciales internacionales (Anderson y van Wincoop, 2003; Anderson y Yotov, 2011; Baier et al., 2019; Egger et al., 2011) y también un efecto positivo en el crecimiento económico (Manwa & Wijeweera, 2016). Ante esto, se han firmado más de 350 acuerdos comerciales bilaterales desde 1986 (Baier et al., 2019), corroborando los beneficios de la apertura comercial. En particular, Lim y Breuer (2019) señalan que los beneficios de reducir las barreras arancelarias son especialmente notables en los países en desarrollo, ya que su crecimiento económico ha mejorado. Por lo tanto, llevar a cabo una política de apertura comercial enfocada en la firma de acuerdos comerciales para mejorar el crecimiento económico, como es el caso de Colombia, también está en línea con los extensos hallazgos de la investigación empírica.

Colombia, país sudamericano que forma parte de uno de los tratados comerciales regionales más antiguos del continente, como es la Comunidad Andina desde 1969 (Comunidad Andina, 2020), ha mostrado un interés continuo en la integración comercial con los mercados externos

como estrategia para promover su desarrollo económico. Prueba de ello es su temprana adhesión en 1981 al Acuerdo General sobre Aranceles Aduaneros y Comercio (GATT, luego OMC) (Organización Mundial del Comercio, 2019). No obstante, la apertura comercial colombiana se intensificó a partir de la década de 1990 a través de la implementación de la llamada política de Apertura Comercial. Dicha política buscó una economía mucho más productiva y eficiente y siguió un camino de liberalización comercial promovido por el “Consenso de Washington”. El principal objetivo de los hacedores de política colombianos fue estimular el crecimiento económico del país a través del incremento de sus flujos comerciales, estrategia económica defendida por destacados autores (Manwa y Wijeweera, 2016). En consecuencia, el aumento de las exportaciones ayudaría a equilibrar el déficit estructural de su balanza comercial. Como resultado, en las últimas décadas, el gobierno colombiano ha firmado un número significativo de acuerdos comerciales de diversos alcances como el mecanismo elegido para incrementar los valores de los flujos comerciales con sus socios, entre los que se destacan prominentes TLCs. A pesar de ello, y en línea con los hallazgos de Irwin (2019), en el debate nacional no existe consenso sobre el efecto positivo que ha tenido la apertura comercial en la balanza comercial ya que las cifras muestran lo contrario, cuestionando su efectividad.

Entre estos tratados se destacan el tratado de libre comercio bilateral con los Estados Unidos de América (USA) y el tratado multilateral de libre comercio con la Unión Europea (UE), ya que juntos representan más de la mitad del comercio internacional de Colombia (MinCIT, 2018a). Adicionalmente, las exportaciones colombianas a estos destinos están compuestas en su mayoría por productos minero-energéticos y las importaciones colombianas están compuestas casi en su totalidad por bienes no minero-energéticos y, al mismo tiempo, su balanza comercial con ambos mercados presenta un importante déficit. Adicionalmente, es importante señalar que Colombia es uno de los países con las tasas de crecimiento económico más altas de la región, pero también es un país con condiciones económicas, sociales y políticas complejas. Asimismo, el país es altamente dependiente de la industria de los combustibles y los esfuerzos del gobierno para reducir la alta dependencia de esta industria no han tenido los resultados esperados. Según Abreo et al. (2022a), la industria de los combustibles aporta el 63,3% del total de las exportaciones nacionales, y más precisamente, las exportaciones de petróleo y sus derivados corresponden al 59,1% de las exportaciones de combustibles a precios constantes. Al respecto, Karabulut et al. (2020) afirman que las guerras comerciales recientes han aumentado la volatilidad de los precios de las materias primas, lo que afecta el crecimiento económico de los países altamente dependientes de la producción de petróleo, y además, la volatilidad de los precios perjudica la integración económica de estos países en los mercados externos (Zeynalov,

2017). Sin embargo, el tema más crítico con respecto al patrón comercial colombiano es el hecho de que las reservas de petróleo son limitadas. Según Presidencia de la República (2020), las reservas de petróleo del país se agotarían en 6,3 años. Es innegable que este escenario plantea la urgente necesidad de diversificar el patrón comercial del país, no solo como medida para reducir los riesgos económicos de volatilidad de precios (Haddad et al, 2013) sino también como medida para reponer las principales fuentes de divisas del país, que en su mayoría provienen de una industria que, según el citado informe, probablemente dejará de ser la principal industria nacional en términos de exportaciones. Por el contrario, y en línea con el modelo clásico de ventajas comparativas, las importaciones colombianas muestran un patrón completamente diferente al de las exportaciones, que se componen casi en su totalidad de bienes no combustibles y muestran una tendencia ascendente constante (World Integrated Trade Solution, 2020).

Es también importante ahondar en el hecho de que Colombia es una economía con condiciones muy complejas en cuanto a la calidad institucional, que sin duda influyen en el entorno empresarial. Ante esto, Franz (2019) afirma que Colombia es un claro ejemplo de un país con deficiencias en buena gobernanza reflejadas en su calidad institucional y por ende en su desarrollo económico. En este sentido, la nación se ha visto ampliamente afectada por un largo conflicto armado interno que ha debilitado la consolidación de sus instituciones, y por ende, el adecuado desarrollo de las actividades económicas. Datos del Banco Mundial (2020) indican que el nivel de calidad institucional colombiana es inferior al promedio mundial y significativamente inferior al que muestran los países que pertenecen a la OCDE, organización de la que Colombia es miembro desde 2020. Por lo tanto, la baja calidad institucional del país y la tendencia a la baja de las exportaciones nacionales en los últimos años confirman lo establecido por diversos autores: mejores/peores instituciones promueven/dificultan los flujos de comercio internacional.

Por lo tanto, bajo el contexto anteriormente descrito, el objetivo principal de este trabajo es determinar empíricamente en qué medida el proceso de apertura comercial colombiano, centrado en la firma de TLCs, ha ayudado a impulsar su comercio internacional, y particularmente, en qué medida esta estrategia ha ayudado a equilibrar el déficit comercial colombiano. Adicionalmente, se han perseguido objetivos adicionales, como evaluar en qué medida la apertura comercial ha afectado el comercio internacional colombiano (flujos de exportación e importación) por tipo de bienes (combustibles y no combustibles), así como evaluar el impacto de la calidad institucional colombiana para promover sus exportaciones y examinar si el efecto del TLC entre Colombia y los países de la UE, como uno de los acuerdos

comerciales más representativos para el país, ha sido una estrategia exitosa para mejorar su comercio, entre otros objetivos abordados a lo largo de la tesis.

Los resultados relacionadas con el primer trabajo generado a partir de la investigación consignados en el artículo denominado “Un análisis empírico del proceso de apertura comercial en Colombia y su efecto en el balance de su déficit comercial estructural” confirman que el proceso de apertura comercial colombiano iniciado en 1991 e intensificado a partir de 2005, a través de la firma de un número considerable de TLCs, tuvo efectos negativos que afectaron el desempeño de la balanza comercial colombiana, y por ende, profundizado el déficit comercial del país. Esto se explica debido a que los modelos de gravedad propuestos en este estudio muestran un efecto adverso de los TLCs sobre las exportaciones colombianas y, por el contrario, un efecto positivo sobre sus importaciones, lo que explica la expansión del déficit en la balanza comercial del país. Sin embargo, es fundamental señalar que el análisis de los flujos comerciales colombianos por tipo de producto revela algunas condiciones importantes. Por un lado, las exportaciones colombianas de combustibles se ven afectadas negativamente por la liberalización comercial, a diferencia de las exportaciones colombianas de no combustibles, que sí se promueven. El resultado del parámetro de la variable TLC en cada modelo (negativo y superior en exportaciones de combustibles y positivo e inferior en exportaciones de no combustibles) en un patrón comercial donde la mayoría de las exportaciones son de bienes minero-energéticos, permite explicar el impacto global negativo de esta variable en los flujos de exportación colombianos. Por otro lado, el efecto de la apertura comercial revela un impacto positivo en las importaciones colombianas independientemente de grupo de producto analizado. Los resultados de la variable TLC en las estimaciones propuestas contradicen parcialmente lo planteado por autores relevantes, quienes definen un impacto predominantemente positivo en la promoción del comercio internacional a través de la entrada en vigor de acuerdos comerciales entre países (Anderson & Yotov, 2016; Baier & Bergstrand, 2009; Egger et al., 2011; Fally, 2015; Santos Silva & Tenreyro, 2006). Además, los hallazgos sugieren que la variable OMC es capaz de incrementar las exportaciones e importaciones colombianas de bienes no minero-energéticos (aunque el valor del parámetro OMC es mucho mayor en el segundo flujo que en el primero), lo que cuestiona la efectividad de la variable TLC para promover el comercio internacional colombiano. Este hallazgo puede ser especialmente relevante considerando la necesidad del país de reemplazar rápidamente sus exportaciones de combustibles con otro tipo de bienes. Por otro lado, los hallazgos relacionados con el análisis TPI muestran una reducción del potencial comercial de Colombia con la mayoría de sus principales socios, lo que aboga por que el país profundice sus acuerdos comerciales vigentes o

explora nuevos mercados. En la misma línea, el TPI de los principales socios colombianos con Colombia refleja la misma tendencia hacia una situación de sobrecomercio, que en este caso está alineada con el notable aumento de las importaciones del país. En general, estos resultados nos permiten afirmar que la apertura comercial colombiana ha perjudicado las exportaciones colombianas y promovido sus importaciones, y por lo tanto ha profundizado su déficit comercial, hallazgos que también son respaldados por el análisis del TPI. Además, estos resultados deben llamar la atención de los hacedores de política colombianos en la formulación de políticas públicas que promuevan el comercio internacional más allá de la firma de nuevos acuerdos comerciales (específicamente TLCs), afirmación que también se sustenta en el significativo efecto observado de la variable OMC en la promoción del comercio internacional de Colombia.

Adicionalmente, los resultados relacionados con el segundo trabajo concebido a partir de la investigación señalados en el artículo “El papel de la calidad institucional en el comercio internacional de un país latinoamericano: evidencia del desempeño exportador colombiano” revela que la mayoría de los indicadores institucionales incluidos en el modelo de gravedad promueven las exportaciones colombianas, hallazgos que están en línea con los resultados de destacados autores (Álvarez et al., 2018; De Groot et al., 2005; Levchenko, 2007; Wu et al., 2012; Yu, 2010). Entre los indicadores de gobernanza que ofrecen un mayor efecto positivo sobre las exportaciones colombianas se destacan: el estado de derecho y la calidad de la regulación, lo que sugiere que aquellas condiciones relacionadas con la seguridad jurídica y la competencia en el mercado son capaces de incrementar sustancialmente las exportaciones. Sin embargo, el efecto del factor de control de la corrupción exhibe un efecto estadísticamente significativo aunque negativo sobre las exportaciones, exponiendo las complejas raíces de la corrupción en el entorno económico y empresarial del país. Los hallazgos también muestran un efecto notable de la variable productividad laboral sobre las exportaciones colombianas, lo que debe ser considerado por los hacedores de política como un factor fundamental para promover este tipo de flujo comercial. Asimismo, el impacto de los TLCs ha perjudicado las exportaciones colombianas, resultado que nuevamente cuestiona la efectividad de esta estrategia para impulsar las exportaciones del país y, por ende, equilibrar su déficit comercial. En cuanto a las conclusiones relacionadas con los efectos de la distancia institucional en las exportaciones colombianas, los resultados confirman que a mayores diferencias en la gobernanza, menores los flujos de exportación. Este hallazgo es pertinente debido a la considerable distancia institucional que Colombia tiene con sus principales socios comerciales. Esta conclusión debe llamar la atención de los hacedores de política colombianos, ya que la mejora de la calidad institucional, como ya se mencionó, no solo tiene un efecto positivo en las exportaciones sino también en la

reducción de la distancia institucional con sus socios, y por ende, en la promoción de estos flujos comerciales. Sin embargo, a la luz de la discusión sobre la importancia de la calidad institucional para promover las exportaciones colombianas, es relevante tener en cuenta que Colombia es un país que tiene un conflicto armado interno desde hace más de medio siglo, que aún prevalece a través de nuevos mecanismos de lucha y, posteriormente, influyen en el estado de las instituciones nacionales y en su evolución de diferentes maneras. En este sentido, los hacedores de políticas deben concentrar sus esfuerzos en mejorar el marco legal del país, y por ende, su ordenamiento jurídico, que brinde serias garantías de cumplimiento de los contratos y protección de la propiedad privada. De igual forma, los hacedores de políticas deben enfocar sus esfuerzos en promover la competencia en el mercado y, por ende, en la implementación de políticas que mejoren los estándares de competitividad y calidad de los procesos de negocios en el sector privado.

El último trabajo publicado como parte de esta tesis “Acuerdo comercial y especialización comercial entre Colombia y la UE” refleja que la entrada en vigencia del TLC entre las partes no tiene significación estadística sobre las exportaciones colombianas, pero sí impulsó las importaciones colombianas, reflejando una profundización del déficit comercial colombiano con el países de la UE. Estos resultados son confirmados por el desempeño de las exportaciones e importaciones colombianas hacia y desde estos países, que reflejan una clara tendencia hacia la profundización del déficit comercial colombiano. Además, los hallazgos confirman que tanto las exportaciones como las importaciones colombianas con la UE muestran un patrón de comercio interindustrial que se relaciona con el modelo Heckscher-Ohlin (H-O). La conclusión fue confirmada por la inclusión en los modelos de gravedad de diferentes variables proxy que miden el efecto de las dotaciones de factores de los países involucrados en su comercio. Estos hallazgos son corroborados por el tipo de bienes que se comercian entre Colombia y los países de la UE, los cuales tienen una clara orientación hacia el comercio interindustrial. En este sentido, los hacedores de política colombianos deberían concentrar sus esfuerzos en incrementar el comercio internacional (tanto exportaciones como importaciones) hacia aquellos países de la UE donde se han identificado diferencias significativas en la dotación de factores debido al patrón de comercio interindustrial entre las partes.

En general, la investigación empírica confirma un efecto adverso del proceso de apertura comercial colombiano evidenciado en la profundización de la balanza comercial del país. Sin embargo, si se analiza por tipo de bien vendido, se observa que este proceso ha impulsado las exportaciones de bienes no combustibles, aunque el crecimiento de las importaciones de este tipo de bienes es mayor. También indica que mejorar la calidad institucional del país podría ser

un factor importante en la promoción de sus exportaciones. Adicionalmente, exhibe un efecto destacado de la variable productividad laboral como aquella capaz de incrementar significativamente sus exportaciones. Además, el análisis empírico de uno de los acuerdos comerciales más importantes para el país establece que este factor no genera ningún efecto (insignificante) sobre las exportaciones colombianas a la UE, aunque sí promueve sus importaciones. Finalmente, el análisis de este acuerdo comercial y de la dotación factorial de los países de la UE y de Colombia establece que el patrón comercial entre las partes está relacionado con el comercio intraindustrial.

Section 1. Scope of the research

1.1. Introduction

Colombia, as a South American country that is part of one of the oldest regional trade agreements on the continent, such as the Andean Community since 1969 (Andean Community, 2020), has shown continuous interest in trade integration with foreign markets as a strategy to promote its economic development. Proof of this is its early adherence in 1981 to the General Agreement on Tariffs and Trade (GATT, later WTO) (World Trade Organization, 2019). Nonetheless, Colombian trade openness intensified since the 1990s through the implementation of the so-called *Apertura Comercial* policy. The trade openness policy sought a much more productive and efficient economy and followed a path of trade liberalisation promoted for and foremost by the “Washington Consensus”. The main objective of the Colombian policymakers was to stimulate the economic growth of the country through the increase of its trade flows, an economic strategy defended by prominent authors (Manwa and Wijeweera, 2016). Consequently, the increase in exports would help balance the structural deficit in its trade balance. As a result, in recent decades, the Colombian government has signed a significant number of trade agreements of various scopes as the mechanism chosen to increase the values of trade flows with its partners. Despite this, and in line with the findings of Irwin (2019), in the national debate, there is no consensus on the positive effect that trade liberalisation has had on the trade balance since national trade figures show the opposite, questioning its effectiveness.

Consequently, Colombia began negotiations to sign a significant number of bilateral and regional trade agreements after the so-called *Apertura Comercial* process. Table 1. shows that, in addition to signing a significant number of trade agreements, these agreements have different intentions, and therefore, reach.

Table 1. Current Trade Agreements of Colombia

Name of the agreement	Countries involved	Type of agreement	Bilateral / Regional	In force
Andean Subregional Integration Agreement - AC	Bolivia, Ecuador & Peru	Regional Trade Agreement	Regional	1969
Chile-Colombia Free Trade Agreement	Chile	Free Trade Agreement	Bilateral	1994
Free Trade Agreement between the United Mexican States and the Republic of Colombia	Mexico	Free Trade Agreement	Bilateral	1995
Partial Scope Agreement on trade and economic and technical cooperation between the Republic of Colombia and the Caribbean Community (CARICOM)	Trinidad and Tobago, Jamaica, Barbados, Guyana, Antigua and Barbuda, Belize, Dominica, Grenada, Monserrat, Saint Kitts and Nevis, Saint Lucia, Saint Vincent & the Grenadines	Partial Scope Agreement	Regional	1995
Economic Complementation Agreement No. 49 between Colombia and Cuba	Cuba	Partial Scope Agreement	Bilateral	2000
Economic Complementation Agreement between Colombia - Mercosur	Argentina, Brazil, Paraguay & Uruguay	Tariff preferences	Regional	2005
Free Trade Agreement between the Republic of Colombia and EFTA States	Switzerland, Iceland, Norway and Liechtenstein	Free Trade Agreement	Regional	Switzerland and Liechtenstein: 2009. Norway and Iceland: 2014
Free Trade Agreement between the Republic of Colombia and the Republics of El Salvador, Guatemala and Honduras	Salvador, Guatemala & Honduras	Free Trade Agreement	Regional	2010
Trade Promotion Agreement between the Republic of Colombia and Canada	Canada	Free Trade Agreement	Bilateral	2011
Trade Promotion Agreement between the Republic of Colombia and the United States of America	United States of America	Free Trade Agreement	Bilateral	2012
Partial Scope Agreement of Commercial Nature No. 28 between the Republic of Colombia and the Bolivarian Republic of Venezuela	Venezuela	Partial Scope Agreement	Bilateral	2012
Trade Agreement between the European Union and Colombia	European Union Countries	Free Trade Agreement	Regional	2013
Pacific Alliance	Chile, Peru y Mexico	Regional Trade Agreement	Regional	2015
Free Trade Agreement between the Republic of Colombia and the Republic of Korea	South Korea	Free Trade Agreement	Bilateral	2016
Free Trade Agreement between Colombia and Costa Rica	Costa Rica	Free Trade Agreement	Bilateral	2016

Source: Own elaboration based on information from MinCIT (2021).

Among these treaties, the bilateral free trade agreement with the United States of America (USA) and the multilateral free trade agreement with the European Union (EU) stand out, as they together represent more than half of Colombia's international trade (MinCIT, 2018a). Additionally, Colombian exports to

these destinations are made up mostly of fuel products and Colombian imports are composed almost entirely of non-fuel goods and, in addition, its trade balance with both markets shows a significant deficit. Furthermore, it is important to note that Colombia is one of the countries with the highest economic growth rates in the region, but also is a country with complex economic, social, and political conditions, among others. Moreover, the country is highly dependent on the fuel industry and the government's efforts to reduce the high dependency on this industry have not had the expected results. According to Abreo et al. (2022a), the fuel industry contributes 63.3% of total national exports, and more precisely, exports of oil and its derivatives correspond to 59.1% of fuel exports. Concerning this, Karabulut et al. (2020) state that recent trade wars have increased the volatility of commodity prices, which affects the economic growth of countries highly dependent on oil production, and in addition, the volatility of prices harms the economic integration of these countries in foreign markets (Zeynalov, 2017). Nonetheless, the most critical issue regarding the Colombian trade pattern is the fact that the oil reserves are about to disappear. According to Presidencia de la Republica (2020), the country's oil reserves would be depleted within 6.3 years. Undeniably, this scenario raises the need for urgent diversification of the country's trade pattern, not only as a measure to reduce the economic risks of price volatility (Haddad et al, 2013) but also as a measure to replace the country's main sources of foreign exchange, which mostly come from of an industry that, according to the cited report, will probably cease to be the main national industry in terms of exports. Conversely and in line with the classical comparative advantage model, Colombian imports show a completely different pattern than exports, which are made up almost entirely of non-fuel goods and show a steady upward trend (World Integrated Trade Solution, 2020).

Furthermore, it is relevant to delve into the fact that Colombia is an economy with very complex conditions in terms of institutional quality, which undoubtedly influence the business environment. Given this, Franz (2019) states that Colombia is an evident example of a country with deficiencies in good governance reflected in its institutional quality and therefore in its economic development. In this sense, the nation has been widely affected by a long internal armed conflict that has weakened the consolidation of its institutions, and therefore, the proper development of economic activities. Data from the World Bank (2020) indicate that the level of Colombian institutional quality is lower than the world average and significantly lower than the one displayed by the countries that belong to the OECD, an organization of which Colombia has been a member since 2020. Therefore, the low institutional quality of the country and the downward trend of national exports in recent years confirm what has been established by several authors: better/worse institutions promote/hinder international trade flows.

All in all, this work raises the question of to what extent the trade liberalisation process has contributed to boosting the nation's international trade and, more specifically whether this process has served to reduce the structural deficit of Colombia's trade balance through an empirical approach.

1.2. Literature review

A considerable amount of literature has been published on the effects of trade liberalisation on international trade and economic growth, among other topics. Most of these studies reveal a positive influence of trade openness on economic growth. Lim and Breuer (2019) point out that this process has promoted economic integration and it has been especially evident in developing countries, where trade liberalisation policies have increased their economic growth. This indicates that Colombia's determination to develop a trade liberalisation process as a policy that promotes its economic growth, based on the promotion of its international trade, has a solid scientific justification and also that the nation is part of the international economic integration trends.

The existing literature on trade liberalisation is extensive and focuses particularly on the individual effect of the preferential trade agreement (PTA) and, more specifically, the free trade agreement (FTA) factor as a variable capable to boost trade flows. In this sense, it is important to take into account the different levels of economic integration that have been defined by various authors (Wu, 2006) and to stipulate that for this study the impact caused by FTAs in the promotion of international trade in Colombia is addressed individually, since the signing of this type of trade agreements has been considered a key strategy to boost the country's exports and imports of goods. In this regard, some of the most prominent authors in the field of international economics have found an enhancing effect of the FTA variable on the increase in trade flows (Anderson and van Wincoop, 2003; Anderson and Yotov, 2011; Baier et al., 2019; Egger et al., 2011) and also a positive effect on economic growth (Manwa & Wijeweera, 2016). Given this, more than 350 bilateral trade agreements have been signed since 1986 (Baier et al., 2019), corroborating the benefits of trade openness. Particularly, Lim and Breuer (2019) point out that the benefits of reducing tariff barriers are especially notable in developing countries, as it has improved their economic growth. Therefore, carrying out a trade liberalisation policy focused on signing trade agreements to improve economic growth, as is the case in Colombia, is also in line with the extensive findings of empirical research.

Colombia, one of the leading economies in Latin America, which has deep institutional complexities, whose macroeconomic indicators depend to a large extent on the performance of the energy sector (mainly oil and coal), and therefore on international prices, began in 1991 a process of trade liberalisation whose effects, to date, question the success of this policy. Its implementation meant the change from an economic system based on import substitution, promoted by the Economic Commission for Latin America and the Caribbean (ECLAC) in Latin America in the second half of the 20th century through the theory of substitutive industrialization (FitzGerald, 1998) to one where tariff barriers were reduced in a very short period of time. The *Proceso de Apertura Comercial* was initiated by former president Cesar Gaviria and has been intensified by his successors (especially during the governments of former presidents Álvaro Uribe Vélez (2002-2010) and Juan Manuel Santos (2010-2018)), showing that trade liberalisation has been a state policy in Colombia. Garcia et al. (2014) argue that Gaviria's objective was to promote a more productive and efficient economy through the implementation of an unprecedented set of reforms aimed

at reducing barriers to international trade. Among the 17 current trade agreements between Colombia and its partners, those signed with the USA and the EU stand out. Based on the Dirección Administrativa Nacional de Estadística (2019), it is observed that these agreements represented half of Colombia's international trade between 2005 and 2018, although both agreements contributed to the deepening of Colombia's trade deficit in the same period. However, most of the Colombian exports to those destinations were composed of oil and coal. On the contrary, the trade agreement between Colombia and the Andean Community (AC) reflected a surplus in Colombia's trade balance between 2001 and 2018 and most of the Colombian exports were made up of products other than oil and coal.

In general, two-thirds of national exports are made up of oil and mining goods (Ministerio de Comercio, Industria y Turismo de Colombia, 2018b). About a third of its foreign sales go to the USA (which is its main trading partner), followed by China (a prominent and growing destination for its exports) and Panama (a country that used to be part of Colombia). The general performance of Colombian exports shows a slight upward trend with countries with which there is a free trade agreement in force, however, this trend is greater with those countries with which there is no trade agreement: China, Panama (there is a signed trade agreement that has not yet entered into force between the parties) and Turkey (there is a trade agreement under negotiation between the parties). This indicates that trade liberalisation has helped to increase exports, although it questions the mechanism of signing bilateral or multilateral free trade agreements as a variable capable of increasing these trade flows. Regarding Colombian imports, almost all of these trade flows are made up of non-fuel goods, although in the study period the country imported a significant amount of refined petroleum products (fuels), mainly from the USA and Mexico. The main origin of Colombian imports is the USA, followed by China, a country that presents outstanding growth rates in its sales to Colombia. Moreover, as mentioned about Colombian exports, the country's imports also reflect an upward trend, however, the growth observed in the evolution of imports is much higher than that reflected in exports. Consequently, a notable deepening of the trade deficit is observed in the analysed period, a period in which some of the country's most important free trade agreements were signed and entered into force.

Another important issue in the Colombian economic context is related to its institutions and governance. The internal armed conflict, drug trafficking, high rates of labour informality, great income inequality, and government corruption, among others, are some of the facts that negatively affect the development of Colombian institutions, and therefore, its governability. Institutions are defined as habits, rules, customs and laws that conduct society (Schmoller, 1900; Hayek, 1967; North, 1990). Additionally, institutional quality has been described as the key factor for economic success (Acemoglu et al., 2005). In this regard, the quality of the country's institutions stands as a factor capable of promoting international trade (Wu et al., 2012). This idea is supported by Anderson and Marcouiller (2002), who affirm that better institutions have a positive impact on bilateral trade flows. Álvarez et al., (2018) argue that, on the one hand, institutional quality promotes bilateral trade, and on the other hand, its effects increase over time. This explains why Li and Samsell (2009) state that countries with good governance indicators tend to trade

more than those with low governance levels. Given this, it would be expected that the trade integration process developed by the Colombian government in recent decades will be supported by solid institutions. Nonetheless, Franz (2019) points out that Colombia is an example of a country with governance deficiencies in institutional matters, which calls into question the promotion of its exports due to the institutional quality effect. The fact is that Colombian institutional quality, and therefore, its governability, is far from those countries that are benchmarks in institutional affairs. Although in this sense, it is also important to mention that the OECD (2013) highlights positive progress in strengthening the quality of its institutions and in inclusive economic growth in the last decades. Based on the World Bank Governance Indicators (WGI), during the analysed period, the institutional distance between Colombia's governance indicators and the average performance of OECD member countries is prominent (Colombia has been a member since 2020). Similarly, the institutional distance between Colombians and the global average performance points out that, in most of the governance indicators, the global institutional quality is superior. Finally, the Colombian institutional quality compared to the performance of similar countries, such as those members of the Andean Community (AC), reflects that Colombian governance is stronger.

Finally, in this research where the performance of Colombian international trade is examined in the framework of a trade openness policy, the effectiveness of one of the most relevant trade agreements for the country is analysed, the one signed between Colombia and the EU. Although, as mentioned, Colombia's main trading partner is the USA, the EU market is crucial for the expansion of the national economy towards a trade bloc that represents the main market for the export and import of goods and the largest importer of services in the world (Procolombia, 2013). Trade relations between the parties date back to 1993 when a cooperation agreement was signed within the framework of the relationship between the EU and the AC; however, bilateral negotiations for a trade agreement began in 2007 (Organization of American States, 2019), and resulted in the entry into force of an FTA in 2013. Nonetheless, it is important to point out that the trade between the parties before the entry into force of the FTA was governed by the Generalized System of Preferences (GSP). The GSP granted preferential access for Colombian exports of goods to the EU market through the general regime or GSP, and later, the special regime or GSP+, a regime that offered additional preferences to the general regime. Furthermore, the trade agreement, in addition to constituting an FTA due to the significant reduction of tariff and non-tariff barriers between the parties, seeks to promote an association that transcends the commercial sphere. That is why the treaty includes certain chapters where the parties agree on advances concerning human rights, sustainable development and labour rights, which confirm that, in principle, the objectives of this association go beyond increasing trade flows.

Overall, the objective of this literature review is to propose a theoretical framework that supports the empirical evaluation of the success or failure of a trade liberalisation policy primarily focused on the signing of trade agreements, specifically FTAs, for the promotion of the Colombian international trade. The increase in international trade between Colombia and its partners should lead to the reduction and consequent balance of the deficit in its trade balance. The evaluation of this policy will be determined

with an empirical approach through the gravity equation, which will include trade, economic, institutional and geographic variables, among others.

1.3. Methodological approach

Considering that the objective of this research is to determine empirically the factors that promote or restrict international trade in Colombia, a widely known, robust and successful econometric method has been implemented: the trade gravity model. The approach was first introduced by Tinbergen (1962) and Pöyhönen (1963) to analyse bilateral trade patterns between nations. The trade gravity model is based on the Law of universal gravity of the English physicist Sir Isaac Newton (Abidin et al., 2013), which states that trade between two countries can be explained by the economic forces of trade in the country of origin and the country of destination (Bergstrand, 1985). Particularly, Guo (2015) notes that the value of goods traded between two economies is directly proportional to the product of their economic masses (GDP) and inversely proportional to their physical distance.

Traditionally, the gravity equation in its canonical expression is defined by Anderson (1979) as follows:

$$X_{ij} = \alpha_o Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3} n_{ij}$$

In the proposed equation X_{ij} denotes trade flows between countries i and j , Y_i and Y_j denote the GDPs of each country, and D_{ij} represents the physical distance between the countries. Subsequently, authors such as Krugman (1995) stated that although bilateral distance is one of the central factors that explain bilateral trade between nations, it cannot be the only variable that determines international trade. This and other significant advances in the theoretical justification of the trade gravity model contributed to one of its major developments proposed by Anderson and van Wincoop (2003). They theoretically justified the inclusion of what they called Multilateral Resistant Terms (MRT), showing that a well-specified gravity equation should control for relative trade costs, which shape bilateral trade between nations.

$$X_{ij} = \alpha_o Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3} Z_{ij}^{\alpha_4} n_{ij}$$

These advances made it possible to consider a more robust gravity equation than the previous one, where the MRT (Z_{ij}) were included as variables that, in addition to those traditionally used, determined trade between nations. Moreover, fixed effects were also included to capture unobservable MRT in bilateral trade, which is another relevant advance in the gravity equation. Some of these are: country pair fixed effects, country fixed effects and time-invariant fixed effects. The inclusion of the former is appropriate when the models lack plausible instrumental variables (Gopinath et al., 2014). The second is useful to

absorb all unobservable trade costs between pair countries (Baier et al., 2019). Lastly, the latter is appropriated to measure the determinants of trade in a database of many years (Gopinath et al., 2014).

Furthermore, although gravity equations have traditionally been estimated in their logarithmic-linear form, recent developments have shown a more suitable form of estimation. Relevant contributions have pointed out that the gravity equation should be estimated in its multiplicative form, as pointed out by Santos Silva and Tenreyro (2006). They stated that the Poisson pseudo-maximum likelihood (PPML) approach is a more robust and suitable estimator for heteroscedasticity and other econometric drawbacks, it offers a natural way of dealing with zero values, it produces smaller and more appropriate coefficients than those produced by log-linear estimation, and it offers an identical weight for all observations. Additionally, the PPML estimator offers an adequate fit between the fixed effects and the MRT, which would indicate that greater confidence should be given to the estimates of the gravitational model that use the PPML method (Fally, 2015).

Finally, the gravity equation has been used widely in different areas. According to Giuliano et al. (2015), the gravitational model has been applied in areas such as intercity transport, local commerce, travel destinations in relation to their costs, to analyse investment policies in urban transport and is widely applied for the estimation and analysis of bilateral trade flows. Similarly, Natale et al. (2015) state that in the seafood market, the model has been used to assess the impacts of food safety standards and non-tariff measures on exports to the EU and the USA, as well as to identify the determinants of specific trade flows, such as catfish exports from Vietnam to the USA. Moreover, Frankel and Rose (2005) used the gravity model to study the inverse relationship between international trade and the environment due to pollution. Furthermore, De Frutos et al. (2019) establish that the method has been used to evaluate customer entrances to shopping centres, patient flows between hospitals or fans attending music concerts. In the same vein, Kabir et al. (2017) state that the gravity equation has been used to economically estimate the ex-post effects in different categories of trade integration on bilateral trade flows. Nonetheless, the authors question the capacity of the gravity equation to develop analyzes of the ex-ante effects on international trade, despite econometric developments in dynamic panel data models.

Once the general theoretical and empirical foundation implemented in the thesis has been exposed, we proceed to address the particular methodology used in each chapter. In section 3.1. entitled An empirical analysis of Colombia's trade liberalisation process and its effect on the equilibrium of its structural trade deficit, the trade gravity model proposed by Anderson and van Wincoop (2003) is applied to measure the determinants of Colombian trade (both exports and imports) by type of product (fuel and non-fuel products). The panel data used in the empirical analysis include 136 Colombian trading partners to whom 99% of national exports were sold in 2018 (Dirección Administrativa Nacional de Estadística, 2019), from 2005 to 2018. Based on the approach of Egger et al. (2011), six equations are proposed to identify and measure, first, the factors that improve or hinder: total Colombian exports, fuel Colombian exports and non-fuel Colombian exports, through the first three equations proposed. Second, we measure the factors that improve or hinder: total Colombian imports, fuel Colombian imports and non-fuel Colombian

imports, through the remaining 3 equations. Each of the six equations has the same set of explanatory variables of the economic, historical, cultural, geographical and trade integration conditions between Colombia and its partners. Additionally, each equation also contains time-fixed effects because the panel spans a significant number of years and time-invariant country-fixed effects on the Colombian trading partner to capture unobservable MRTs. Moreover, in this section, we also implement the trade potential index (TPI) approach as a method that allows us to compare the potential trade between Colombia and its trading partners predicted by each model with their actual trade volume (De Benedictis and Vicarelli, 2005), and therefore to be able to identify those countries with which Colombia has an over-trading or an under-trading situation. Consequently, we calculate and analyse the TPI between Colombia and its partners for each trading flow (six equations) proposed in 2005 and 2018. It is important to specify that the year 2005 is important in the Colombian trade integration evolution since it is the moment in which there is evidence of an increase in the trade openness of the country through the signing of new trade agreements. And the year 2018 offered, at the time of the study, the most recent trade data between the countries. The calculation of the TPI in these two years allowed us to observe the evolution of the TPI from an initial moment of dynamization of the Colombian trade openness until the most recent time, which allows us to infer the implications related to the comparison between actual trade and potential trade by type of product between Colombia and its trading partners.

In section 3.2. the trade gravity model is employed to identify the impact of Colombian institutional quality on its exports following the model proposed by Anderson and van Wincoop (2003). As in the previous section, the empirical approach includes 136 Colombian trading partners that represent the destination of 99% of national exports, from 2005 to 2018. The approach also considers the influence of institutional barriers to Colombian exports based on the new trade theory (NTT). Based on Álvarez et al. (2018), we consider principles linked to the NTT such as love for variety preferences, increasing returns to scale technologies and iceberg transport, which are related to transport and non-transport factors, and consequently, to trade costs. The model proposed will allow us to determine the drivers of Colombian exports to its partners. As usual, the gravity equation includes some common control variables related to physical distance, the economic size of the countries, variables that reflect the state of the economic integration of the countries, and common cultural and social roots. Additionally, the equation considers the effect of Colombian labour productivity on its exports. The theoretical justification for its inclusion is related to the NTT, suggesting that wages could have a positive impact on productivity. Furthermore, the model comprises six institutional quality indicators provided by the World Bank (Control of corruption, Government effectiveness, Political stability and absence of violence/terrorism, Regulatory quality, Rule of law, Voice and accountability). Each indicator reveals a particular dimension of the country's institutional quality. These indicators are included in the equations with lagged effect because we consider that there is a lagged influence of these variables on international trade (Gani and Scrimgeour, 2016). Finally, we measure the effects of the governance variables, on the one hand, in levels, and on the other hand, in the differences in levels between the institutional quality of the pair of countries, which is

usually called institutional distance. In this regard, we include these variables in the specifications one by one to evade correlation problems.

In section 3.3. the trade gravity model is used to identify the variables that favour or harm trade between Colombia and the EU countries and, in particular, to examine the effect of the trade agreement in force since 2013 between the parties on the evolution of their trade flows (exports and imports). The empirical approach follows the model proposed by Anderson and van Wincoop (2003) and different types of fixed effects are included in the regression to capture unobservable trade frictions. The study analyses trade data (exports and imports) between Colombia and the EU countries between 2005 and 2019. The gravity equation includes trade data between Colombia and the United Kingdom (UK) since, according to the European Commission (2019), the trade relationship between the parties is valid until 2020. The model includes control variables and variables related to the trade integration of the nations involved that will allow us to examine the determinants of exports and imports within the framework of the trade agreement. Furthermore, the model includes variables related to factor endowments (relative factor endowment (RFE), human capital (HC) and population density (PD)), which will denote whether the pattern of bilateral trade between Colombia and the EU (exports and imports) is related to the Heckscher-Ohlin (H-O) model or the Linder hypothesis. Therefore, on the one hand, the Heckscher-Ohlin (H-O) model asserts that nations with different factor endowments will trade more (Frankel, 1997), and on the other hand, the Linder (1961) hypothesis states that those nations with similar factor endowments have similar preferences and, consequently, will trade more. Consequently, if the sign of the variables related to the endowment of factors has a positive sign, it means that the commercial pattern between the parties is oriented to the H-O model (inter-industry) and, on the contrary, if the sign of the variables related to the factor endowments is negative will mean that the pattern of trade between the parties is oriented to the Linder hypothesis (intra-industry).

All in all, the methodological approach of this research is based on the theoretical and empirical foundations of the gravity model applied to international trade. This approach is based on the vast literature related to the theoretical foundation of the model (lacking until sometime) and the relevant theoretical/empirical advances proposed by prominent authors.

1.4. Hypotheses and research objectives

The purpose of this research consists in testing the following hypothesis:

- 1.4.1. H.1. The Colombian trade liberalisation process based on the signing of the FTA has helped reduce and balance its trade deficit.

The H.1. from an economic perspective, is one of the main concerns of the policymakers due to the implications that a deficit in the trade balance brings to an economy such as the Colombian one. In this sense, trade openness was implemented in the country to generate a more efficient and integrated

economy that would increase its trade flows and that would eventually allow it to advance towards a balance in its trade balance. However, and as mentioned above, the success in advancing these goals continues to be questioned by Colombian public opinion.

1.4.2. H.2. The signing of the FTAs between Colombia and its partners has helped to increase their exports and imports flows.

The H.2. purpose is to establish the capacity of the FTAs as that trade policy capable of increasing the flow of exports and imports between Colombia and its trading partners. Concerning this, most of the findings with an empirical approach have corroborated a positive relationship between having trade agreements in force and experiencing increases in the volumes of trade flows, however, some findings affirm the opposite, although to a lesser extent. As stated, this finding is crucial for the evaluation of this trading strategy developed in recent decades by the different governments of the country, which, following the Washington Consensus, seek to boost the country's international trade.

1.4.3. H.3. To what extent have the FTAs improved the performance of Colombian exports and imports?

The H.3. is strongly connected with the H.2. Therefore, this hypothesis, in addition to determining the effect (positive or negative) of the FTAs on the increase in the country's trade flows, quantifies the impact of this policy on the national export and import flows. This quantification is relevant since it offers an additional approximation for the analysis of the trade effect of the FTAs in the Colombian case in each gravity equation proposed in the study. Additionally, this will allow us to infer how deep or slight the impact of the main Colombian trade strategy has been to promote its international trade flows.

1.4.4. H.4. Colombia is positively taking advantage of the trade potential it has with its trade partners regardless an FTA is in force.

Based on the comparison between the actual volume of trade and the one predicted by gravity models between Colombia and its trading partners (TPI approach), the H.4. analyses the implications for Colombia of having an over-trading or an under-trading situation with its partners. For the calculation of the TPI approach, the main destinations of national exports and imports are taken into account, regardless of whether or not there is a current trade agreement between the parties. This approach will allow us to make some recommendations for Colombian policymakers related to targeting and strengthening those markets for which the gravity model indicates that Colombia has a situation of sub-trade. On the other hand, it would allow us to know those destinations with which Colombia has an over-trading situation, suggesting the need to strengthen some factors that make up the model and that would allow, in principle, to expand its potential trade with those destinations.

1.4.5. H.5. The Colombian institutional quality is a factor that promotes Colombian exports to its partners.

The H.5. delves into the relevance of having high-quality institutions that support the increase in trade flows to international markets. In this regard, the literature confirms that institutional quality is a factor

capable to enhance international trade. Addressing this hypothesis is essential to understand the effect of institutional quality in a country such as Colombia, which has various governance complexities marked by an internal armed conflict and by illegal economies such as drug trafficking. Additionally, the hypothesis also compares the performance of Colombian institutional quality with countries of the CA, the OECD and the world average, which will allow us to determine the progress achieved by the country concerning other nations and analyse the impact of these differences (institutional distance) in international trade between Colombia and its partners.

1.4.6. H.6. Colombian labour productivity is a variable that can boost prominently its exports.

The H.6. addresses whether the labour productivity variable that is a proxy for labour competitiveness can promote Colombian exports. As stated, the inclusion of the labour productivity variable in the gravity equation is based on the NTT and is related to trade cost. Therefore, high labour productivity suggests that wages can have a positive effect on productivity. Given this, this hypothesis explores how effective and to what extent the evolution of this factor is capable of boosting national exports.

1.4.7. H.7. The FTA between Colombia and the EU has facilitated the reduction of the Colombian trade deficit.

The H.7. is strongly connected with the H.1. and the H.2. since this hypothesis evaluates, although in a particular case, the effect of trade agreements in reducing Colombia's trade deficit. The empirical analysis of the trade agreement between Colombia and the EU countries is relevant, firstly, because of the economic, social and political conditions of the European bloc, which are of great interest to most of its partners, and secondly, because this treaty goes beyond the framework of a common FTA and is thus expressed in the treaty. This exposes the need to generate basic conditions related to human rights, sustainable development and labour rights, among others.

1.4.8. H.8. The trade pattern between Colombia and the EU is related to inter-industry or intra-industry trade.

The H.8. inquires on the trade pattern carried out between Colombia and the European bloc. Therefore, it is important to investigate this aspect because, in principle, by observing the pattern of trade between the parties provided by the Colombian national statistic institution, it could be inferred that there is a pattern of inter-industry trade. However, this hypothesis identifies, through the use of a contrasted methodology (the Heckscher-Ohlin (H-O) model and the Linder hypothesis), the type of trade pattern present in the trade exchange between Colombia and the EU countries.

1.5. Empirical results and discussion

This research reveals the findings obtained in 3 papers published in peer-reviewed journals, which can be seen in the chapter called “Section 3. Published works”. The results obtained and the discussion generated around them will be addressed individually for each of the published papers.

Section 3.1. entitled “An empirical analysis of Colombia’s trade liberalisation process and its effect on the equilibrium of its structural trade deficit” assesses the effects of Colombia’s trade openness process carried out mainly through the signing of FTAs, and consequently, its success in reducing the country’s trade deficit. As stated, this paper determines the factors that promote or restrict international trade between Colombia and its partners by type of products (fuel and non-fuel). In this context, it is important to note that Fuel goods represents those products from code 321.1 to code 351.0, according to the Standard International Trade Classification and non-fuel goods represent those goods other than those defined as fuel (World Integrated Trade Solution, 2020). Subsequently, six models are proposed in order to analyse the determinants of Colombian trade flows as follows: total exports, fuel exports, non-fuel exports and total imports, fuel imports, non-fuel imports.

In general, models that examine the determinants of Colombian exports, as expected, reflect a negative effect of the distance variable and a positive impact of the GDP variable of the Colombian partner in the promotion of these flows, which is in line with the theoretical foundations of the gravity equation. Moreover, the WTO factor has a positive effect on Colombian non-fuel exports, a finding that highlights the importance of this mechanism of multilateral trade integration in the promotion of national exports, particularly on non-fuel goods. Moreover, the OECD variable is insignificant in all the proposed models, which questions the relevance of the member countries of this organization as consumers of Colombian products. Additionally, the FTA variable harms Colombian total and fuel exports and benefits non-fuel exports. The latter finding suggests that while the FTA factor has stimulated Colombian non-fuel exports, which is in line with the objectives set by the Colombian state, it has hurt Colombian fuel exports to a noteworthy extent. Therefore, taking into account that a considerable amount of Colombian exports are composed of fuel products, the net effect of the FTA variable on the country’s total exports is negative. Hence, if this performance prevails over time and if we consider the country’s high dependence on its oil exports, the nation would continue to witness the deepening of its trade deficit and, consequently, the Colombian peso would experience a constant path of depreciation (a dynamic that is already perceived). And to further complicate this scenario, a report from the Presidencia de la República de Colombia (2020) states that Colombia has oil reserves for the next 6.3 years. Concerning this, the newly elected president of the republic, Gustavo Petro, is the first left-wing president elected in the country with a clear ecological orientation, has stated in several scenarios that he will prohibit the issuance of new oil exploration licenses and the exploitation of oil through the fracking technique in the national territory (Programa de Gobierno 2022-2026, 2022). This government promise of the elected president has generated great controversy since it means that in the medium and long term Colombia will lose its main source of foreign exchange

due to the impossibility of obtaining new oil reserves through the generation of new exploration licenses or the implementation of the effective technique of fracking in active oil wells. Furthermore, it is important to point out that this deficit has been financed by a surplus in the capital account, a surplus that in some years has been greater than the deficit presented in the trade balance (Buitrago and Leon, 2015; Banco de la República de Colombia, 2022). In this sense, several legal reforms have been implemented in the country with the aim of making the foreign direct investment (FDI) in Colombia more attractive to foreign investors (Ramirez and Quintero, 2019) and, consequently, FDI inflows have grown considerably, with the oil and mining sectors being the ones that have received the largest amounts of investment (Valosa, 2019). This confluence of complexities highlights the need for trade policymakers to generate effective actions to promote non-fuel exports, thus replacing fuel exports.

Furthermore, models that evaluate Colombian import flows show that the distance factor only hurts fuel imports, which implies that the distance factor does not restrict or favour total and non-fuel Colombian imports. It explains why a considerable amount of non-fuel imports come from India and China, one of the main suppliers of non-fuel goods in Colombia, countries with which Colombia has a great physical distance. Moreover, the distance variable harms fuel imports and having a common border also harms these flows, which explains why fuel imports come from nearby markets with which Colombia does not share a physical border (The USA and Mexico). As expected and in line with the theoretical approach of the gravity model, the GDP of the Colombian partner variable has a positive effect on imports regardless of the specification. The WTO variable has a relevant impact on the growth of Colombian total and non-fuel imports and this effect stands out, especially in the latter. These findings once again highlight the importance of this type of multilateral trade agreement as one capable of promoting, in this case, imports from Colombia and particularly imports of non-fuel goods. The OECD variable harms total and non-fuel imports, suggesting that being a member of this organization reduces the flow of imports of goods to Colombia. Additionally, the FTA factor has a substantial positive impact on each of the Colombian import flows analysed, emphasising the positive effect generated in imports of non-fuel goods, which are the group of products that make up the majority of national imports. The findings indicate, unlike exports (total and fuel exports), that trade liberalisation has promoted Colombian imports.

Concerning the analysis carried out through the TPI approach, we can affirm that there is a tendency towards an over-trading situation with the majority of the main Colombian partners, which reveals the growth of Colombian exports to these countries. This picture suggests that the performance of Colombian exports to these countries has exceeded that estimated by the models. In this regard, the notable deepening of the over-trading situation with countries such as China, Panama and Turkey stands out. Nonetheless, the Colombian TPI with its main trade partner has increased, suggesting a reduction of Colombian exports, regardless of the type of product analysed, to the USA, especially after the signing of the FTA. This finding questions once again the effectiveness of signing trade agreements, in this case, the one signed between Colombia and the USA, as a strategy to promote national exports. Furthermore, the analysis by type of product exposes an over-trading situation for fuel products with most of its main

partners (highlighting the deepening of the over-trading situation with Brazil, Chile, China and Panama), in contrast to what is observed with non-fuel products, where a single trend is not reflected. Overall, the TPI approach for Colombian exports indicates that although the trade liberalisation had a positive effect on non-fuel exports, which is observed in a general trend towards over-trading, total exports have been affected by the significant decrease in fuel exports. Referring to the TPI of the Colombian partner with Colombia, the models show a predominant tendency towards an over-trading situation, which is especially evident for total and non-fuel imports. This tendency is higher than that reflected by the Colombian TPI with its partners and designates a notable growth of Colombian imports from its main partners as a result of its trade openness, indicating a significant effect of this process in the promotion of Colombian imports, exceeding what was predicted by the model. It is important to point out that the USA TPI with Colombia has increased although its exports to the country have grown considerably in recent years. Therefore, the TPI approach for Colombian partners allows us to infer that trade liberalisation has succeeded in promoting its imports and this is in line with the performance of Colombian import data.

All in all, the study allows us to affirm that although Colombian non-fuel exports have grown during the period analysed, the global effect on Colombian exports has been negative, due to the composition of the country's export basket. Conversely, the findings show that in the same period Colombian imports have grown substantially, and this is also confirmed by the evolution of Colombian international trade data. Therefore, the Colombian goal of reducing and eventually balancing its trade deficit has not been accomplished. Consequently, the expected growth of bilateral trade driven by trade liberalisation particularly focused on the signing of FTAs has not been what was expected, at least for Colombian exports. This scenario would probably lead to a deepening of Colombia's trade deficit and, subsequently, to the detriment of the entire economy of the country.

Section 3.2. called "The role of institutional quality in the international trade of a Latin American country: evidence from Colombian export performance" examines the impact of Colombian institutional quality on its exports in a framework of trade liberalisation. The objective of this research is to assess to what extent each of the indicators proposed by the World Bank governance indicators (WGI) affect Colombian exports and also to assess the impact of the Colombian labour productivity factor as a variable capable of increasing its exports, all this in an environment of trade integration. Given this, we estimate the gravitational model including the six institutional indicators separately in order to elude correlation problems, and therefore, to identify their individual effect on Colombian exports.

In the gravity model equation, we include some common variables to estimate the equation. The distance factor and the GDP of the Colombian partner, both statistically significant, offer the expected impact (adverse and positive, respectively) on Colombian exports based on the fundamentals of the gravity model. Conversely, contiguity and common language variables are insignificant in the model. Additionally, the variable labour competitiveness, which is a proxy of productivity per worker, reveals that salaries have a remarkable positive impact on labour productivity. This variable stands out as the one capable of

generating the greatest effect in promoting national exports, so this finding should draw the attention of Colombian policymakers. Nonetheless, based on the OECD (2019), Colombian labour competitiveness is decreasing, it is a third of that achieved by OECD countries and is even lower than that the one registered among some Latin American countries, which questions whether this factor can really promote its exports taking into account the impossibility of the State to promote the development of this factor. Additionally, the regression reflects that the OCDE and the WTO variables are insignificant in the model. The finding related to the WTO variable partially questions the findings obtained in the article referenced in section 3.1. called “An empirical analysis of Colombia's trade liberalisation process and its effect on the equilibrium of its structural trade deficit”, since although they agree that this variable is insignificant and, consequently, has no effect on the country's total exports, in the academic paper of section 3.1., the result related to the WTO factor is statistically significant and generates a positive effect on total imports from Colombia. The FTA variable harms Colombian exports, which questions the effectiveness of Colombian trade openness and it is in line with the findings of Abreo et al. (2022a).

The influence of the institutional indicators on Colombian exports exhibits some significant and interesting findings. Of the six indices proposed by WGI, all are statistically significant, five have a positive effect on Colombian exports and one of them reflects a negative impact on them. This means that the improvement in the evolution of institutional indices promotes an increase in exports and vice versa. As for the five indices that have a positive effect on Colombian exports, the rule of law and the regulatory quality stand out as those with the greatest effect on trade. It is important to note that the other three variables (voice and accountability, government effectiveness, and political stability) also show a positive effect on Colombian exports, but to a lesser extent. Surprisingly, the control of corruption variable offers a negative effect on Colombian exports. This suggests that if Colombia advances in this matter, its exports will decrease, a result that contradicts various studies and, above all, questions the complexities and influence of corruption in the country's economy, and therefore, in its exports. Furthermore, the institutional distance argues that most of the differences in the indices between Colombia and its partners are statistically significant (control of corruption, government effectiveness, rule of law and regulatory quality) and, more importantly, that the institutional distance between Colombia and its partners harms its exports. The results regarding institutional distance advocate the importance for Colombia to strengthen its institutional quality because the distance between its governance and that of its partners negatively affects its exports.

Section 3.3. entitled “Trade agreement and trade specialization between Colombia and the EU” delves into the effectiveness of the FTA between the parties to increase their trade (export and import flow) and eventually balance the Colombian trade deficit with the bloc. The study also examines their trade pattern, which will allow us to determine whether the trade between the parties is related to the Heckscher-Ohlin (H-O) model of inter-industry trade or the Linder hypothesis of intra-industry trade.

The model that examines the determinants of Colombian exports exhibits a negative effect on the distance variable and, on the contrary, a positive effect on the sum of the GDP of Colombia and its partner

(GDP_{Colj}), as expected, based on the theoretical basis of the gravity model. Additionally, variables such as whether the EU country is landlocked, whether it belongs to the OECD, and whether the countries share legal origins, promote Colombian exports. These findings may clarify why most Colombian exports go to coastal EU countries such as the Netherlands and Spain. They also explain why most of these trade flows go to OECD members (in addition to the countries already mentioned, the Netherlands and Spain, the other destinations of Colombian exports to the EU in terms of traded values are Germany, Italy and the United Kingdom, respectively). Nevertheless, the model indicates that the variables related to whether the nations share a language, whether the EU country is part of the Eurozone and the impact of the FTA signed between the parties, do not offer statistical significance. Result related to the FTA variable advocates that this variable does not affect Colombian exports to the EU, which questions, once again, the effectiveness of signing trade agreements (as is the case of the trade agreement analysed in this section) as a strategy to promote export flow carried out by the Colombian government in the last decades (Abreo et al., 2021; Abreo et al., 2022a). Furthermore, variables related to factor endowment (capital-labour ratio, human capital and population density) in the model that assesses Colombian exports exhibit positive signs and are statistically significant, which suggests that those flows to the EU are related to an inter-industry trade pattern or to the Heckscher-Ohlin (H-O) model. In this sense, it is essential to point out that each of the results of the three variables that denote the factor endowment of the analyzed countries offer the same sign, which confirms the sufficiency of the findings regarding the pattern of trade between the parties. These results argue that a greater difference in the values of these variables between the parties promotes Colombian exports, suggesting that bilateral trade benefits from differences in factor endowments and, subsequently, there is a complementary trade pattern between Colombia and the EU. These results are in line with what is exported by Colombia to the EU (mainly oil and mining goods and goods from the agricultural sector).

On the other side, the model that analyses the determinants of Colombian imports reflects that the distance, common legal origin, landlocked and OECD variables are statistically insignificant. This suggests that these variables have no effect on Colombian imports. On the contrary, sharing a common language and belonging to the Eurozone have a positive impact on this trade flow, elucidating why Spain and the EU countries that belong to the euro area, respectively, are relevant suppliers of goods for Colombia. Similarly, the sum of the GDP of Colombia and its partner has a positive impact on Colombian imports, as theoretically expected. Finally, the FTA factor exhibits a positive influence on Colombian import flows, outcomes that are in line with our previous findings (Abreo et al., 2021; Abreo et al., 2022a). Regarding the effect of the factor endowment variables in the model that examines the determinants of Colombian imports, these show a positive result and suggest that a greater difference in the values of these variables between countries promotes Colombian imports from the EU, and therefore, based on the results, a trade pattern related to an inter-industry trade pattern or the Heckscher-Ohlin (H-O) pattern is appreciated, as in Colombian exports. As in the case of the model that analyzes the trade pattern of national exports, the findings on this trade flow are confirmed with the results generated by each of the three variables that denote the factor endowment of the parties. These findings may explain why most of the Colombian

imports are composed of capital goods, construction materials, goods of consumption and intermediate goods (MinCIT, 2021).

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[3](#)

Section 2. General Conclusions

2.1. Conclusions

The present dissertation has different purposes, however, the main objective is to determine to what extent the Colombian trade openness process, centred on the signing of FTAs, has helped boost its international trade, and particularly, to what extent this strategy has helped to balance the Colombian trade deficit. Subsequently, additional objectives have been achieved, such as assessing to what extent trade liberalisation has affected Colombian international trade (export and import flows) by type of goods (fuel and non-fuel), as well as evaluating the impact of Colombian institutional quality in promoting its exports and, examining whether the effect of the FTA between Colombia and the EU countries has been a successful strategy to improve their trade, among others. Therefore, the presentation of the general conclusions of this research will be exposed individually for each of the published papers, with deductions that are in line with what was stated in section 1.4. Hypotheses and research objectives.

Conclusions related to Section 3.1. "An empirical analysis of Colombia's trade liberalisation process and its effect on the equilibrium of its structural trade deficit" confirm that the Colombian trade liberalisation process that began in 1991 but intensified as of 2005, through the signing of a considerable number of FTAs, has negatively affected the performance of the Colombian trade balance, and therefore, it has deepened the country's trade deficit. This is explained because the gravity models that examine the impact of trade liberalisation focused on the signing of FTAs on Colombian international trade show an adverse effect on Colombian exports and, on the contrary, a positive effect on its imports, which clarifies the expansion of its trade deficit. However, it is essential to point out that the analysis of Colombian trade flows by type of product reveals some important inferences. On the one hand, Colombian fuel exports are negatively affected by trade liberalisation, unlike Colombian non-fuel exports, which are promoted. The result of the parameter of the FTA variable in each model (negative and higher in fuel exports and positive and lower in non-fuel exports) together with a higher percentage of fuel products over Colombian exports, allows explaining the negative global impact on Colombian exports. On the other side, the effect of trade liberalisation reveals a positive impact on Colombian imports regardless of the product analysed. The results of the FTA variable in the proposed estimates contradict what was stated by Egger, who claims a predominantly positive impact on the promotion of international trade through the entry into force of trade agreements between countries (Anderson & Yotov, 2016; Baier & Bergstrand, 2009; Egger et al., 2011; Fally, 2015), Santos Silva & Tenreyro, 2006). Furthermore, the findings suggest that the WTO variable is capable of increasing Colombian non-fuel exports and Colombian non-fuel imports (although the value of the WTO parameter is much higher in the second flow than in the first), which questions the effectiveness of the FTA variable to promote Colombian international trade. This finding may be especially relevant considering the country's need to rapidly replace its fuel exports with non-fuel exports. On the other hand, the findings related to the TPI analysis show a reduction in Colombian trade potential with most of its main partners, which advocates that the country should deepen its current trade agreements or explore new markets. In the same vein, the TPI of the main Colombian partners with Colombia reflects

the same trend toward an over-trading situation, which in this case, is aligned with the notable increase in the country's imports. In general, these results allow us to affirm that the Colombian trade liberalisation has harmed Colombian exports and promoted Colombian imports, and therefore has deepened its trade deficit, findings that are also supported by the TPI analysis. Furthermore, these results should draw the attention of Colombian policymakers in the formulation of public policies that promote international trade beyond the signing of new trade agreements, a statement supported by the observed effect of the WTO variable on the promotion of Colombian exports and imports of non-fuel goods.

Conclusions related to Section 3.2. "The role of institutional quality in the international trade of a Latin American country: evidence from Colombian export performance" reveal that most of the institutional indicators included in the gravity model promote Colombian exports, findings that are in line with the results of leading authors (Álvarez et al., 2018; De Groot et al., 2005; Levchenko, 2007; Wu et al., 2012; Yu, 2010). Among the governance indicators that offer the greatest positive effect on Colombian exports, the rule of law and the regulation quality stand out, suggesting that those conditions related to legal certainty and market competition are capable of increasing exports substantially. Nonetheless, the effect of the corruption control factor exhibits a statistically significant and negative effect on exports, exposing the complex roots of corruption in the country's economic and business environment. The findings also exhibit a prominent effect of the labour productivity variable in Colombian exports, which should be considered by policymakers as a fundamental factor to promote this type of trade flow. Moreover, the impact of the FTAs harmed Colombian exports, a result that once again questions the effectiveness of this strategy to boost the country's exports and, therefore, balance its trade deficit. Concerning conclusions related to the effects of institutional distance on Colombian exports, the results confirm that the greater the differences in governance, the smaller the export flows. This finding is pertinent due to the notable institutional distance it has with its main trading partners. This conclusion should draw the attention of policymakers, since the improvement of institutional quality, as already mentioned, not only has a positive effect on exports but also on the reduction of the institutional distance with its partners, and therefore, in the promotion of this trade flow. All in all, in light of the discussion on the importance of institutional quality to promote Colombian exports, it is relevant to bear in mind that Colombia is a country that has had an internal armed conflict for more than half a century, which still prevails through new mechanisms of struggle, and subsequently, influence the state of national institutions and their evolution in different forms. In this regard, policymakers should focus their efforts on improving the legal framework of the country, and therefore, its legal system, which provides serious guarantees of compliance of contracts and protection of private property. Similarly, policymakers should focus their efforts on promoting market competition and, therefore, on the implementation of policies that improve the standards of competitiveness and quality of business processes in the private sector.

Conclusions related to Section 3.3. "Trade agreement and trade specialization between Colombia and the EU" show that the entry into force of the FTA between the parties does not have statistical significance on Colombian exports, but it boosted Colombian imports, reflecting a deepening of the Colombian trade

deficit with the EU countries. These results are confirmed by the performance of Colombian exports and imports to and from these countries, which reflect a clear trend towards a deepening of the Colombian trade deficit. Furthermore, the findings confirm that both Colombian exports and imports with the EU show a pattern of inter-industry trade that is related to the Heckscher-Ohlin (H-O) model (Abreo et al., 2022b). The conclusion was confirmed by the inclusion in the gravity models of different proxy variables that measure the effect of factor endowments of the countries involved in their trade. These findings are corroborated due to the type of goods that are traded between Colombia and the EU countries, which have a clear orientation toward inter-industry trade. In this regard, Colombian policymakers should focus their efforts on increasing international trade (both exports and imports) towards those EU countries where significant differences in factor endowments have been identified due to the pattern of inter-industry trade between the parties.

In general, the empirical research confirms an adverse effect of the Colombian trade liberalisation process evidenced in the deepening of the country's trade balance. However, if it is analysed by type of traded good, it is observed that this process has promoted exports of non-fuel goods, although the growth of imports of this type of goods is greater. It also indicates that improving the country's institutional quality could be an important factor in promoting its exports. Additionally, it exhibits a prominent effect of the labour productivity variable as the one capable of significantly increasing its exports. Furthermore, the empirical analysis of one of the most important trade agreements for the country establishes that this factor does not generate any (insignificant) effect on Colombian exports to the EU, although it promotes its imports. Finally, the analysis of this trade agreement and the factor endowment of the countries involved establishes that the trade pattern between the parties is related to intra-industry trade.

2.2. References

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Section 3. Published works

- 3.1. An empirical analysis of Colombia's trade liberalisation process and its effect on the equilibrium of its structural trade deficit. (Scopus Q2).

An empirical analysis of Colombia's trade liberalization process and its effect on the equilibrium of its structural trade deficit

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Ministry of Science, Technology and Innovation of Colombia

Abstract

This article examines the extent to which Colombia's trade liberalization, as a government strategy to boost its exports, has helped to balance its structural trade deficit. Based on the trade gravity model theory, we derive two-way specifications (Colombian exports and imports) in order to analyze bilateral trade flows (fuels and non-fuels) between Colombia and 136 countries from 2005 to 2018. Additionally, we compare the real export performance of Colombia with its main partners through the trade potential index (TPI), to assess the effect of Colombia's openness on bilateral trade. The econometric approach indicates that the free trade agreement (FTA) factor has a negative net effect on Colombia's exports and a positive net impact on Colombia's imports. Finally, the TPI analysis allows us to infer that although there is an evolution towards the intensification of Colombian trade, this trend is greater in imports than in exports, which suggests a deepening of the Colombian trade deficit.

KEYWORDS

Colombia, free trade agreement (FTA), international trade, trade balance, trade gravity model

1 | INTRODUCTION

The past decade has witnessed the rapid development of trade liberalization as one of the most critical policies in enhancing international trade around the world. In this regard, empirical research has explored the effects of the free trade agreement (FTA) factor on bilateral trade, showing that FTAs improve bilateral trade among associated countries (Egger et al., 2011).

Colombia, as part of the Andean Community (AC) and one of the fastest-growing countries in the region, has developed a policy of trade openness in the last decades. This policy has been implemented through the signing of relevant trade agreements, which have different trade scopes and follow global trends in trade liberalization. However, there is no consensus about whether this process has had the expected effect on Colombia's exports and its trade balance, and therefore, on domestic production and welfare.

The purpose of this paper is to analyze the effects of Colombia's trade liberalization process and also to assess the impact of the signing of bilateral and regional trade agreements as an effective policy to reduce the Colombian trade deficit. Additionally, our study delves into the effect of FTAs on Colombia's trade in fuel and non-fuel-related goods, which allows us to determine the individual influence of FTAs on these types of products, which is essential due to the country's high dependence on its fuel exports. Furthermore, this study could be replicated in most of the Latin American countries, which are highly dependent on their commodity exports, as well as those countries whose exports depend particularly on fuels.¹ Moreover, this study will allow us to analyze, through an empirical approach, the performance of the trade balance of a country which, on the one hand, largely depends on its fuel exports and, on the other hand, whose oil reserves are about to run out. As far as we know, this is the first study to explore the determinants of Colombia's international trade (export and import flow) in terms of fuel and non-fuel flows. Consequently, the results of the study will allow us to make some trade policy recommendations focused on improving the efficiency of Colombia's trade openness.

Furthermore, we applied the trade gravity model to a cross-sectional data set of bilateral exports to 136 countries from 2005 to 2018. Subsequently, this study sets out to assess the effects of a group of variables on exports between the parties, where the FTA factor is a relevant variable. Additionally, a robust estimation of bilateral trade will allow us to compare the actual export performance of Colombia and its partners with the estimated export potential generated by the model through the trade potential index (TPI). This comparison will permit us to determine whether the signing of trade agreements by Colombian governments has had the expected effect on trade. The research also considers two aspects of recent empirical analysis of international trade. The first is the fact of the presence of many zeros in bilateral trade data and the need to estimate the model with an approach more suitable than that of a traditional log-linear form; this approach is called the Poisson pseudo maximum likelihood (PPML; Santos Silva & Tenreyro, 2006). The second is the application of fixed effects to capture unobservable determinants in trade flows (Gopinath et al., 2014; World Trade Organization 2012). Summing up, the proposed study will allow us to discern whether the Colombian trade liberalization process has helped to balance its trade deficit.

The paper is organized as follows. Section 2 describes the evolution of Colombia's trade liberalization strategy in the last few decades through the international economic integration policy initially called *Apertura Comercial*. Section 3 describes our methodological approach. Section 4 is concerned with the specification and data used for this study. Section 5 presents the findings of the research, focusing on the effects of the variables involved in bilateral trade and the results of the TPI. Section 6 provides a discussion. Section 7 concludes.

2 | Colombia's TRADE LIBERALIZATION PROCESS

Several authors state that trade liberalization has a positive impact on economic growth (Manwa & Wijeweera, 2016). In this vein, Baier et al. (2019) claim that more than 350 bilateral trade agreements have been notified to the WTO since 1986. Thus, there is evidence that the determination of the most recent Colombian governments to develop a trade policy of international economic integration is associated with global trends, following what other countries have already done to promote their exports. This process, which has been encouraged by the promotion of international trade and investment relationships, has helped to create what Sokolov-Mladenović et al. (2017) have called the global village. According to Lim and Breuer (2019), the pace of decreasing barriers to international trade has quickened in the last 30 years, strongly reflected in developing countries, where this factor has helped boost their economic growth.

Colombia's aim of trade openness was embodied through membership of the General Agreement on Tariffs and Trade (GATT, lately WTO), reached on October 3, 1981 (World Trade Organization, 2019). The WTO has promoted the liberalization of international trade in recent decades through agreements signed by its member countries.² More recently, continuing its process of international economic integration, Colombia joined the Organisation for Economic Co-operation and Development (OECD) in 2020 (Organisation for Economic Co-operation & Development, 2020).

Nevertheless, Colombia's openness was sluggish until 1991. Since then, trade liberalization has intensified, with the helping hand of the former president of the republic, Cesar Gaviria Trujillo. According to García et al. (2014), Gaviria declared the intention of opening the economic system to make it more productive and efficient. To do so, an unprecedented set of reforms were implemented to promote what Gaviria called *Apertura Comercial*. Consequently, Colombia began negotiations to sign a significant number of bilateral and regional trade agreements.

In Colombia's openness, two agreements stand out. According to Dirección Administrativa Nacional de Estadística (Dirección Administrativa Nacional de Estadística, 2019a), the FTA between Colombia and the United States and the Commercial Agreement between Colombia and the European Union are arrangements that, on average, accounted for more than half of Colombia's exports and imports from 2005 to 2018. Nevertheless, both agreements have shown a deficit in Colombia's trade balance in recent years (Ministerio de Comercio Comercio and Industria y Turismo de Colombia (2018a)). Likewise, it is essential to clarify that, although both markets are of great importance, there is a big difference in trade amounts (Ministerio de Comercio, Comercio, & Industria y Turismo de Colombia, 2018b), which is explained by the more robust background of the commercial relationship between Colombia and the USA. This is mostly elucidated by conditions such as their productive complementariness (most of Colombia's exports to the USA are oil, mining or agricultural goods, unlike the USA's exports, which are mostly goods with high added value); the income level of US citizens; the relatively short distance between the two countries; the degree of trade openness defined in their FTA; and their robust and historical cooperation in different and strategic areas for Colombia's economic development and social stability, which have also improved their bilateral relationship.

Another notable trade association for Colombia is the one reached with the Andean Community, within the framework of a customs union. This agreement is highlighted by the fact that Colombia's exports are mainly made up of manufactured products, unlike the USA and the EU. Colombia's agreement with the AC is the oldest one signed by Colombia, and it is a natural market for national products due to its contiguity. According Ministerio de Comercio Comercio and Industria y Turismo de Colombia (2018a), trade flows grew continuously from 2001 to 2018,

except for the slight drop registered in 2009. Likewise, trade relations with the AC countries reflect the fact that, from 2001 to 2018, Colombia had a surplus in its trade balance, wherein a vast majority of exports are not from the oil or mining sectors. In particular, Colombia's exports to AC countries are mostly composed (72%) of goods from basic and light industry. In contrast, imports from AC countries are mostly composed (65%) of raw materials, particularly agricultural products. This situation indicates, on the one hand, Colombia's specialization in the production and export of manufactured goods, and on the other hand, the promotion of the production of value-added goods in commercial relations with the AC countries. Additionally, the trade flows show that Colombia and its AC partners have a robust inter-industry trade pattern. However, it is essential to note that there is also intra-industry trade between them, mainly represented by machinery and transport equipment goods (Ramos & Toro, 2012). Nevertheless, trade agreements such as the Pacific Alliance, the Caribbean Community and Mercosur have taken on greater commercial importance in recent years due to the notable increase in Colombia's exports to these destinations.

Figure 1 shows Colombia's export performance in millions of constant US dollars (base year 2000) to central destination countries by type of product from 2005 to 2018 in annual average figures. It shows that Colombia's exports are mainly made up of fuels, and their relative importance in total exports continues to be noteworthy in each of the periods analyzed. In particular, Colombia's exports to the USA represent about a third of total Colombian exports in every period shown, showing the significance of the US market. Furthermore, exports exhibit an expansionary trend with countries with which a trade agreement is in force. Those countries are Ecuador, Mexico, Brazil, Spain and even Chile, although the latter fell slightly in the last period. However, according to Figure 1, the highest export growth rates occur with countries with which there is no signed trade agreement: China, Panama and Turkey. In this regard, Colombia's exports to China have shown an outstanding performance, explained by

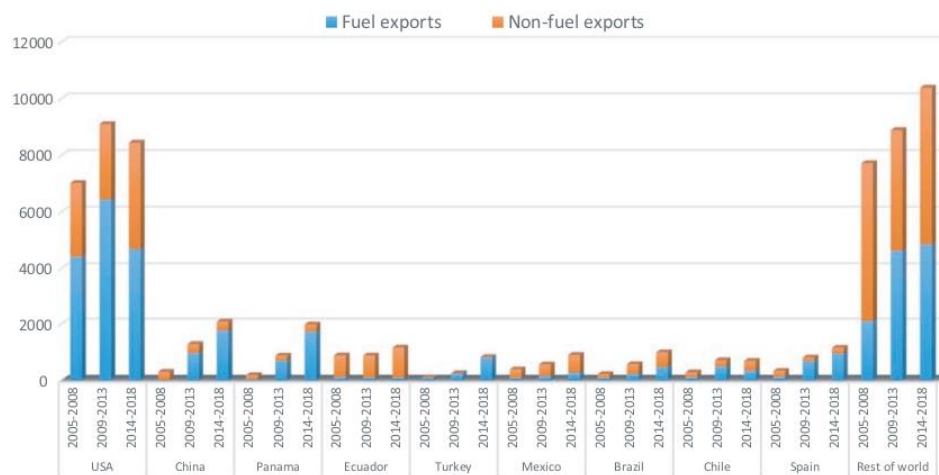


FIGURE 1 Main world destinations of Colombian exports in millions of constant US dollars (base year 2000) by type of product. *Source:* Authors' own calculations based on World Integrated Trade Solution (World Integrated Trade Solution, 2020a, 2020b). Deflated values based on the Export Price Index from Banco de la República de Colombia (Banco de la República de Colombia, 2020b)

the growth in its consumption of oil and mining goods. These types of exports represented 93.8% of Colombia's exports to China in 2018 (Ministerio de Comercio, Comercio, & Industria y Turismo de Colombia, 2020). Moreover, it is important to note that there is a trade agreement already signed with Panama and the legislative bodies of both countries are processing its approval, and also that another trade agreement is under negotiation with Turkey (Ministerio de Comercio, Industria y Turismo de Colombia, 2019).

Figure 2 shows Colombia's import performance in millions of constant US dollars (base year = 2000) by country of origin and type of product from 2005 to 2018 in annual average figures. It can be seen that the USA is the primary origin of Colombian imports. Nevertheless, this scenario may change shortly due to the notable increase in imports from China. Additionally, a remarkable growth in Colombian imports from most of the countries is evident. Unlike exports, Colombian imports consist almost entirely of non-fuel³ goods. However, it is important to mention that the USA is a prominent supplier of refined petroleum products such as gasoline and light oils (Dirección Administrativa Nacional de Estadística, 2019b). Furthermore, it must be stated that even with a profound devaluation of the Colombian peso, which lost 42.3% of its value between 2005 and 2018 (Banco de la República de Colombia, 2020a), imports have shown an upward trend. Moreover, Colombia's international trade has been strongly influenced by the international price oscillation of fuel goods; according to Ministerio de Comercio Comercio and Industria y Turismo de Colombia (2018b), 63.3% of Colombian exports were composed of those types of products. This fact creates a substantial influence on the terms of trade, causing a constant and notable fluctuation in the USD/COL exchange rate. It is important to note that, although there is a general assumption about the symmetric effect of exchange rate changes on the trade balance (depreciation improves the trade balance and appreciation worsens it), this assumption is incorrect and is adequately explained through the concept of the asymmetric J-curve (Bahmani-Oskooee et al., 2020). Nevertheless, Bahmani-Oskooee et al. (2019) found that depreciation provokes an increase in price competitiveness and exports in the short run, but this

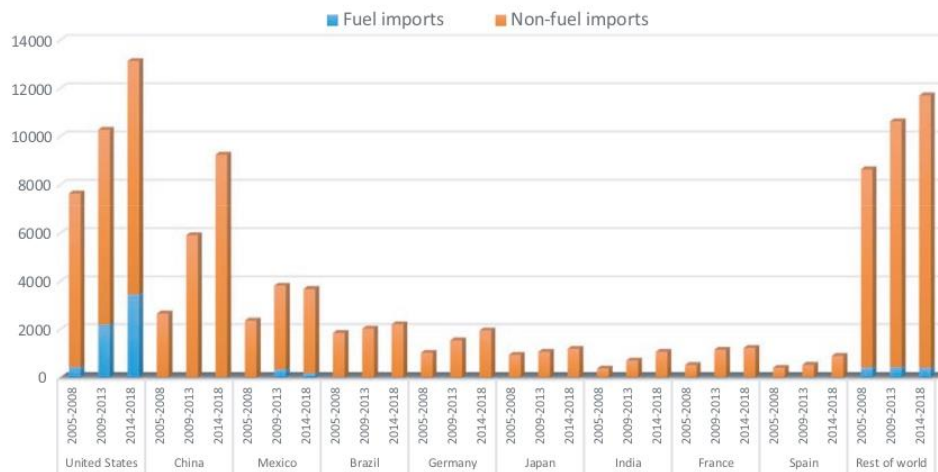


FIGURE 2 Main world origins of Colombian imports in millions of constant US dollars (base year 2000) by type of product. *Source:* Authors' own calculations based on World Integrated Trade Solution (2020a). Deflated values based on the Import Price Index from Banco de la República de Colombia (2020b)

positive effect must be accompanied by other measures such as an adequate monetary policy to have a long-term effect.

Considering all of this evidence, it seems that Colombian exports have an explicit dependence on the fuel industry. In this regard, Karabulut et al. (2020), in their study on the effect of global economic uncertainties on commodity prices, affirm that certain shocks such as the recent trade wars have increased their price volatility which can eventually generate lower growth for countries dependent on commodity production such as Colombia. Additionally, although the growth of non-fuel exports has been remarkable, an oil export substitution scenario is not feasible in the short term under current economic conditions. Moreover, Colombia has seen a deepening of its trade balance deficit, especially in the last period analyzed. It is imperative to highlight that the trade deficit scenario was intensified after the signing of some of the most prominent FTAs, questioning their effectiveness in reducing its deficit. Hence, it suggests that the income elasticity of imports appears to be greater than that of exports, resulting in the deterioration in terms of trade reflected in the expansion of the Colombian trade deficit. Finally, although Colombia's trade openness has had a positive influence on Colombian exports, the positive effect has been more significant on Colombian imports, deepening the country's trade deficit.

3 | METHODOLOGICAL APPROACH

To assess the determinants of Colombian trade flows, a robust and successful econometric method is implemented: the trade gravity model. The technique is commonly used in empirical studies to consider the factors that explain international trade among countries. Furthermore, it is a very good fit for predicting bilateral trade flows, and this property has been recognized in many papers (Fally, 2015). The model is proposed based on the theory called the *law of universal gravity* of the English physicist Sir Isaac Newton (Abidin et al., 2013). For Bergstrand (1985), the gravity equation states that trade between two countries can be explained by the economic forces of trade in the country of origin and by the economic forces of trade in the country of destination, and, additionally, through the economic forces that help or resist the flow of trade from origin to destination. Guo (2015) state that the volume of trade between two economies is directly proportional to the product of their economic masses, defined by their gross domestic products (GDPs), and inversely proportional to the physical distance between them.

Consistent with Anderson (1979), the gravity equation is ordinarily specified as

$$X_{ij} = \alpha_0 Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3} n_{ij},$$

where X_{ij} denotes trade flows between country i and country j , Y_i and Y_j denote the country incomes defined by their GDPs, and D_{ij} denotes the distance between i and j . Furthermore, the equation includes all the factors that might create resistance to trade. Likewise, n_{ij} represents an error factor statistically independent of the regressors. Finally, $\alpha_0, \alpha_1, \alpha_2, \alpha_3$ are unknown parameters.

The first developments of the gravity model for the study of international trade were formulated by Tinbergen (1962) and Pöyhönen (1963). They analyzed the pattern of bilateral trade among European countries. Anderson (1979) claimed that the gravity equation was probably the most successful mechanism for the empirical study of international trade, although at that time part of its theoretical justification had not been identified. Deardorff (1984) affirmed that, despite this initial criticism of the theory, the gravity model has become popular due to its empirical success in predicting bilateral trade flows of various commodities in different situations.

The theoretical justification of the gravity model was mainly made by Anderson and van Wincoop (2003), who recognized that the prediction of the gravity model could be derived from the Ricardian approach, the Heckscher–Ohlin–Samuelson model and the New Theory of Trade Based on increasing returns to scale (Gopinath et al., 2014; Kabir et al., 2017).

Furthermore, one of the most critical advances in the gravity model was the introduction of multilateral resistance terms (MRT), popularized by Anderson and van Wincoop (2003). They showed that controlling relative trade costs is crucial for a well-specified gravity model. Additionally, their theoretical results showed that bilateral trade is determined by relative trade costs (World Trade Organization, 2012). Furthermore, this statement was already supported by Krugman (1995), who stated that bilateral distance is a crucial empirical element in bilateral trade, and added that this could not be the sole factor that matters in the gravity equation.

Another important key in the development of the gravity model was the introduction of fixed effects. These are implemented to capture unobservable MRT in trade flows. Country-pair fixed effects are useful when econometric models lack plausible instrumental variables (Gopinath et al., 2014). Likewise, they are useful when there are specific MRT that affect trade between a pair of countries, but not with third parties (World Trade Organization, 2012). Moreover, individual country fixed effects effectively absorb all bilateral trade frictions, including any unobservable component of trade costs, which otherwise would enter the error term and potentially lead to inconsistent estimates (Baier et al., 2019). Furthermore, Gopinath et al. (2014) mention that these effects are used to control systematic tendencies to export or import large amounts relative to GDP and other observed trade determinants. Due to that, any unobservable determinants that contribute to change in the overall level of exports or imports of a country will be taken into account. Lastly, time-variant fixed effects are suitable for a database that spans many years.

4 | SPECIFICATION AND DATA

In the empirical study, 136 countries were selected. These countries accounted for 99% of Colombia's exports in 2018 (Dirección Administrativa Nacional de Estadística, 2019a). The period analyzed was from 2005 to 2018. The study period was chosen taking into account that since 2005 Colombia's trade integration process has intensified through the signing of trade agreements, and until 2018 due to the implementation of the latest economic data available at the time the research was complete.

The variables implemented in the model vary in economic, historical, geographical and trade characteristics. The specification follows the variable selection process made by Egger et al. (2011), which was adapted to our research, and contain the elements shown in Table 1. Consequently, six econometric specifications that follow the approach of Egger et al. (2011) are proposed to analyze, on the one hand, total export flows and export flows by type of products (fuels and non-fuels) from Colombia to its partners and, on the other hand, the total import flows and the import flows by type of products (fuels and non-fuels) from Colombia's partners to Colombia.

The first three econometric specifications include time fixed effects captured by δ_t , time-invariant country fixed effects in the destination captured by α_j and an identical set of explanatory variables. Model (1) represents the estimation of total Colombia's exports to its partners, model (2) the estimation of Colombia's fuel exports, and model (3) the estimation of Colombia's non-fuel exports. These models are summarized as.

TABLE 1 Variables implemented in the model

Variables	Description	Update date	Source	Expected sign
$X_{Total\ Colj}$	Colombia's exports to its partners in constant USD	June 19, 2020	World Integrated Trade Solution	
$M_{Totalj\ Col}$	Colombia's imports from its partners in constant USD	June 19, 2020	World Integrated Trade Solution	
$X_{Fuels\ Colj}$	Colombia's fuel exports to its partners in constant USD	June 19, 2020	World Integrated Trade Solution	
$M_{Fuelsj\ Col}$	Colombia's fuel imports from its partners in constant USD	June 19, 2020	World Integrated Trade Solution	
$X_{Non-fuels\ Colj}$	Colombia's non-fuel exports to its partners in constant USD	June 19, 2020	World Integrated Trade Solution	
$M_{Non-fuelsj\ Col}$	Colombia's non-fuel imports from its partners in constant USD	June 19, 2020	World Integrated Trade Solution	
$LogDIST_{Colj}$	Log distance in kilometers between Colombia and country j	March 30, 2019	CEPII	-
$CONTIG_{Colj}$	Common physical border between Colombia and country j	March 30, 2019	CEPII	+
$COMLANG_{Colj}$	Colombia and country j share a common legal language that is spoken by at least 9% of the population of both countries	March 30, 2019	CEPII	+
$COLONY_{Colj}$	Colombia and country j ever in colonial relationship	March 30, 2019	CEPII	+
$LogGDP_j$	Log GDP of Colombia's partner in constant USD	July 1, 2019	World Bank	+
WTO_j	Colombia's partner is a member of the WTO	March 30, 2019	CEPII	+
$OECD_j$	Colombia's partner is a member of the OECD	June 30, 2020	OECD	+
FTA_{Colj}	Colombia and country j with free trade agreement in force	May 8, 2019	WTO	+

Source: Own elaboration.

$$\begin{aligned}
X_{Coljt} = & \exp(\beta_0 + \beta_1 \text{LogDIST}_{Colj} + \beta_2 \text{CONTIG}_{Colj} + \beta_3 \text{COLONY}_{Colj} \\
& + \beta_4 \text{COMLANG}_{Colj} + \beta_5 \text{LogGDP}_{jt} + \beta_6 \text{WTO}_{jt} \\
& + \beta_7 \text{OECD}_{jt} + \beta_8 \text{FTA}_{Coljt} + \delta_t + \alpha_j) n_{Coljt} .
\end{aligned} \tag{1}$$

The remaining econometric specifications also include time fixed effects captured by α_t , time-invariant country fixed effects in origin captured by α_j and an identical set of explanatory variables. In these models, the dependant variable varies from total imports from Colombia's partners in model (4), to fuel imports from Colombia's partners in model (5) and non-fuel imports from Colombia's partners in model (6). These models are summarized as.

$$\begin{aligned}
X_{jColt} = & \exp(\beta_0 + \beta_1 \text{LogDIST}_{jCol} + \beta_2 \text{CONTIG}_{jCol} + \beta_3 \text{COLONY}_{jCol} \\
& + \beta_4 \text{COMLANG}_{jCol} + \beta_5 \text{LogGDP}_{jt} + \beta_6 \text{WTO}_{jt} \\
& + \beta_7 \text{OECD}_{jt} + \beta_8 \text{FTA}_{jColt} + \delta_t + \alpha_j) n_{jColt} .
\end{aligned} \tag{2}$$

Additionally, the latest studies have proposed estimating gravity models in multiplicative form instead of the usual log-linear estimation. Santos Silva and Tenreyro (2006) recommend Poisson pseudo maximum likelihood as a more suitable estimator in gravity models. They claim that this estimator is robust to different patterns of heteroskedasticity, providing a natural way to deal with zero values of the dependent variable when there are many elements and offer identical weight to the observations. In this regard, they noted that although there are pairs of countries that do not trade in some years (zero values), their inclusion in the gravity equation in its multiplicative form (PPML) does not pose problems. On the contrary, the inclusion of zero values strengthens the estimation and, therefore, the results of the study. Frankel (1997) described the different ways to deal with zero values in gravity models when a log-linear method is used in the estimations, but all of these procedures lead to inconsistent parameters of interest. Additionally, estimating with PPML instead of ordinary least squares (OLS) has an effect on the size of the coefficients. They state that the PPML estimator produces smaller and more suitable results in variables such as distance, colony, contiguity, and trade agreements among others than those provided by the OLS estimator. The authors also state that the PPML approach does not provide evidence of incorrect specification or puzzling results generated by the other approaches, which allows them to claim that the empirical methods conventionally used to estimate gravity equations are inappropriate. Considering all these facts, Fally (2015) affirms that more trust should be placed in those gravity model estimates that implement the PPML method. Gopinath et al. (2014) state that the differences in the coefficient are due to the existence of a nonlinear effect in the distance and, therefore, OLS estimates a more substantial trade for large economies and reduced trade for small economies. Moreover, Fally (2015) states that the PPML estimator leads to a perfect fit between the fixed effects and their MRT. Regarding MRT, Anderson and van Wincoop (2003) state that the traditional trade gravity model is incorrectly specified because this does not take into account MRT, which can be solved with the inclusion of exporter and importer fixed effects. However, it is important to note that, in some very specific and rare circumstances, the estimation results can be improved using country-pair effects (WTO, 2012). Given this, the models proposed in this study are estimated with the PPML approach, exporter or importer time-invariant fixed effects (depending on the model) to account for MRT and time fixed effects because the panel covers many years.

5 | RESULTS

Table 2 presents the results of the six proposed models based on the data described in Section 4. The models that estimate Colombia's exports to the world reflect some interesting results. In line with the theoretical and empirical approach, the distance factor harms exports. Likewise, according to the trade gravity model theory, the GDP of Colombia's partners has a substantial effect on Colombia's exports in each model. Additionally, control variables such as contiguity, common language, and colony are statistically significant only for the non-fuel model, except for the latter variable, which is also significant in the fuel estimate. Furthermore, if a Colombian partner is a member of the WTO, Colombia's non-fuel exports will increase considerably. Conversely, the variable corresponding to whether a Colombian partner is part of the OECD is insignificant in every model. Finally, regarding total exports, the coefficient reveals that when Colombia has an FTA with its partners, its total exports decrease by 28.2%. In the same vein, when Colombia has an FTA with its partners, its fuel exports decrease by 67.7%. However, if Colombia has an FTA with its partners, its non-fuel exports grow by 45.2%.

Turning to the models that estimate Colombia's imports from the world, some differences are observed concerning the previous specifications. The distance variable is significant only in the fuel imports model, and its effect is large and negative on these flows. Additionally, in each of the specifications, a directly proportional effect of the GDP values of Colombia's partners on its imports is observed. Concerning the control variables, the contiguity factor negatively and significantly affects fuel imports. Colonial ties are insignificant in these models. Furthermore, if a Colombian partner is a member of the WTO, total and non-fuel Colombian imports from such a partner will increase considerably. Moreover, if a Colombian partner is a member of the OECD, total and non-fuel Colombian imports from such a partner will be reduced. Additionally, the effect of an FTA between the parties on the models is positive, although its magnitude differs in each model. In particular, its effect on total imports will expand their flows to Colombia by 62.6%, by 101.2% for fuel imports, and by 61.6% for non-fuel imports.

Furthermore, related to the remarkable effect of the FTA factor on non-fuel exports and non-fuel imports, we performed a hypothesis test on means. Regarding the bilateral trade in non-fuel goods, the test result confirms that the difference between the two parameters is significantly different from zero. The test also confirms that the effect of the FTA on non-fuel imports is higher than on non-fuel exports with a significance level of 1%. This information allows us to infer that although the FTA has a significant influence on Colombia's non-fuel trade flows, the effect is greater in the case of these imports, which is in line with the regression values. The hypothesis test on means was also performed for total exports and total imports. The test result confirms that the difference between the two parameters is also significantly different from zero. The result also confirms that the positive effect of the FTA parameter on total imports is higher than the negative effect of this parameter on total exports with a significance level of 1%. Both test results suggest a deepening of Colombia's trade deficit and, therefore, an eventual impact on its economic growth.

Accordingly, the models are robust and fit well enough to use the predicted trade volumes of this model as a benchmark for discussing the potential trade of Colombia with its partners, and *vice versa*, through the trade potential index. According to Egger (2002), the TPI is calculated using the residual values of the estimated gravity equation. Hence, the TPI ratio is obtained by calculating the difference between the observed and the predicted values.

De Benedictis and Vicarelli (2005) calculate the TPI as

TABLE 2 Estimation results

Variables	Exports			Imports		
	Total (1)	Fuels (2)	Non-fuels (3)	Total (4)	Fuels (5)	Non-fuels (6)
<i>LogDIST_{C_{oilj}}</i>	-1.450 (0.314)***	-1.856 (0.403)***	-0.956 (0.147)***	-0.212 (0.372)	-4.088 (1.052)***	0.002 (0.319)
<i>CONTIG_{C_{oilj}}</i>	0.094 (0.446)	-0.689 (0.760)	0.840 (0.255)***	0.249 (0.540)	-4.012 (1.804)**	0.549 (0.488)
<i>COMLANG_{C_{oilj}}</i>	0.385 (0.426)	0.047 (0.578)	0.803 (0.226)***	0.763 (0.473)	-1.062 (1.420)	0.879 (0.455)*
<i>COLONY_{C_{oilj}}</i>	0.583 (0.370)	1.262 (0.552)**	-0.459 (0.194)**	-0.465 (0.486)	0.751 (1.290)	-0.514 (0.483)
<i>LogGDP_j</i>	0.813 (0.097)***	0.920 (0.152)***	0.721 (0.058)***	0.997 (0.112)***	1.470 (0.250)***	0.976 (0.117)***
<i>WTO_j</i>	-0.465 (0.667)	-0.931 (0.683)	0.884 (0.393)**	1.874 (0.455)***	-1.823 (1.386)	2.286 (0.469)***
<i>OECD_j</i>	0.235 (0.555)	0.349 (0.790)	0.237 (0.331)	-0.820 (0.446)*	-0.279 (1.064)	-0.777 (0.455)*
<i>FTA_{C_{oilj}}</i>	-0.331 (0.180)*	-1.131 (0.362)***	0.373 (0.118)***	0.486 (0.160)***	0.699 (0.301)**	0.477 (0.182)***
<i>Constant</i>	10.236 (3.232)***	11.068 (3.861)***	5.787 (1.720)***	-7.313 (3.344)**	13.711 (3.020)***	-9.191 (3.065)***
Observations	1,870	1,870	1,870	1,870	1,870	1,870
R ²	0.846	0.752	0.909	0.894	0.911	0.884
Countries	136	136	136	136	136	136
Time-invariant country fixed effects	✓	✓	✓	✓	✓	✓
Time fixed effects	✓	✓	✓	✓	✓	✓

Notes: Robust standard errors, based on robust standard errors that have been adjusted for clustering by country pair, in parentheses.

p* < .1; *p* < .05; ****p* < .01.

$$TPI_t = \frac{\hat{X}_{ijt}}{X_{ijt}},$$

where X_{ijt} is the observed value of exports from country i to country j , and \hat{X}_{ijt} is the estimated value of exports generated by the gravity model. Then the TPI is standardized so that it takes values between -1 and 1 :

$$TPI_i = \frac{TPI_{t-1}}{TPI_{t+1}}.$$

Positive values of TPI between 0 and 1 show an under-trading situation, while negative values between -1 and 0 show an over-trading situation.

In this study, TPI is calculated for 2005 and 2018, taking into consideration that Colombia's trade integration process intensified from 2005 and that 2018 is the most recent year of available data. Colombia's TPI with its main partners is computed for every model proposed and is presented in Table 3. Model (1) reflects that, in terms of total exports, Colombia has an over-trading situation with the majority of its main partners (Chile, China, Ecuador, Panama, and Turkey), a situation that deepened by 2018. Likewise, its under-trading situation is decreasing with some of its partners (Brazil and Spain). This situation suggests that Colombia's exports to these countries have grown more than the estimate by the model according to the proposed specification, reflecting the intensification of Colombia's exports with these countries (see Figure 1). Conversely, Colombia's TPI level with the USA has increased during the same period. This is explained by the contraction of Colombia's exports after the entry into force of their FTA (see Figure 1). On the other hand, model (2) shows that, in terms of fuel exports, Colombia has notably reduced its TPI with most of its partners (Brazil, Chile, China, Panama, Spain, and Turkey). Nonetheless, Colombia's TPI has experienced an expansion with countries such as Ecuador, Mexico and the USA. Concerning Ecuador, this is explained by the fact that Colombia's fuel exports to Ecuador have remained relatively stable in the last period. In the case of the USA, fuel products exported to this destination have been partially replaced by non-fuel exports. Regarding Mexico, Colombian fuel exports to this destination have grown, although their growth rate has been lower compared to the advance of non-fuel exports. Furthermore, model (3) shows that, in terms of non-fuel exports, Colombia has seen a reduction of its TPI with its partners (Brazil, China, Ecuador, Mexico,

TABLE 3 Colombia's TPI with its main partners

Country	Total		Fuels		Non-fuels	
	2005	2018	2005	2018	2005	2018
Brazil	0.70	0.14	0.78	-0.75	0.66	0.02
Chile	-0.29	-0.45	-0.22	-0.63	-0.36	-0.27
China	-0.07	-0.59	NA	-0.57	-0.32	-0.34
Ecuador	-0.49	-0.17	-0.74	0.10	-0.22	-0.27
Mexico	0.16	0.16	0.06	0.16	0.31	0.10
Panama	0.22	-0.28	0.22	-0.48	0.20	0.27
Spain	0.38	0.05	0.65	0.01	-0.10	0.01
Turkey	-0.04	-0.64	-0.48	-0.66	0.80	0.65
USA	-0.08	0.09	-0.11	0.10	-0.10	0.07

Source: Authors' own calculations based on TPI estimates.

TABLE 4 Main Colombian partners' TPI with Colombia

Country	Total		Fuels		Non-fuels	
	2005	2018	2005	2018	2005	2018
Brazil	-0.09	-0.18	-0.26	-0.60	-0.05	-0.15
China	-0.08	-0.32	-0.74	-0.11	-0.06	-0.32
France	0.11	0.01	-0.68	0.35	0.13	-0.02
Germany	-0.12	-0.15	0.68	0.76	-0.13	-0.19
India	0.30	0.10	0.82	-0.29	0.33	0.11
Japan	0.16	0.04	-0.72	0.76	0.20	0.06
Mexico	-0.37	-0.48	0.91	-0.27	-0.44	-0.50
Spain	0.03	-0.07	0.84	0.47	0.05	-0.07
USA	0.06	0.16	0.29	-0.04	0.03	0.20

Source: Authors' own calculations based on TPI estimates.

Spain, and Turkey), some of which already reflected an over-trading situation. This is due to the notable growth of its non-fuel exports to these countries and the subsequent reduction of its export potential. However, Colombia's TPI with countries such as Chile (to which Colombia has increased its non-fuel exports and has reduced its fuel exports), Panama (where the largest proportion of Colombia's exports are fuels), and the USA (where non-fuel exports have gained in importance relative to fuel exports) reflect an expansion in Colombia's TPI in the period analyzed.

The TPI for Colombia's main partners is computed for every model proposed and is presented in Table 4. Model (4) shows that, in terms of Colombia's total imports, every partner has reduced their TPI level with the nation, except for the USA, although the latter's exports to Colombia are growing at a remarkable rate (see Figure 2). The evolution of Colombia's partners' TPI reflects that openness has boosted Colombian imports above the model's predictions. Additionally, model (5) shows that, in terms of Colombian fuel imports, the TPI level of Colombia's partners with Colombia is quite variable. Nonetheless, it is essential to state that of the partners presented, only the USA and Mexico export fuels to Colombia. In both cases, a noteworthy reduction of their TPI level with Colombia can be seen, although the USA experienced an increase in its fuel exports to Colombia in each period and Mexico presents a small decline in the last period (see Figure 2). Furthermore, model (6) reveals that, in terms of Colombia's non-fuel imports, the TPI performance of its partners was similar to that observed in model (4). This trend shows that openness has boosted Colombia's non-fuel imports above the model's predictions.

In summary, the data obtained allow us to infer that, in general, Colombia's TPI with its partners and Colombia's partners' TPI with Colombia reflect a trend towards the intensification of the over-trading situation or towards achievement of this status. The evolution of Colombia's trade flows (exports and imports) reflects a clear trend towards over-trading in the period studied. However, there is higher growth in its import flows than in its export flows. Considering this, the consolidation of that trend over time would lead the country to suffer an intense exchange rate crisis due to a deepening of the national trade deficit. Additionally, if we complement this trend with the expected depletion of fuel products in the short term (Presidencia de la República de Colombia, 2020), the economic problems generated by the probable exchange rate crisis would be harmful to the Colombian economy.

6 | DISCUSSION

The proposed trade gravity model approach shows the influence of Colombia's trade integration processes on its bilateral trade, primarily through the signing of FTAs. Remarkably, most of the parameter values are consistent with similar latest studies (Baier et al., 2019; Egger et al., 2011; Fally, 2015; Melitz & Toubal, 2019; Santos Silva & Tenreyro, 2006).

Firstly, we want to highlight that the distance coefficient is not as large as in other studies (Santos Silva & Tenreyro, 2006). This is explained by the fact that we estimate the models through the PPML approach. However, the impact of the distance on bilateral trade is still high and adverse in the majority of the models. Despite all the improvements in transport, freight packaging, insurance and the like, the distance variable continues to be one of the critical factors that explain the volume of bilateral trade.

Regarding models that estimate Colombia's exports, it is appreciated that its trade openness has promoted the achievement of some objectives, for instance, the partial substitution of fuel exports by non-fuel exports. This encouraging effect is exhibited in Colombia's non-fuel export performance, where substantial growth is observed. Similarly, there is a notable influence on Colombia's non-fuel exports if a destination country is a member of the WTO. Additionally, the effect of the FTA variable on total and fuel exports is adverse, and this effect is more prominent in fuel than in total exports. The opposite effect of the FTA variable on Colombia's exports is contrary to that found by similar studies (Ahcar, 2018; Cárdenas & García, 2005; Serrano et al., 2015). Nonetheless, it is relevant to note that these studies were conducted in years prior to ours, which could explain the differences between our studies in the effects identified by the FTAs. The findings show that, on the one hand, Colombia's trade openness has helped promote non-fuel exports and, on the other hand, the amount of fuel exports has decreased with some partners. Nevertheless, due to the high dependence on fuel exports, the Colombian government should create an effective policy to promote non-fuel exports due to the reduced reserves of fuel-related products in the following years (Presidencia de la República de Colombia, 2020). Therefore, if Colombian policy-makers fail to replace fuel exports, the deepening of the trade balance deficit will damage the local currency to such a level that the Colombian peso may experience an unprecedented devaluation, affecting the entire economy.

Turning to the models that estimate Colombian imports, trade openness has helped to promote Colombian imports substantially. This is especially evident in the specifications for total and non-fuel imports. Notably, models for total and non-fuel imports reveal that distance is insignificant in these flows. This suggests that transportation costs do not restrict them, which explains why countries such as China and India are large suppliers of the country. In contrast, the model for fuel imports reflects that distance is a factor that profoundly and negatively affects fuel exports to Colombia. This explains that most of these imports come from nearby markets. However, having a common border with Colombia restricts its fuel exports. The situation implies that these exports are made by nearby countries with which a common border is not shared, such as the USA and Mexico (see Figure 2). Concerning the FTA factor in Colombian imports, its positive effect can be seen in every model with a predominance on non-fuel imports. Likewise, it is essential to highlight that if the Colombian partners belong to the WTO, their total exports and their non-fuel exports to Colombia tend to grow significantly. Nonetheless, if the Colombian partners belong to the OECD, their exports of the same type of products to Colombia will be negatively affected, the opposite result to that expected.

In accordance with the present results, we can affirm that there is a clear trend towards a deepening of Colombia's trade balance not only in the present day but also in the future.

These results are contrary to those found by Quansah and Ahn (2017), who in their study of sectoral trade found that the signing of the bilateral trade agreement between Korea and Australia helped to balance their bilateral trade. The deficit situation is reflected in the notable difference between the values of the FTA parameters generated for exports and imports. The results of the hypothesis test on means performed for total exports and non-fuel exports also confirm this tendency. These results suggest a greater positive influence of the FTA variable on imports than on exports for the referred models, which confirms the trend towards a deepening of the Colombian trade deficit. In this regard, it would be interesting to inquire into the degree of complementarity between Colombia and its trading partners, taking into account the results obtained in this respect by Vahalík (2014). Additionally, this trade deficit tendency is also easily perceived through the evolution of Colombian bilateral trade in recent years, confirming once again the expansion of Colombia's trade deficit and the very likely damage to its economy in the long term.

Regarding Colombia's TPI with its partners, the proposed models reveal a general trend towards an over-trading situation with most of its partners, although its performance varies in relation to the model analyzed. The results of Colombia's TPI allow us to identify a defined pattern with some of its strategic partners in every model proposed. For instance, Colombia's TPI with the USA reveals a trend towards an expansion of its under-trading situation, and this is evidenced in the notable decline in Colombian exports to the USA. Moreover, Colombia's TPI with China reflects a remarkable trend towards the intensification of its over-trading situation, which is reflected in a notable increase in its exports to this country. Likewise, there is a significant trend towards an over-trading situation with countries such as Brazil, Chile and Turkey. However, if the analysis focuses on the type of products, it is observed that there is a general trend towards an over-trading situation in fuel exports, unlike non-fuel exports, where there is no defined general trend. These deductions allow us to affirm that although Colombia's liberalization has had a positive impact on non-fuel exports, which is reflected in a general trend towards an over-trading situation, the evolution of total exports has been affected mainly by the reduction of fuel exports to the USA, and this reduction has not been balanced by the growth in non-fuel exports.

Turning to the TPI of Colombia's partners with Colombia, the models reflect an evident tendency towards a situation of over-trading (imports) greater than that reflected for the Colombian TPI with its partners (exports). This trend is mainly reflected in the models of total and non-fuel imports since fuel imports are relatively low and come principally from Mexico and the USA. However, a strategic supplier to Colombia such as the USA shows a trend towards an under-trading situation in the total and non-fuel imports models and a trend towards an over-trading situation in the fuel imports model, which is evidenced in a considerable increase in Colombia's imports from this country (see Figure 2). Conversely, the other Colombian supplier countries analyzed reflect a clear trend towards an over-trade situation in total and non-fuel imports (see Table 4), a tendency that is reflected in the strengthening of Colombian imports (see Figure 2). This scenario allows us to sustain that the Colombian openness has been successful for Colombia's partners due to the manifest tendency towards the over-trading situation reflected by most of the TPIs of its partners. This is also confirmed through the notable increase in Colombia's imports from each of its analyzed partners.

These findings suggest that the impact of Colombian trade liberalization carried out mainly through the signing of the FTA has deepened its trade deficit. Regarding this, as noted by Thirlwall (1979) in the balance of payments constrained growth theory, international trade can drive long-term growth through the interaction between trade and growth. Therefore, long-term growth will occur if national products are more attractive to foreigners and if foreign products are

less attractive to nationals; or through increased global growth (Setterfield, 2011). Consequently, our findings indicate a breach of what was indicated by Thirlwall since the objective of balancing Colombia's trade deficit, and eventually reaching a trade surplus through trade openness, has not been achieved, which calls into question Colombia's future economic growth under these circumstances. In the same vein, it is essential to remark that the expected increase in bilateral trade between Colombia and its main partners through the signing of FTAs, and the consequent liberalization of trade between the parties, was not as expected, at least for Colombia's exports. Finally, our findings on the FTA factor contrast with the results obtained in other studies, where a positive value of the FTA parameter is predominant (Anderson & Yotov, 2016; Baier & Bergstrand, 2009; Egger et al., 2011; Santos Silva & Tenreyro, 2006).

7 | CONCLUDING REMARKS

In this paper, we present the results of a gravity model approach applied to evaluate the trade performance by type of products between Colombia and its principal partners from 2005 to 2018. The study yields insights into the trade effects created by Colombia's trade openness and the TPI is implemented to assess its influence.

Although, as mentioned, the global effect of the FTA on Colombia's total exports to its partners is adverse, the analysis of its effect by type of goods yields two different outcomes. On the one hand, It is observed that an FTA in force between Colombia and its partners reduces the fuel exports of the former, and these tend to be partially replaced, although to a lesser extent, by non-fuel exports. This effect is in line with one of the purposes of Colombian trade policy: the substitution of fuel exports for non-fuel exports, which has been promoted through numerous government programs to boost exports of non-fuel goods (Procolombia, 2020). It should be noted that this purpose of Colombian trade policy is strategic to support greater diversification of the country's exports, since a recent report (Presidencia de la República de Colombia, 2020), stated that proven oil reserves were claimed to amount to 2,036 million barrels in 2019, which means that the oil reserves would be depleted within 6.3 years. Furthermore, concerning non-fuel exports, a noticeable positive influence is observed in their promotion if Colombian partners are members of the WTO. The effect of being a member of the WTO on Colombian exports is greater than that generated by the signing of bilateral or regional trade agreements framed in the FTA variable.

On the other hand, Colombia's imports from its partners have been promoted by the signing of FTAs with Colombia. Unlike Colombian exports, the encouraging effect of an FTA on Colombian imports prevails in each estimate. Additionally, the effect of being a member of the WTO for non-fuel imports is prominent. Moreover, if we compare the values of the FTA parameter and its influence on Colombian exports and imports, particularly of total goods and non-fuel goods through the results of the hypothesis test on means, a clear trend towards a deepening of the Colombian trade deficit is expected.

Additionally, the reduction of Colombia's TPI with its main partners, reflected in the proposed specifications, shows that the country should diversify its export destinations. Subsequently, the country should analyze the viability of deepening its trade integration with countries with which there is no traditional integration process, through integration mechanisms other than FTAs. Likewise, the possibility of deepening the agreements already established with some of its partners through the signing of new agreements could be studied, as is the case of the Pacific Alliance agreement. This policy has boosted Colombia's exports to the member countries of the alliance, with which Colombia previously had a trade agreement. Furthermore, although the evolution

of Colombia's TPI with its main partners shows a trend towards an over-trading situation, this is not reflected in the expected increase in national exports. On the contrary, the same trend reflected in the TPI of the Colombian partners with Colombia is established in a higher relative increase in Colombia's imports from its main partners. These facts reveal that the Colombian trade liberalization process has intensified the deficit in its trade balance. According to Dirección Administrativa Nacional de Estadística (2019a), Colombia's trade balance with most of these countries has become a deficit during the last period proposed (2015–2018). Consequently, these deductions question the Colombian trade liberalization policy focused on the signing of new trade agreements as an effective measure to increase its exports, and therefore reduce its trade deficit.

Furthermore, as noted, Colombia's trade pattern is mainly dependent on fuel goods, which means trading goods with little or no added value, and their prices and consumption depend on exogenous factors. In this regard, it is observed that the signing of trade agreements has partially supported the substitution of fuel exports for non-fuel exports, although the amount of this substitution has not offset the fall in fuel exports. Therefore, greater efforts are needed to ensure a proper conversion of Colombia's trade pattern. This challenge must be complemented by effective trade policies that promote the competitiveness of Colombian companies in global scenarios. For instance, although Colombia has seen its trade potential with its main partners reduced, its TPI with some countries is superior to others. Consequently, the Colombian government should create public policies that guide companies to trade with more suitable country destinations to take advantage of its TPI situation.

Finally, although our econometric approach contradicts the effect of other studies on the positive influence of signing FTAs on countries' exports (as is the case of its negative effect on Colombia's total and fuel exports), this positive effect of the FTA variable is reached only in Colombian non-fuel exports. Similarly, this positive effect is achieved by Colombian imports, regardless of the type of goods. Likewise, our findings reflect that the expected effect of boosting Colombia's exports through trade openness, and consequently reducing its trade deficit, has not been achieved; on the contrary, the deficit shows a tendency to expand. Hence, this information can be used to develop public interventions aimed at boosting Colombia's trade beyond the development of a trade policy focused on the signing of new trade agreements. These policies should be aimed at strengthening a more competitive national production, which promotes its exports and discourages its imports, to balance its trade deficit and promote its long-term growth (Thirlwall, 1979). Finally, future research should be focused on determining the reasons why this expected positive effect has not been adequately achieved in Colombia's trade liberalization process, evidenced in the structural and ascendant deficit of Colombia's trade balance.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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ENDNOTES

- ¹ Fuel goods: products from code 321.1 to code 351.0, according to the Standard International Trade Classification (SITC 3; World Integrated Trade Solution, 2020).
- ² It is important to note that although WTO rounds have reduced trade barriers among nations, they took longer to institutionalize it than through bilateral or regional agreements (Lim & Breuer, 2019).
- ³ Products other than those classified as fuels.

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3.2. The role of institutional quality in the international trade of a Latin American country: evidence from Colombian export performance. (Scopus Q1).

RESEARCH

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The role of institutional quality in the international trade of a Latin American country: evidence from Colombian export performance

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Abstract

This paper analyses the relevance of Colombian institutional quality in recent years in terms of the performance of its exports within a framework of trade openness. Based on the trade gravity model, we examine the effect of governance on the evolution of Colombian exports through an econometric approach that identifies, on the one hand, the influence of institutional quality, and on the other hand, the influence of the institutional distance between Colombia and its trading partners. We use a panel data set for 2005–2018, through which the export flows from Colombia to 136 of its trading partners are considered. The findings indicate that Colombian institutional quality and the institutional distance between the country and its partners are statistically significant and affect its foreign sales. Similarly, there is a prominent influence of regulatory quality and the rule of law variables in the performance of Colombian exports in relation to other variables included in the model. We conclude that the Colombian government must improve its institutional quality considerably as a fundamental step towards boosting its overseas sales, not least because the country's institutional distance from the world average is notable, which also affects its exports.

Keywords: Institutional quality, Free trade agreements, Trade, Exports, Trade balance, Trade gravity model

1 Introduction

In recent years, relevant research has explored the effect of institutional variables, which have received a great deal of attention (Anderson and Marcouiller 2002; Dollar and Kraay 2004; Levchenko 2007; Egger et al. 2011; Egger and Nigai 2015; Álvarez et al. 2018), and it is widely understood that higher institutional quality and a better atmosphere of governance reduce business costs and promote an efficient business environment, which can improve bilateral trade flow between nations (Wu et al. 2012).

Colombia, as one of the countries experiencing one of the highest economic growth rates in Latin America over the past decades, has developed a dynamic policy of trade openness in order to promote its economic development through the promotion of its



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exports. Nonetheless, although the trade openness policy has been defined by different studies as a successful policy to improve bilateral trade, this has been widely questioned in Colombia. The nation's trade balance, which has historically been in deficit, has deepened further in recent years, presenting one of the largest imbalances in Latin America after only Mexico and Argentina (ECLAC 2020). Based on this negative trend established within a context of complex socioeconomic factors, such as high rates of informality, greater concentration of wealth, controversial electoral processes, drug trafficking and internal armed conflict, among others related to governance, this study attempts to evaluate the effect of Colombian institutional quality on its export trade flows. The results will allow us to simultaneously infer the extent to which the quality of Colombian governance affects its exports, and to present the findings of a study that could be replicated in similar Latin American countries. Consequently, the findings of the study will allow us to offer some policy suggestions to address overcoming the deficiencies related to governance in Colombia.

This paper contributes to previous research into the influence of governance on international trade, with a focus on emerging economies that have followed the path of trade liberalisation promoted by developed economies. This study is the first to address the effect of institutional quality on exports from a country like Colombia, which has been deeply affected by a long internal armed conflict that has affected the numerous efforts made by national authorities over recent decades to improve their governance indices. We apply the trade gravity model to a cross-sectional dataset of bilateral exports between Colombia and 136 countries from 2005 to 2018, before we then use a group of institutional quality indices elaborated by the World Bank (WB) to test the influence on Colombian exports, firstly, from the institutions, and, secondly, from the institutional distance between Colombia and its trading partners. Furthermore, we include variables based on the new trade theory framework to assess the endogenous characteristics of the exporting country and the effect of them on trade flows. Finally, the econometric model is estimated by the Poisson pseudo-maximum likelihood (PPML) approach (Silva and Teneyro 2006), which is the most suitable econometric procedure in the presence of a large number of zeros, potential endogeneity, and econometric drawbacks.

This paper is organised as follows. The first part describes the influence of institutions on international trade, as well as the performance of Colombian exports and the country's institutional quality over recent decades. The second part of this paper will present the methodological approach, specification, and research data. Finally, it will offer its findings, focussing on the discussion and central conclusions.

2 Influence of institutions on international trade

The role of institutions in society has been widely analysed by leading authors. For Schmoller (1900), institutions are habits, rules of morality, customs and laws that, when related to each other, establish a system. Commons (1934) defines institutions as collective acts that control individual acts, suggesting that society is made up of individual institutions such as the state, the family, the corporation, and the commercial association among others. Moreover, Hayek (1967) proposes that institutions are rules that conduct society, which can be divided into two classes. The first class is called "organisation" and involves simple rules which do not evolve, have defined

objectives, and have been deliberately created. The second class is “spontaneous rules”: complex rules with no defined objectives which are constantly evolving and have been created in an unplanned or unconscious way. Furthermore, North (1990) divides institutions into formal constraints (such as rules, laws, and constitutions) and informal constraints (such as standards of behaviour, conventions, and self-imposed codes of conduct), claiming that formal institutions can change rapidly while informal rules cannot. In particular, the influence of institutions on the economy has been addressed by authors such as Acemoglu et al. (2005), who place institutions as key to economic success, dividing them into extractive and inclusive categories. Moreover, they claim that extractive institutions favour the elites and restrict long-term growth while inclusive institutions are linked to political democracy and promote economic growth. Finally, Chavance (2008) supports the relationship between institutional quality and economic growth, establishing that good institutions are based on economic freedom, rule of law, private property, flexible labour markets, clearly delineated property rights, and shareholder-oriented corporate governance.

Furthermore, the effects of higher institutional quality on international trade have been highlighted by trade literature over the last decades, supporting the idea that better institutions and governments will increase international trade flow (Bilgin et al. 2018). This hypothesis is strongly supported by Anderson and Marcouiller (2002), who argue that bilateral trade is positively affected by the quality of the institutions involved. In the same vein, Álvarez et al. (2018) state that institutional quality increases bilateral trade and this effect increases over time. Furthermore, Linders et al. (2005) conclude that the quality levels of institutions in both the exporting and importing countries increase the volume of trade between them. Likewise, Li and Samsell (2009) find that countries with a reputation for strong governance have a higher trade volume than those without. This view is supported by Jalilian et al. (2007), who point out that institutional development reduces information imperfections, increases economic incentives, and reduces transaction costs. Similarly, Chowdhury and Audretsch (2014) state that higher institutional quality and good governance reduce trade costs and the risks of defaulting while Yu et al. (2015) go further, claiming that better institutions, both formal and informal, ease trade. These statements have been proven by researchers who found that the level of institutional quality has a statistically significant positive influence on trade (de Groot et al. 2005). The evidence reviewed indicates a positive and relevant connection between institutions and trade.

The significance of the connection between institutions and trade is reflected in existing research that affirms how weak institutions can restrict international trade with a negative effect similar to that of tariffs (Álvarez et al. 2018; Anderson and Marcouiller 2002). Moreover, poor institutional quality can obstruct trade and lead to poor performance in manufactured exports (Méon and Sekkat 2004). Francois and Manchin (2013) affirm that the influence of institutions on trade is most notable in low-income countries. This statement suggests that carrying out public reforms to improve institutional quality should be a critical factor in government policy in order to obtain greater bilateral exchanges, particularly in developing nations. However, Kaufmann et al. (2011) find crucial differences between the achievements in institutional quality within developed

and emerging economies, with the former demonstrating more improvements in governance.

The remarkable role of institutional quality in promoting trade, based as it is on strong and reliable institutions in both exporting and importing countries, is also explained by the similarity in the quality of their institutions. In this regard, Kostova (1997) introduces the concept of institutional distance, defined as the difference between the institutional profiles in the original and host countries. Since this idea was introduced, institutional distance has gained importance in international trade studies (Beugelsdijk et al. 2018). Some researchers who have analysed the difference in institutional quality between nations have found that most bilateral trade takes place between economies with high standards of institutional quality, in particular when the difference between their indicators is small (Álvarez et al. 2018). The importance of the similarity in institutional quality is also supported by de Groot et al. (2005), who state that countries with similar quality of governance trade more with each other, showing that higher differences in quality of governance between exporting and importing countries limit bilateral trade flow. However, there are concerns regarding the rigour during the construction of the indicator and the subsequent comparability of its results with similar research (Bae and Salomon 2010). Nonetheless, Kostova et al. (2019) point out that the richness of the institutional perspective provides several opportunities to analyse its cross-border influence on numerous strategic and organisational outcomes.

Furthermore, there is a growing body of research that recognises the importance of individual institutional variables in the economic success of nations. One of the most critical of these variables is the rule of law. As noted by Gani and Scrimgeour (2016), the rule of law is based on the interaction between citizens and institutions, and the strength of the law can be essential in promoting investment and boosting economic performance. This variable is considered so noteworthy that some studies measure the institutional quality of nations directly through it (Dollar and Kraay 2004). Its importance is also reinforced by Zeynalov (2017), who claims that the rule of law is one of the critical factors for improving bilateral trade amongst nations. Likewise, Álvarez et al. (2018) identify in their empirical research that the rule of law demonstrates one of the strongest connections with trade volumes. Finally, Gani and Scrimgeour (2016) point out that the defence of the rule of law, effective enforcement of business and trade agreements, absence of bureaucracy, an improved regulatory atmosphere, and the freedom of citizens to exercise their political and civil rights are vital aspects to promoting trade.

The risk of default or risk of no-payment generates uncertainty in trade integration, and this risk is defined through contract enforcement mechanisms. In the 1960s, Olson (1996) addressed the issue and claimed that undeveloped and inefficient institutions, such as weak enforcement mechanisms, could limit productive cooperation and thereby affect trade. Similarly, Ranjan and Lee (2007) demonstrate that imperfections in the enforcement of contracts can reduce the volume of trade in both differentiated and homogeneous goods. Nunn (2007) goes further regarding the significance of this factor in bilateral trade, claiming that application of the contract has a greater effect on the international pattern of trade than the country's capital endowments and skilled labour combined. However, although conventional trade theory states that the endowments of a country, its level of technology and its competitiveness explain trade, Gani

and Scrimgeour (2016) claim that poor governance can create limitations to trade, making the vital role of good institutions in economic progress yet more evident.

Another major factor that directly affects bilateral trade flows is corruption. On this matter, Krueger (1974) points out that trade openness positively affects competitiveness and consequently reduces the effects of corruption whereas trade barriers create bureaucracy in business processes and, as a consequence, illegal benefits. Additionally, Anderson and Marcouiller (2002) state that corruption and weak legal enforcement of contracts increase the risks to trade with countries exhibiting such weaknesses harming trade flow. Similarly, Nunn (2007) finds that the quality level of democracy is positively linked to bilateral trade flow, and this view is supported by Yu (2010), who affirms that a higher level of democracy improves bilateral trade exchange. In their study of the Asia-Pacific region, Helble et al. (2009) analyse the influence of institutional transparency on trade, finding that greater transparency of the trade environment through greater predictability and simplification of procedures has a substantial impact on trade costs.

To determine the effects of institutional quality on bilateral trade, some authors have gone beyond the analysis of formal institutional factors. Li and Samsell (2009) claim that previous studies of institutional quality mainly consider formal institutions and disregard informal ones, such as the governance environment. According to Yu et al. (2015), trust can moderate the risk of default assumed by exporters in an environment of malfunction of formal institutions, and consequently improve economic results. This view is supported by Guiso et al. (2009), who claim that low levels of trust can negatively affect bilateral trade. Furthermore, institutional quality can indirectly affect bilateral trade due to the discouragement of foreign direct investment (FDI), taking into account that this factor is a determinant of international trade (Mauro 1995). This statement suggests that the expected positive effect on trade through the attraction of FDI would not be achieved with weak government institutions (Jude and Levieuge 2017). Finally, Demir and Hu (2016) also state that institutional differences can create an entry barrier for FDI, consequently hampering trade.

3 Colombian export performance and institutional quality

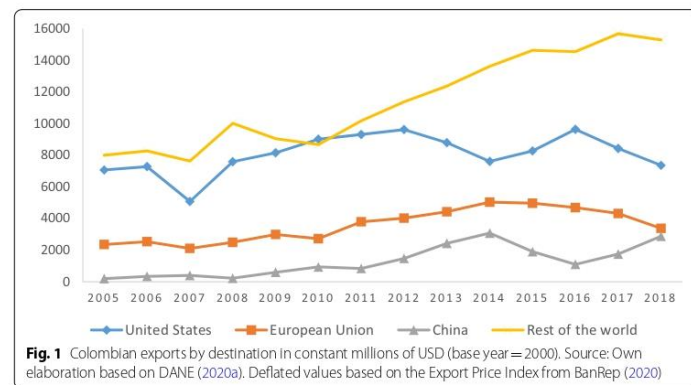
Since the early 1990s, following international trends, Colombia has developed a trade policy that promotes its integration with international markets, seeking a positive impact on its economic growth. To do this, former President César Gaviria Trujillo passed an unprecedented set of reforms in 1991 which aimed to encourage what he called an *Apertura Comercial* process. As noted by García et al. (2014), Gaviria's aim of opening up the economic system was to encourage a more productive and efficient national economy. However, to date, there is little agreement on the commercial success of this process due to the few, inefficient measures developed by different governments to support and promote the competitiveness and productivity of national companies in a constantly changing economic scenario. Additionally, it is important to mention that Colombia began to sign its most important bilateral trade agreements from 2009. As confirmation of this statement, Colombia strengthened its trade relations through FTAs with the European Free Trade Association (EFTA) in 2009, Canada in 2011, the United States (US) in 2012, the European Union (EU) in 2013 and, more recently, with the countries of the Pacific Alliance (PA) in 2015 and the Republic of Korea in 2016 (MinCIT

2019). In this sense, it is essential to clarify that the trade agreements most prominent in Colombia are those signed with the US and the EU, as these agreements represented more than half of Colombian trade between 2005 and 2018, despite the fact they have contributed to deepening the deficit in Colombia's trade balance in recent years (MinCIT 2018a).

Figure 1 shows the performance of Colombian exports by destination at constant prices (base year = 2000) from 2005 to 2018.

The information displayed in Fig. 1 can be analysed in different ways. On the one hand, it suggests that the US is the main destination of Colombian exports. The US hegemony as the leading destination of Colombian exports has reduced in recent years, especially after the FTA between the parties came into force. Similarly, Colombian exports to EU member states have experienced a notable reduction after the FTA between the parties came into effect. Moreover, China has emerged as one of the most prominent destinations for Colombian exports.

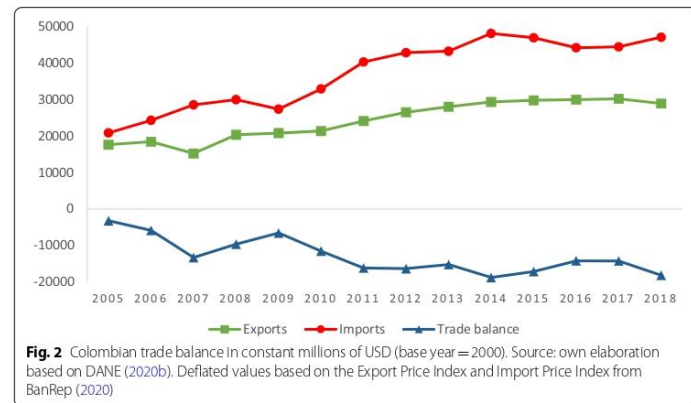
It is important to note that Colombian exports are mainly composed of oil and mining goods. According to MinCIT (2018b), this sector contributed 63.3% of national exports, growing by 17.5% in 2018 on 2017. More precisely, 59.1% of Colombia's total exports in 2018 were made up of oil and its derivatives, with that sector growing by 6.5% compared to 2017, reflecting its strategic importance for the economy. In this regard, Karabulut et al. (2020) examine the effect of economic uncertainty on international commodity trade, highlighting the negative effect of trade wars on the exchange of this type of goods, which represents a serious risk for Colombian commodity exports, given their relevance in the current scenario of economic uncertainty. Furthermore, as noted by Zeynalov (2017), volatility in international oil prices has harmed globalisation in oil-producing countries, which have generally used the revenues from this industry ineffectively. Moreover, Haddad et al. (2013) state that diversification of exports allows a country to manage the risk generated by the volatility transmitted by trade, thereby obtaining the benefits of openness. Colombia faces a significant challenge in this regard. A reduction of its high dependence on the oil industry in terms of exports, and an improvement of its



institutional quality might both drive the diversification of exports. Consequently, Moenius and Berkowitz (2011) claim that countries with lower institutional quality that carry out institutional reforms can experience advances in the diversity of their exports. In view of that, more substantial and appropriate efforts are required to ensure the diversification of Colombian exports and thus avoid an exchange crisis resulting from a very probable depreciation of the Colombian peso due to the expected reduction of its oil exports in the coming years (Presidencia de la Republica de Colombia 2020). Regarding this probable state of affairs, Bahmani-Oskooee et al. (2019) recognise the negative effect of the devaluation of the local currency on Kazakhstan’s exports, which, like Colombia, is an economy highly dependent on oil sales. Nonetheless, Bahmani-Oskooee et al. (2020), in their study on the effect of the exchange rate on sectoral trade between a developing country such as Pakistan and the US found that in a situation of rupee depreciation, the trade balances of some sectors may benefit (vegetables, fresh or dried; manufactured leather; and footwear, among others), which shows that the probable depreciation of the Colombian peso could also have a positive influence on certain sectors, if the Colombian economy and, eventually, its trade patterns, were adequately diversified. Therefore, it is essential to point out that, on the one hand, the Colombian authorities must focus their short-term economic policies on avoiding the depreciation of the Colombian peso and harming its exports, while on the other hand, they must focus their long-term policies on ensuring adequate diversification of their trade pattern in order to avoid significant damage to the economy. Similarly, and as stated by Gupta et al. (2019), Colombian policymakers should also offer incentives to exporters (e.g., insurance coverages, low-interest rate loans, tax incentives) to maintain international trade in times of economic uncertainty caused principally by geopolitical risks.

Figure 2 shows the Colombian trade balance performance at constant prices (base year = 2000) from 2005 to 2018.

Figure 2 reflects the performance of the Colombian balance of trade, which shows a clear deepening of its trade deficit. Although exports show a slight upward trend in the



period analysed, the upward trend of imports is much higher. This situation has generated an increase in the Colombian trade deficit. During the period analysed, deepened with greater intensity from 2009 and reaching its highest level in 2018. However, as mentioned above, the trade deficit has continued since 2005, intensifying after the signing of various FTAs by the Colombian government as a key policy for trade integration in global markets. Regarding imports, DANE (2019) states that the main suppliers exporting to Colombia are the US, China and the EU, respectively. It is important to note that China went from being a modest supplier of products to Colombia in 2005, to the second largest source of Colombian imports in 2018, partly to the detriment of imports from the US and the EU.

Furthermore, as noted by several studies, there is a strong relationship between export performance and the institutional quality of nations. Regarding Colombia, the effects of good governance on exports remains unclear. According to Franz (2019), Colombia accurately exemplifies the inadequacies of good governance in terms of institutions and economic development, suggesting that Colombian institutional quality is not a factor that encourages national exports.

In this regard, this study aims to determine the extent to which Colombian institutional quality influences its export performance. The institutional quality of the countries involved in the study are based on figures taken from the World Bank's Global Governance Indicators (WGI) prepared by Kaufmann et al. (2011) and is shown in Table 1.

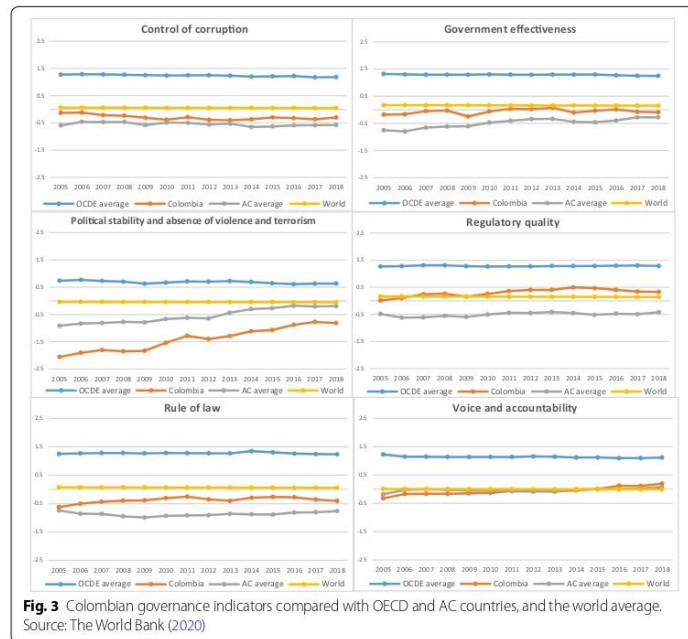
The six WGIs comprise broad dimensions of governance and allow us to determine the specific effects of each indicator on Colombian exports. Moreover, the WGIs are considered the most detailed and geographically complete set of institutional indices currently available (Álvarez et al. 2018).

Figure 3 illustrates Colombian governance indicators compared to the average among the Organisation for Economic Co-operation and Development (OECD) countries, the Andean Community (AC) countries and the whole world from 2005 to 2018.

Figure 3 illustrates the remarkable institutional distance across all the governance indicators between Colombia and the OECD countries between 2005 and 2018; however, the institutional distance is more noticeable in indicators such as control

Table 1 Definition of World Bank governance indicators (WGI). Source: Kaufmann et al. (2011)

Indicator	Definition
Control of corruption	The extent to which public power is used for private gain, counting on small and large forms of corruption, as well as the management of the State by elites and private interests
Government effectiveness	The quality of public services, the capacity of the public function and its independence from political pressures; and the quality of policy formulation
Political stability and absence of violence/terrorism	The probability that the government will be damaged by unconstitutional or violent affairs, including terrorism
Regulatory quality	The government's ability to provide strong policies and regulations that enable and promote the development of the private sector
Rule of law	The extent to which agents trust and accept the rules of society, including the quality of contract enforcement and property rights, the police, and the courts, as well as the probability of crime and violence
Voice and accountability	The extent to which citizens participate in the selection of their government, freedom of expression, freedom of association and freedom of the press



of corruption, government effectiveness, and rule of law. Regarding the institutional distance between Colombia and the AC countries, the former performs better across the majority of indicators (control of corruption, government effectiveness, regulatory quality, and rule of law). By contrast, the AC countries demonstrate a higher level of both political stability and the absence of violence and terrorism, as should be expected following the long period of internal conflict that Colombia has experienced. However, it is essential to highlight the upward trend in this indicator since 2012, when the government of the former President Juan Manuel Santos and the *Fuerzas Armadas Revolucionarias de Colombia* (FARC) began formal negotiations to end the internal armed conflict that has lasted more than 50 years (Lopez et al. 2019). Moreover, the Colombian index performance reflects a higher upward trend in the voice and accountability indicator since 2013. Finally, Fig. 3 also shows the evolution of the global average institutional indices, most of which are higher than the Colombian indices (except in regulatory quality, and voice and accountability, in which a similar evolution is observed). This last comparison allows us to infer that the quality level of Colombian governance is lower still than the global average, which indicates, on the one hand, a wide margin for institutional improvement and, on the other, the poor institutional quality of the country.

According to the empirical findings obtained by different authors about the effect on trade of institutional quality, it is important to remark on the need to improve the quality of Colombian institutions in order to positively influence exports. The OECD (2013) highlights a notable change in Colombia owing to the implementation of public policies in the last 10 years that seek to strengthen its institutional quality and to promote sustainable and inclusive economic growth. However, as evidenced in Fig. 3, Colombian institutional quality is still some distance from the average level of OECD countries, which are characterised by high standards of governance.

4 Methodological approach, estimation and data

In light of this discussion, this study implements the trade gravity model to determine the effects of institutional quality on Colombian exports. This methodology is a successful approach to analysing the performance of bilateral trade flows based on variables such as distance, the size of the country's economy, and other factors that could facilitate, or impede, trade. This approach allows us to test what recent studies have indicated regarding the influence of institutional variables on bilateral trade.

The trade gravity model was first introduced by Tinbergen (1962) and Poyhonen (1963), who formulated this method based on the *Law of Universal Gravity* formulated by the English physicist Isaac Newton. The approach states that the economic forces of trade can explain bilateral trade between origin and destination, and where a series of variables converge to promote or restrict trade flow between nations (Bergstrand, 1985).

According to Anderson and van Wincoop (2003), the trade gravity equation is modelled as follows:

$$X_{ij} = \alpha_o Y_i^{\alpha_1} Y_j^{\alpha_2} D_{ij}^{\alpha_3} Z_{ij}^{\alpha_3} n_{ij}$$

The equation establishes the relationship between a country's exports (X_{ij}), the income levels of the countries of origin and destination ($Y_i^{\alpha_1}$; $Y_j^{\alpha_2}$), the physical distance between them ($D_{ij}^{\alpha_3}$), and all the factors that might impede trade ($Z_{ij}^{\alpha_3}$).

This empirical study considers Colombian exports to the 136 partners that constitute 99% of its export trade. The analysis begins in 2005, the year in which Colombia's trade openness intensified, and ends in 2018, to avoid the impact of COVID-19 on the institutional quality of the nation. The variables implemented in the model vary according to economic, historical, geographical, and trade integration features.

Our specification follows the proposal of Álvarez et al. (2018), which estimates the effect of institutional barriers on exports based on the new theory of trade (NTT), wherein assumptions such as love for variety preferences, increasing returns to scale technologies, and iceberg transport are considered. Therefore, their proposal considers the influence of transport and non-transport factors as linked to trade cost. With this in mind, we include other variables connected to the context of Colombian trade, and we determine whether institutional variables affect Colombia's bilateral trade with its main partners.

Table 2 exhibits the variables implemented in the model proposed.

Table 2 exhibits the standard variables implemented in the trade gravity model as control variables such as contiguity and common language. Physical distance is included as a proxy for transport cost. Additionally, the GDP of the destination is

Table 2 Information of variables implemented in the model. Source: Own elaboration

Variable	Description	Update date	Source	Expected sign
X_{Cofj}	Exports from Colombia to its partners in constant USD	June 19, 2020	World Integrated Trade Solution	
LogDIST_{Cofj}	Log Distance in kilometres between country i to country j	March 30, 2019	CEPII	-
CONTIG_{Cofj}	Common physical border between country i and country j	March 30, 2019	CEPII	+
COMLANG_{Cofj}	Origin and destination share a common legal language that is spoken by at least 9% of the population of both countries	March 30, 2019	CEPII	+
LogGDP_j	Log Gross domestic product of destination country in constant USD	July 30, 2019	World Bank Data	+
LogLABCOMP_{Cof}	Log labour competitiveness of origin	August 1, 2020	Calculated by authors with data from the United Nations	+
WTO_j	Colombian partner is a member of the WTO	March 30, 2019	CEPII	+
OECD_j	Colombian partner is a member of the OECD	June 30, 2020	OECD	+
FTA_{Cofj}	Origin and destination country with Trade Agreement in force	May 8, 2019	WTO	+
$\text{Control of corruption}_{Cof}$	Colombian control of corruption: estimate	June 30, 2020	World Bank Data	+
$\text{Control of corruption}_j$	Colombian partner's control of corruption: Estimate	June 30, 2020	World Bank Data	+
$\text{Government effectiveness}_{Cof}$	Colombian government's effectiveness: estimate	June 30, 2020	World Bank Data	+
$\text{Government effectiveness}_j$	Colombian partner's government's effectiveness: estimate	June 30, 2020	World Bank Data	+
$\text{Political stability}_{Cof}$	Colombian political stability: estimate	June 30, 2020	World Bank Data	+
$\text{Political stability}_j$	Colombian partner's political stability: estimate	June 30, 2020	World Bank Data	+
$\text{Regulatory quality}_{Cof}$	Colombian regulatory quality: estimate	June 30, 2020	World Bank Data	+
$\text{Regulatory quality}_j$	Colombian partner's regulatory quality: estimate	June 30, 2020	World Bank Data	+
Rule of law_{Cof}	Colombian rule of law: estimate	June 30, 2020	World Bank Data	+
Rule of law_j	Colombian partner's rule of law: estimate	June 30, 2020	World Bank Data	+
$\text{Voice and accountability}_{Cof}$	Colombian voice and accountability: estimate	June 30, 2020	World Bank Data	+
$\text{Voice and accountability}_j$	Colombian partner's voice and accountability: estimate	June 30, 2020	World Bank Data	+

included as a variable that measures the economic dimensions of the country's partners. The variable LABCOMP depends on productivity and wages, and is established via the link between GDP and the number of workers in a country. According to Álvarez et al. (2018), its incorporation into the model is based on the so-called new trade theory (NTT), and more precisely, on the Krugman–Dixit–Stiglitz model. This variable suggests that the higher labour productivity is, the lower the marginal labour requirements become, and, therefore, wages can have a positive correlation with productivity. Moreover, the model incorporates variables that reflect important trade integration mechanisms aligned with the Colombian strategy of trade openness, such as FTAs signed between the parties and whether its partner is a member of the WTO and the OECD.

In addition to the variables mentioned above, Table 2 displays six governance indicators. The World Bank (2020) provides the governance indicators implemented in the model, and they reflect each dimension of the institutional quality of a country. The score for each index ranges from -2.5 to 2.5 , with the latter denoting higher quality. Furthermore, it is essential to note that we lag the institutional variables in our specifications because we consider that they have a lagged effect on trade (Gani and Scrimgeour 2016), and also to avoid endogeneity problems.

Table 3 shows the descriptive statistics of the variables used in the empirical study. It is imperative to underline that a substantial number of bilateral trade observations are zeros, reflecting the need to use an appropriate estimator for this type of data.

Table 3 Descriptive statistics of the data. Source: Own elaboration

Variable	Mean	St. Dev	Min.	Max.
X_{Cdj}	174	763	0	9790
LogDIST_{Cdj}	9843.69	4635.13	733.53	19,369.97
CONTIG_{Cdj}	0.04	0.19	0	1.00
COMLANG_{Cdj}	0.14	0.35	0	1.00
LogGDP_j	510,000	1,640,000	1240	17,900,000
LogLABCOMP_{Cdj}	13,461.85	864.9	11,670.21	14,559.61
WTO_j	0.86	0.34	0	1.00
OECD_j	0.24	0.43	0	1.00
FTA_{ij}	0.16	0.37	0	1.00
$\text{Control of corruption}_{Cdj}$	-0.30	0.09	-0.41	-0.12
$\text{Control of corruption}_j$	0.05	1.06	-1.67	2.47
$\text{Government effectiveness}_{Cdj}$	-0.06	0.09	-0.25	0.07
$\text{Government effectiveness}_j$	0.16	0.99	-2.09	2.44
$\text{Political stability}_{Cdj}$	-1.40	0.42	-2.06	-0.77
$\text{Political stability}_j$	-0.04	0.95	-2.97	1.62
$\text{Regulatory quality}_{Cdj}$	0.30	0.14	0.01	0.50
$\text{Regulatory quality}_j$	0.15	1.02	-2.53	2.26
Rule of law_{Cdj}	-0.38	0.10	-0.62	-0.26
Rule of law_j	0.06	1.03	-2.34	2.10
$\text{Voice and accountability}_{Cdj}$	-0.07	0.13	-0.32	0.19
$\text{Voice and accountability}_j$	-0.001	1.02	-2.31	1.74
Observations	1904			

Exports and GDP data in millions of USD

Given this, a first definition considers the influence of institutional quality in levels over Colombian bilateral exports with its main partners, and this influence is modelled in the following specification:

$$\begin{aligned}
 X_{Coljt} = \exp & \left(\alpha_0 + \beta_1 \text{Institutions}_{Colt-1} + \beta_2 \text{LogDIST}_{Colj} \right. \\
 & + \beta_3 \text{CONTIG}_{Colj} + \beta_4 \text{COMLANG}_{Colj} + \beta_5 \text{LogGDP}_{jt} \\
 & + \beta_6 \text{LogLABCOMP}_{Colt} + \beta_7 \text{WTO}_{jt} \\
 & \left. + \beta_8 \text{OECD}_{jt} + \beta_9 \text{FTA}_{Coljt} \right) n_{Coljt}
 \end{aligned} \quad (1)$$

A second definition considers the difference between levels of institutional quality in Colombia and the destination countries (Colombian partners) in order to analyse the Colombian export panorama. The institutional quality difference between countries is commonly called institutional distance, and it captures in a simple way how the quality of institutions in the exporting country are better (positive) or worse (negative) than those in the importing country (Álvarez et al. 2018). In this regard, the authors conclude that a relative difference in favour of (or against) the exporting country promotes (or restricts) its exports due to their reduced (or wider) institutional distance. Consequently, the following specification is proposed:

$$\begin{aligned}
 X_{Coljt} = \exp & \left(\alpha_0 + \beta_1 \text{DiffInstitutions}_{Coljt-1} + \beta_2 \text{LogDIST}_{Colj} \right. \\
 & + \beta_3 \text{CONTIG}_{Colj} + \beta_4 \text{COMLANG}_{Colj} + \beta_5 \text{LogGDP}_{jt} \\
 & + \beta_6 \text{LogLABCOMP}_{Colt} + \beta_7 \text{WTO}_{jt} \\
 & \left. + \beta_8 \text{OECD}_{jt} + \beta_9 \text{FTA}_{Coljt} \right) n_{Coljt}
 \end{aligned} \quad (2)$$

Finally, we estimate our models in their multiplicative form through the Poisson pseudo-maximum likelihood (PPML) estimator. This estimator has been widely used in recent studies due to its consistent results (Egger and Nigai 2015). Silva and Teneyro (2006) strongly recommend the use of the PPML estimator in trade gravity models rather than the ordinary least square (OLS) because the former includes a difference in the size of the coefficients, which are therefore smaller and more suitable. Additionally, the PPML estimator addresses potential endogeneity and econometric drawbacks such as bias produced by heteroscedasticity, serial correlated error, and multicollinearity (Álvarez et al. 2018). Moreover, the estimator is able to include zero values of trade in the specification, which is an advantage in the presence of a large number of zeros (Francois and Manchin 2013).

5 Results

In this section, we present the results for the specifications proposed in the previous section, showing the influence of the institutions on Colombian exports. It is important to note that we estimate the models by including institutional variables one by one in order to avoid correlation problems between them.

Table 4 offers the results of the estimations of Colombian exports based on the gravity Eq. (1), where governance indices are included in terms of levels in the origin country. The estimation shows that the distance factor is statistically significant in

Table 4 The influence of Colombian institutions on its exports

Variables	Control of corruption (t-1)	Government effectiveness (t-1)	Political stability (t-1)	Regulatory quality (t-1)	Rule of law (t-1)	Voice and accountability (t-1)
Institutional Index _{Col} (t-1)	- 1.142** (0.528)	0.673** (0.288)	0.226*** (0.072)	0.993*** (0.230)	0.942*** (0.351)	0.522** (0.203)
LogDIST _{Colj}	- 1.312*** (0.285)	- 1.311*** (0.285)	- 1.317*** (0.285)	- 1.316*** (0.284)	- 1.314*** (0.285)	- 1.315*** (0.285)
CONTIG _{Colj}	0.201 (0.406)	0.197 (0.407)	0.217 (0.406)	0.217 (0.406)	0.200 (0.406)	0.210 (0.407)
COMLANG _{Colj}	0.545 (0.372)	0.544 (0.372)	0.548 (0.372)	0.552 (0.372)	0.543 (0.372)	0.544 (0.372)
LogGDP _j	0.786*** (0.087)	0.786*** (0.087)	0.786*** (0.087)	0.786*** (0.087)	0.787*** (0.087)	0.786*** (0.087)
LogLABCOM- P _{Col}	2.533** (1.071)	2.944** (1.149)	2.617*** (0.878)	2.044** (0.882)	2.586** (1.202)	2.990*** (1.010)
WTO _j	- 0.444 (0.698)	- 0.441 (0.698)	- 0.454 (0.698)	- 0.453 (0.697)	- 0.443 (0.698)	- 0.449 (0.698)
OECD _j	0.280 (0.540)	0.275 (0.542)	0.289 (0.544)	0.294 (0.544)	0.272 (0.542)	0.281 (0.544)
FTA _{Colj}	- 0.292* (0.163)	- 0.284* (0.166)	- 0.306* (0.167)	- 0.316* (0.166)	- 0.281* (0.163)	- 0.293* (0.168)
Constant	- 14.791 (9.800)	- 18.342* (10.549)	- 14.889* (8.145)	- 10.070 (8.443)	- 14.621 (11.379)	- 18.738** (9.328)
Observations	1869	1869	1869	1869	1869	1869
R-squared	0.889	0.889	0.888	0.894	0.895	0.887
Reset test	0.654	0.681	0.683	0.699	0.691	0.681

Robust standard errors in parentheses. These are based on robust standard errors that have been adjusted for clustering by country pair

*** $p < 0.01$

** $p < 0.05$

* $p < 0.1$

each specification at a confidence level of 99%. However, the so-called control variables included (contiguity and common language) are not statistically significant. Similarly, the GDP variable of the destination, which represents the size of the economy, has a positive impact on exports and is statistically significant at a confidence level of 99%. Furthermore, the labour competitiveness variable in Colombia (as origin country), which indicates the productivity level per worker, and, therefore, the requirements for productive factors and wages, has a prominent positive effect on Colombian exports, which suggests that an increase in this factor should significantly boost exports. Regarding the variables that illustrate the Colombian trade integration mechanisms, the regression shows that there is no statistical significance between Colombian export levels and whether the destination country belongs to the WTO or OECD. These results raise questions around Colombia's recent accession to this organization in 2020 (OCDE 2020) as an economic mechanism with a favourable effect on its exports. Additionally, and contrary to the predominant positive results from different studies, the FTA variable exhibits a negative effect on Colombian exports, which suggests that when Colombia shares a trade agreement with its partners, its exports decrease.

Regarding the variables of interest, we understand that all institutional indices are statistically significant and the majority of their results show the expected sign. The estimations show that the most relevant connections between trade and institutions are the rule of law and regulatory quality variables. The results are in line with prominent studies that have identified the substantial influence of these variables in the promotion of international trade (Álvarez et al. 2018; Anderson and Marcouiller 2002; Yu et al. 2015). Similarly, voice and accountability, government effectiveness, and political stability are variables demonstrating a notable effect on increasing Colombian exports, albeit at lower levels, in the latter variable in particular. On the other hand, the control of corruption variable exhibits a negative effect on Colombian exports, suggesting that improvements in this area could hinder exports. This result contradicts most of the empirical studies, which identified this variable as an export driver.

Table 5 reveals the results of the regressions of Colombian exports based on the gravity Eq. (2), focussing on the institutional distance between Colombia and its main partners. As mentioned, institutional distance is calculated as the difference between the

Table 5 The influence of the institutional distance between Colombia and importing countries on Colombian exports

	Dif. control of corruption (t-1)	Dif. governm. effectiv. (t-1)	Dif. Political stability (t-1)	Dif. regula. quality (t-1)	Dif. rule of law (t-1)	Dif. voice and accounta. (t-1)
Institutional Index _{Col(t-1)}	-0.278** (0.127)	-0.416*** (0.141)	-0.039 (0.144)	0.295** (0.131)	-0.295** (0.137)	-0.123 (0.220)
LogDIST _{Colj}	-1.226*** (0.249)	-1.231*** (0.237)	-1.295*** (0.279)	-1.277*** (0.243)	-1.236*** (0.240)	-1.273*** (0.262)
CONTIG _{Colj}	0.369 (0.427)	0.396 (0.380)	0.214 (0.415)	0.272 (0.382)	0.362 (0.418)	0.189 (0.411)
COMLANG _{Colj}	0.693* (0.355)	0.669* (0.344)	0.557 (0.369)	0.597* (0.340)	0.654* (0.349)	0.576 (0.371)
LogGDP _j	0.766*** (0.093)	0.757*** (0.088)	0.786*** (0.088)	0.781*** (0.088)	0.758*** (0.095)	0.787*** (0.091)
LogLABCOMP _{Col}	2.850** (1.255)	2.663** (1.264)	3.376*** (1.234)	3.025** (1.269)	2.760** (1.273)	3.161** (1.270)
WTO _j	-0.553 (0.664)	-0.568 (0.620)	-0.454 (0.710)	-0.563 (0.655)	-0.535 (0.653)	-0.499 (0.746)
OECD _j	-0.125 (0.529)	-0.301 (0.526)	0.228 (0.542)	-0.206 (0.528)	-0.201 (0.510)	0.070 (0.450)
FTA _{Colj}	-0.191 (0.151)	-0.104 (0.136)	-0.247 (0.176)	-0.129 (0.138)	-0.125 (0.143)	-0.211 (0.171)
Constant	-17.712 (12.019)	-15.622 (12.274)	-22.677** (11.251)	-19.101 (12.263)	-16.563 (12.472)	-20.750* (11.977)
Observations	1869	1869	1869	1869	1869	1869
R-squared	0.894	0.890	0.887	0.883	0.890	0.890
Reset test	0.380	0.264	0.644	0.310	0.215	0.561

Robust standard errors in parentheses. These are based on robust standard errors that have been adjusted for clustering by country pair

***p < 0.01

**p < 0.05

*p < 0.1

governance indicators in Colombia (exporting country) and those of the destination country, to compare the institutional qualities of Colombia and its partners. The regressions show similar results in terms of influence on exports and statistical significance as those shown in Table 4 for variables such as distance, contiguity, GDP and labour competitiveness, and membership of the WTO and OECD. However, in this model, the common language variable becomes statistically significant when the institutional distance variables feature the same. Similarly, in this model, the FTA variable is not statistically significant.

Regarding institutional distance variables, Table 5 shows that the majority of them are statistically significant (except in the difference between political stability and voice and accountability), and that their effect on Colombian exports is adverse. As mentioned, a negative result in regression suggests a restriction of exports from Colombia to its partners due to the institutional distance, and the negative effect of institutional distance on Colombian exports is in line with indications from Bilgin et al. (2018). They affirm that a greater difference between the quality levels of the institutions in origin and destination countries negatively affects bilateral trade flows. The greatest adverse effect is shown in the distance between the effectiveness of the government variables, which suggests that differences between the quality of public services, capacity of the public function, and its independence from political pressures found between Colombia and its partners negatively affect the former's exports. Nonetheless, the adverse effect of institutional distance on Colombian exports is also exhibited in the control of corruption, regulatory quality, and the rule of law variables, albeit to a lesser extent.

6 Discussion

The results obtained by the proposed specifications allow us to examine the influence of institutional quality (whether we consider them in levels or their differences) on Colombian exports.

Regarding the impact of governance indices in levels on Colombian exports, the variables regulatory quality and rule of law exhibit a greater influence than the other indices, and this influence has been recognised by numerous studies. These variables are related to market competition and legal certainty, correspondingly, and our results reveal that their impact on the country's exports is outstanding. These findings should encourage the creation of more efficient policies to improve performance against those indices and what they represent in terms of governance as an effective measure to boost Colombian exports. In this regard, our results are in line with those revealed by Soeng and Cuyvers (2018), through which they provide evidence that Cambodia's exports are positively influenced by the same variables we used in our study. Their study confirms too that the rule of law is the most relevant institutional variable for promoting the growth of Cambodia's exports. On the other hand, the control of the corruption variable exhibits an adverse effect on exports, which reflects an ambiguous perspective on the social roots of corruption in the country and its diverse and opposite economic effects. This finding could be the initial basis of an additional study to determine the reasons for the negative effect of the control of corruption indicator on Colombian exports, a finding which contradicts recent research suggesting control of corruption has a positive effect on the volume of countries' exports.

The prominent positive effect, exposed in each regression, that the labour competitiveness variable could have on Colombian exports is supported by the findings of Álvarez et al. (2018), who maintain that the labour productivity of the exporter, through lower factor requirements and salaries, boosts bilateral trade. With this in mind, it is essential to note that the promotion of policies that enhance Colombian labour productivity could be a powerful strategy to improve its exports, and our results confirm this statement. Nevertheless, the OECD (2019) affirms that Colombian labour productivity is on the decline; business tax breaks do little to improve the country's productivity; and comparatively, Colombian labour productivity is one-third of that achieved by the average OECD country, and even lower than the level reached by some Latin American countries. These statements suggest that Colombian labour productivity may hardly be a factor in promoting the short-term growth of exports, and consequently, the reduction of Colombia's trade deficit. Moreover, our findings show that once an FTA comes into effect between Colombia and its partners, it negatively affects Colombian exports, which questions the effectiveness of the core strategy of the Colombian government to promote its exports and eventually balance its trade deficit. The findings of the negative influence of the FTAs over Colombian exports with its partners differ from those found by Ahcar Olmos (2018) in his empirical study on international trade between Colombia and the EU, and those established by Cárdenas and García (2005) in their study on the effect on trade of the signing of the FTA between Colombia and the US.

Concerning the institutional distance and their influence on Colombian exports, it can be observed that the difference between governances in Colombia and its partners negatively affects its exports, with most of the variables included. The results are in line with those findings that indicate countries with similar (or different) standards of governance trade more (or less) with each other (de Groot et al. 2005). Moreover, the findings of Liu et al. (2020) regarding the effects of institutional distance on trade flows between China and countries following the Belt and Road Initiative (BRI), exhibit inhibition of the bilateral trade flows, deriving from uncertainty and transaction costs related to institutional distance. Nonetheless, it is important to mention that at least half of Colombian exports go to countries whose governance indices are generally higher (the US, the EU, and even some Chinese governance indices) than its own (see Fig. 1), which to some extent throws into question the common findings on institutional distance and the negative effect on exports when the distance is wide. Nevertheless, our findings should concern Colombian policymakers seeking to improve the level of institutional quality as a means to expand national exports with its partners, as the regression results suggest.

Overall, we can state that institutional quality has a strong influence on Colombian exports, where the effects of the regulation quality and rule of law variables stand out above the others. In the same vein, the institutional distance between Colombia and its partners represents another factor that harms exports. Therefore, the strengthening of institutional quality should be seen by the Colombian authorities as a primary strategy to support the trade integration process, focused not only on the opening of new markets through trade agreements, but also on measures that improve the economic, legal, social, and political environment of business.

7 Conclusion

In this study, we have worked with a panel of the bilateral trade flows between Colombia and 136 of its partners to determine the influence of the country's institutional quality on its exports. To achieve this, we proposed a gravity model and considered concepts from the new trade theory. We included control variables related to economic size, geographical distance, cultural proximity, trade integration mechanisms, and labour competitiveness in order to estimate their effects on Colombian exports. In particular, the effects of institutional indices on Colombian exports flows were considered in levels and the institutional distances between countries. Our findings confirm the hypothesis that institutional quality has a positive effect on Colombian trade for most of the indices considered in the paper. However, the effects of the control of corruption index on exports differs from findings in previous studies, which suggest this variable has a vital role in the expansion of trade.

We conclude that in terms of Colombian exports, the results demonstrate that rule of law and regulatory quality have the most substantial impact, which reveals the need to improve conditions related to legal certainty and market competition in the country. Moreover, the estimations exhibit the remarkable effect on exports of the labour competitiveness variable. Nonetheless, as mentioned, Colombian labour productivity is declining, and the measures implemented by the government to enhance this indicator are not having the expected effect. Furthermore, unlike previous findings regarding the impact of trade agreements on exports, our results reveal that having an FTA in force hurts Colombian exports. Furthermore, it is crucial to point out that the variables that are usually considered in gravity models such as physical distance, GDP, contiguity, language, and an FTA, among others, include limited or even zero margin for improvement. By contrast, developing countries such as Colombia have a considerable margin for improvement in their institutional indicators (see Fig. 3), which could be a fundamental driver boosting its exports.

On the other hand, institutional distance estimates reveal that the differences in institution quality between Colombia and its partners reduce its volume of exports. These results confirm the need to improve Colombian governance indices, not only as a policy capable of improving institutional quality, but also as a policy that reduces the institutional distance from its partners, thereby promoting exports by reducing these institutional differences. Our findings support previous studies where it is concluded that institutional difference affects trade flows, as is the case with Colombian exports.

Our study offers some policy suggestions for Colombia, where governance has been influenced by an internal armed conflict that has lasted for more than 50 years. One suggestion concerns the outstanding effect of the variable rule of law on Colombian exports and the objective to improve the country's legal framework, aimed mainly at strengthening its judicial system, which provides the conditions for improving the compliance of contracts and protection of private property. These advances will also have an indirect effect on promoting private investment. Another policy suggestion focuses on the regulation quality variable, oriented towards the improvements of conditions for the promotion of the private sector through the reinforcement of policies and regulations that support its development. Overall, Colombian policymakers should focus their efforts on improving each of the Colombian institutional quality indices because of the individual

effect of each index on the expansion of exports and, therefore, on higher economic growth.

In general, the results of this research support the idea that institutional quality promotes exports between nations. Our study confirms the hypothesis regarding the influence of institutional quality on exports, regardless of whether we consider its influence in levels or institutional distance between Colombia and its partners.

However, one limitation of our study is that we estimate using aggregate trade data and we do not provide sectoral economic results. Another is the non-inclusion of informal governance indices such as the trust variable, which could provide different perspectives on the risk of default presumed by exporters to be present in an environment of poor effectiveness among formal institutions. Further research should also identify effective policies or measures that improve the country's institutional quality level as a factor that strengthens business development in the republic and eventually promotes the growth of exports to its partners. Finally, we consider that future studies could empirically examine the impact of COVID-19 on the institutional quality of developing countries and, consequently, its effect on their exports.

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Authors' contributions

CA, RB and CR contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing interests

The authors declare that they have no competing interests.

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3.3. Trade agreement and trade specialization between Colombia and the EU.
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TRADE AGREEMENT AND TRADE SPECIALIZATION BETWEEN COLOMBIA AND THE EU

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ABSTRACT

The study analyses the relevance of the trade agreement between Colombia and the European Union as a policy that promotes trade between them (export and import flows) and, subsequently, establishes its effectiveness in reducing the trade deficit of the former. Furthermore, the paper analyses the determinants of trade flows between the parties, emphasizing the effect of factor endowment on their bilateral trade. We use a panel data set from 2005 to 2019, wherein the export and import flows between Colombia and the countries of the European Union are considered. The findings indicate that the trade agreement between the two parties has deepened the Colombian trade deficit. Additionally, it is established that the parties share an inter-industry trade pattern based on their factor endowment. Consequently, the Colombian government should consider these findings to reorient its trade policy towards those European Union countries that have an opposite factor endowment.

Keywords: Colombia, European Union, trade agreement, factor endowment, trade gravity model.

JEL Classification: F13, F14, F15, F47, F53.

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RESUMEN

El estudio analiza la relevancia del acuerdo comercial entre Colombia y la Unión Europea como una política que promueve el comercio entre ellos (flujos de exportaciones e importaciones) y, subsecuentemente, establece su efectividad en la reducción del déficit comercial del primero. Adicionalmente, el artículo analiza los determinantes de los flujos comerciales entre las partes, destacando el efecto de la dotación de factores en su comercio bilateral. Utilizamos un conjunto de datos de panel de 2005 a 2019, en donde se cubren los flujos de exportación e importación entre Colombia y los países de la Unión Europea. Los hallazgos indican que el acuerdo comercial entre las dos partes ha profundizado el déficit comercial colombiano. Asimismo, se establece que las partes comparten un patrón de comercio interindustrial basado en su dotación de factores. En consecuencia, el gobierno colombiano debe considerar estos hallazgos para reorientar su política comercial hacia aquellos países de la Unión Europea que tienen una dotación de factores opuesta.

Palabras clave: Colombia, Unión Europea, acuerdo comercial, dotación de factores, modelo de gravedad del comercio.

Clasificación JEL: F13, F14, F15, F47, F53.

1. INTRODUCTION

Colombia, as one of the Latin American countries presenting the highest economic growth rates in the region in recent years, has developed a trade policy focused on openness in order to stimulate its trade flows. This trade policy is in line with that indicated by Egger *et al.* (2011), who affirm that trade agreements between associated countries increase their bilateral trade. In this sense, recent Colombian governments have signed a significant number of preferential trade agreements. However, the country's trade balance, structurally in deficit, has been negatively affected by trade liberalization. This fact poses significant questions regarding the focus of current Colombian trade policy on signing trade agreements.

This research aims, in particular, to evaluate the trade effects of the entry into force of the Free trade Agreement (FTA) between Colombia and the European Union (EU), using an empirical approach. Notably, the Colombia-EU agreement is one of the most important FTAs signed by Colombia after that signed with the United States of America (US), because of the trade amounts involved, and it offers Colombia preferential access to a large and attractive market. Furthermore, in our empirical approach, we include variables related to the factor endowment of the countries, which will provide evidence of the type of trade that has developed between them (inter- or intra-industry), as well as their effect on the commercial exchange. This will allow us to determine whether the Colombian trade pattern is in line with the Heckscher-Ohlin (H-O) model or the Linder hypothesis (Erdey and Pöstényi, 2017), and, therefore, whether the trade between the parties is related to inter-industry or intra-industry trade. Moreover, this assessment is developed through an empirical modelling strategy—the so-called trade gravity model—and we estimate the specifications through a more suitable approach than that of a traditional log-linear form; this approach is called the Poisson pseudo-maximum likelihood (PPML) (Santos Silva and Teneyro, 2006). Our findings indicate that, on the one hand, the FTA factor has a positive effect on Colombian imports from the EU but, on the other, it does not reflect any (statistically significant) effect on Colombian exports to the EU. Therefore, this suggests a deepening of the existing Colombian trade deficit. Additionally, the results related to the type of trade carried out between the parties show a clear and marked inter-industry pattern, suggesting that Colombia tends to trade (export and import flows) with EU countries that have different factor endowments. Consequently, trade between the parties is founded on the inter-industry trade pattern; they trade goods belonging to utterly different branches of activity.

In general, this empirical work is novel because it explores the nature of specialization in bilateral trade between an emerging South American country and a trading bloc such as the EU. The study is carried out within the framework of a bilateral trade agreement between the parties, measured through the trade gravity model and estimated through a more suitable method for these models called the PPML. Finally, the paper is organized as follows. The first section will describe the evolution of the Colombian trade liberalization strategy over the last few decades through

an international economic integration policy called *Apertura Comercial*. The second section of this paper will present the background and scope of the signed FTA between Colombia and the EU countries. The third section is concerned with the methodological approach, specification and data used for this study. The fourth section will offer the findings of the research, focusing on the effects of the variables involved in bilateral trade. As a final point, the last section focuses on discussion and includes additional concluding remarks.

2. COMMERCIAL AGREEMENT BETWEEN COLOMBIA AND THE EUROPEAN UNION

The existing literature on international trade is extensive and places particular emphasis on the effects of FTAs in promoting world trade by reducing trade barriers. In this regard, Lim and Breuer (2019) point out that in recent decades barriers to international trade have decreased significantly, especially in developing countries, as a measure to promote economic growth. This is the case of Colombia, a Latin American economy which, according to García *et al.* (2014), carried out a series of exceptional reforms in the early 1990s, aimed at promoting its trade openness and, subsequently, achieving a more productive and efficient economic system.

This study pays special attention to the Commercial Agreement struck between Colombia and the EU since the European Single Market offers remarkable opportunities for an economy that has been growing constantly over the last few decades. To ensure that continuous progress is maintained, the Colombian economy needs to expand into relevant markets, such as the EU bloc. The integration process with the EU is an opportunity for Colombia to access a market that, as a trade bloc, is the largest global commercial power with the second most traded currency in the world, the number one importer and exporter of goods worldwide and the largest buyer and seller of commercial services while also enjoying the highest Gross Domestic Product (GDP) [Procolombia, 2013a].

Therefore, the last decades have witnessed the rapid development of the trade relationship between Colombia and the EU. Structurally, more than half of Colombia's exports to the EU are mainly made up of coal, oil and their derivatives, respectively (MinCIT, 2018). The European

Single Market is one of the main destinations of Colombian exports, and it is characterized as an attractive, but unexploited, market for non-mining or oil exports and one of the most important consumers of oil and mining goods from Colombia. In this regard, it is important to note that Colombian exports to the EU amounted to 3,412,838,574 constant USD in 2019, which represented a decrease of 1.83% compared to the values exported to this market in 2018. Therefore, the signing of the trade agreement was strategic for all the countries involved.

According to the Organization of American States (OAS, 2019), negotiations for the signing of an agreement of common interest between the countries that belonged to the Andean Community (AC) (including Colombia) and the EU dated from 1993, when both sides signed a Framework Cooperation Agreement. Nevertheless, it was not until September 2007 that the first round of bloc-by-bloc negotiations was carried out in order to build an association agreement between the parties. The European Parliament (2018) highlights that, in May 2008, the EU and the AC reached a “Flexible Framework Agreement” for the association of the two blocs, in which each AC country could choose its level of participation. As a result, nine rounds of negotiations were carried out between the EU, Colombia and Ecuador after 2009. Consequently, the Trade Agreement was finally signed between the EU and Colombia and Peru in May 2010.

Simultaneously, Colombia and EU commercial relations had been framed under the Generalized System of Preferences (GSP) granted unilaterally by the EU since 2008 until the entry into force of the Commercial Agreement. According to the Andean Community (2008), the GSP has two regimes that granted preferential treatment to Colombian exports. The general regime granted the total suspension of tariffs for non-sensitive products, except for agricultural components, and reduced the *ad valorem* tariff of those classified as sensitive by 3.5 percentage points, except for textile and clothing products. Additionally, the specific tariffs on sensitive products were reduced by 30%. On the other hand, the special regime or GSP+ suspended all tariffs on sensitive and non-sensitive products covered by the GSP. This regime also established the suspension of all specific tariffs, except when the products also had an *ad valorem* tariffs.

This preferential treatment defined the trade between the parties until the trade agreement came into force in 2013. The agreement eliminated

the temporality of the preferential treatment, as well as the unilaterality of the tariff preferences, thereby creating a stable association. Finally, although the tariff preferences for Colombia granted by the EU improved with the entry into force of the FTA concerning those previously established by the GSP and GSP+, most of these preferences already existed. However, the commencement of the FTA granted preferential access into Colombia for goods from EU countries, which they did not previously have; this implies that bilateral preferences would be more relevant for the EU countries than for Colombia.

Regarding the different aspects that were negotiated, it is relevant to point out that the trade agreement between Colombia and the EU is not only a free trade agreement but means much more. It not only promotes free trade but also supports democracy and cooperation programmes, becoming an association agreement. According to Procolombia (2013b), the agreement covered the negotiation of 14 chapters, highlighting the reference to market access, wherein the tariff reduction in agricultural and industrial goods was negotiated. Other chapters, such as *Trade in Services, Technical Assistance and Strengthening of Commercial Capabilities, Dispute Resolution, Intellectual Property, Commercial Defence, and Sanitary and Phytosanitary Measures*, were also negotiated and agreed.

According to the MinCIT (2012b), the *Market Access* chapter established a classification of non-agricultural and agricultural goods. Regarding the first classification (industrial and fishing goods), a tariff reduction for 100% of the universe of these goods was defined for Colombian exports following the entry into force of the trade agreement. On the other hand, the agreement established a 10-year progressive tariff reduction for non-agricultural EU goods. In the case of agricultural goods, their trade was not completely liberalized due to the sensitivity of the issue for both parties. Colombian agricultural products obtained an immediate tariff reduction with the entry into force of the agreement with products such as flowers, coffee, palm oil, most fruits and vegetables, and most cocoa and tobacco products included. Nonetheless, a gradual quota liberalization was arranged for products the EU considered sensitive, such as bananas, sugar and beef, among others. Concerning EU agricultural goods, a series of products that Colombia considered sensitive were defined and subject to transitory and/or contingent tariffs. For instance, the dairy sector and its products were a special case in

the negotiation. Other sensitive products, such as rice, corn, pork and poultry products, were excluded from the agreement.

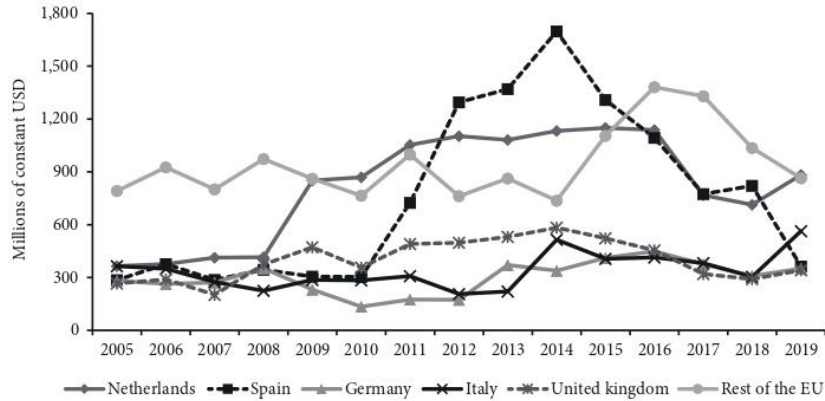
Furthermore, the agreement defined certain commercial defensive instruments, the aim of which was to avoid actions that might go against what was negotiated by the parties. These instruments included anti-dumping measures, subsidies and countervailing duties, and multilateral safeguard measures. These instruments are governed by the World Trade Organization's (WTO) multilateral agreements intended to solve this sort of dispute (MinCIT, 2019).

Finally, the agreement includes commitments regarding respect for human rights and the promotion of trade and sustainable development. According to the MinCIT (2012a), the agreement establishes respect for fundamental human rights as an essential element of the agreement, stating that, in the event of their violation, measures that comply with international law will be adopted. Similarly, in the case of trade and sustainable development, social clauses are included. This concerns the fulfilment of labour rights according to the definitions of the International Labour Organization (ILO), through the commitment of the parties involved to generate employment and decent work.

Figure 1 presents Colombian export performance in millions of constant USD to the main destination countries within the EU from 2005 to 2019.

Figure 1 illustrates the performance of Colombian exports to the main EU markets. One can observe two trends in most of the countries presented, excluding the Netherlands and Spain. The first trend can be observed between 2005 and 2016, where the evolution of Colombian exports to Germany, Italy, the United Kingdom (UK) and the Rest of the EU follows a pattern of moderate stability and there are no significant changes in export values. The other trend can be observed after 2016, when Colombian exports to these countries experienced a significant drop until 2018, although most countries show a slight recovery in 2019. In this group of countries, an outstanding level of exports is observed with Italy in 2014 (514,438,638 constant USD) and 2019 (571,633,289 constant USD) and with the United Kingdom in 2014 (582,987,237 constant USD). Concerning the Netherlands and Spain, which historically have been the main destinations of Colombian exports, the former exhibits a marked upward trend from 2008 to 2016 followed by

Figure 1. EU main destinations of Colombian exports in millions of constant USD

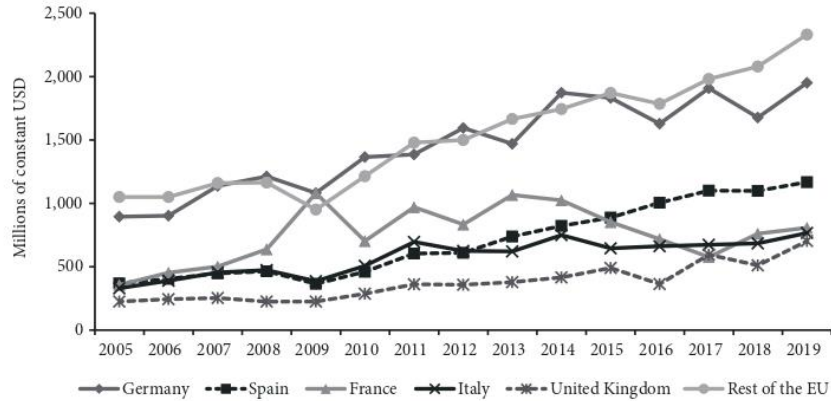


Source: Authors' elaboration based on Direction of Trade Statistics from the International Monetary Fund (IMF, 2021). Deflated values based on the Export Price Index (EPI) from Banco de la República (2020).

a significant drop until 2018 and a slight recovery in 2019. Regarding the performance of Colombian exports to the Netherlands, the highest amount of exports occurs in 2016 (1,149,773,480 constant USD) and one of the lowest is reached in 2018 (713,556,266 constant USD), only comparable with the performance of exports in the period before 2009. Concerning Spain, there is a prominent increase in Colombian exports from 2010 until 2014, followed by a dramatic decline until 2019, with export values similar to those of Germany and the UK. In particular, 2014 stands out as the year where the highest level of exports to Spain was reached (1,698,303,179 constant USD), as well as 2019 (368,224,379 constant USD), when the level of exports reached levels comparable to those presented before 2010. Overall, this indicates a general downward trend in the volume of Colombian exports to the EU in recent years, which calls into question the role of the trade agreement in boosting the country's exports to that market.

Additionally, Figure 2 presents Colombian import performance in millions of constant USD from the major economies of the EU from 2005 to 2019.

Figure 2. Origins of Colombian imports in millions of constant USD from the main EU markets



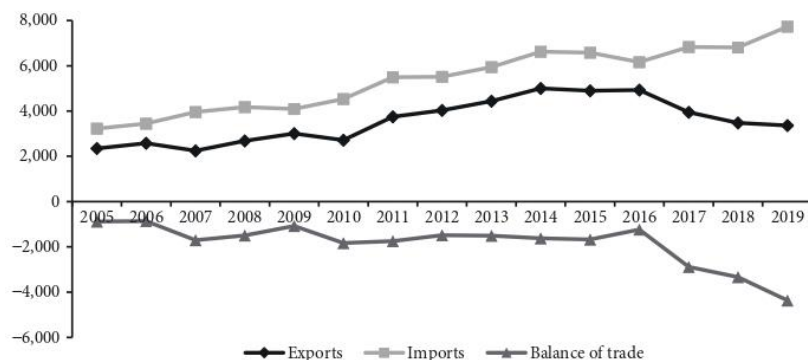
Source: Authors' elaboration based on Direction of Trade Statistics from the IMF (2021). Deflated values based on the Import Price Index (IPI) from Banco de la República (2020).

Figure 2 displays the evolution of Colombian imports from the EU countries, where Germany and Spain stand out as the main suppliers of Colombian imports. It is important to note that the highest level of exports from Germany and Spain was reached in 2019 (1,950,901,617 and 1,167,764,270 constant USD, respectively). Additionally, unlike Colombian exports to the EU, Colombian imports from most of the countries presented, show a sustained upward trend during the period analysed, slightly interrupted in 2009 as a consequence of the financial crisis. Conversely, Colombian imports from France have fluctuated significantly, reaching the highest amount imported in 2009 (1,080,381,150 constant USD), followed by the amounts reached in 2013 (1,066,511,862 constant USD) and 2014 (1,023,695,474 constant USD). This indicates that the trade agreement has been an incentive for the growth of Colombian imports from the EU.

Moreover, Figure 3 shows the Trade Balance of Colombia with the EU in millions of constant USD from 2005 to 2019.

Figure 3 indicates the performance of the Trade Balance of Colombia with the EU. It can be observed that in the period analysed, Colombia has

Figure 3. Trade balance of Colombia with the EU in millions of constant USD



Source: Authors' elaboration based on Direction of Trade Statistics from the IMF (2021). Deflated values based on the Export and Import Price Index from Banco de la República (2020).

a persistent deficit in its trade balance, with a significant widening of the gap from 2016. Additionally, in 2014, the beginning of a clear downward trend in Colombian exports to the EU is observed. This aspect coincides with the drop in international oil prices, which generated significant macroeconomic imbalances in Colombia due to the strong links between the oil sector and other economic sectors (Ramirez and Quintero, 2019). In this regard, it is relevant to note that Colombian exports to the world are mainly composed (63.3% in 2018) by oil and mining goods (Abreo, Bustillo, and Rodriguez, 2022). Furthermore, a marked upward trend in Colombian imports is observed, with a slight slowdown in 2009 and 2016. The slight drop in Colombian imports in 2009 coincides with the global debt crisis, which had effects on a global scale. Moreover, according to MinCIT (2016), the slight slowdown in Colombian imports in 2016 is due to the significant drop in imports of oil derivatives, an aspect that coincided with the start of operations of the most important oil refining plant in the country called Reficar. Finally, the evolution of the trade balance over the period analysed casts doubt on the effectiveness of the signing of the trade agreement between Colombia and the EU as a measure to balance the trade deficit of the former.

3. METHODOLOGICAL APPROACH AND DATA

The gravity model is a robust and effective econometric method implemented in order to explore the drivers of bilateral trade. The pioneers in the application of the gravity model to international trade were Tinbergen (1962) and Poyhonen (1963), who described an equivalent connection between bilateral trade flows and Newton's law of universal gravitation. The most basic economic expression of the gravity model applied to international trade suggests that bilateral trade flows are proportional to the domestic production of the countries involved and inversely proportional to their distance.

$$X_{ij} = \alpha_o Y_i^{(\alpha_1)} Y_j^{(\alpha_2)} D_{ij}^{(\alpha_3)} Z_{ij}^{(\alpha_4)} n_{ij} \quad [1]$$

The empirical and theoretical developments of the gravity model came from advances introduced by Anderson (1979) and Anderson and van Wincoop (2003), among other authors. The main developments are derived from the inclusion of additional variables that promote or restrict bilateral trade, as well as the implementation of the fixed effects of pairs of countries, fixed effects of individual countries and time fixed effects, which are used to control unobservable trade frictions (Gopinath, Helpman, and Rogoff, 2014).

Furthermore, our empirical study includes the 28 countries that belonged to the EU prior to the UK's departure, comprising data on trade between Colombia and the UK in 2019 as the commercial relationship governed by the pre-existing agreement between Colombia and the EU continued until 31 December 2020 (European Commission, 2019). The period analysed was between 2005 and 2019. This selection was made after taking into consideration a period before the FTA between Colombia and the EU was in force and also a period after the same.

The variables implemented in the models are shown in Table 1. Furthermore, Table 2 shows the descriptive statistics for the variables used in the empirical study.

Given this, four econometric specifications are proposed to explain the determinants of Colombian export levels to EU countries. The equations include control variables usually implemented in gravity models such as physical distance ($DIST_{Colj}$), common language ($COMLANG_{Colj}$), common

Table 1. Information of variables implemented in the model

Variable	Description
Dependent variables	
X_{Colj}	Colombian exports to its EU partners in constant USD
M_{Colj}	Colombian imports from its EU partners in constant USD
Independent variables	
$LogDIST_{Colj}$	Log Distance in kilometres between Colombia and EU country (j)
$COMLANG_{Colj}$	Colombia and EU country (j) share a primary or official language
$COMLEG_{Colj}$	Colombia and EU country (j) share common legal origins
$LANDLOCK_j$	EU country (j) is landlocked
$EUROAREA_j$	EU country (j) is a member of the monetary union
$OECD_j$	EU country (j) belongs to OECD
FTA_{Colj}	Colombia and EU country (j) with Regional Trade Agreement in force
$LogGDP_{Colj}$	Log of bilateral sum of the GDP of Colombia and the GDP of EU country (j) in constant USD
$LogRFE_{Colj}$	Log of Relative factor endowment between Colombia and EU country (j)
$LogHC_{Colj}$	Log of differences in human capital between Colombia and EU country (j)
$LogPD_{Colj}$	Log of differences in population density between Colombia and EU country (j)

Source: Authors' elaboration.

	Update date	Source	Expected sign
	Dependent variables		
	January 19, 2021	IMF Deflected values based on EPI from Banco de la República	
	January 19, 2021	IMF Deflected values based on IPI from Banco de la República	
	Independent variables		
	January 30, 2021	Centre d' Etudes Prospectives et d'Informations Internationales (CEPII)	-
	January 30, 2021	CEPII	+
	January 30, 2021	CEPII	+
	January 30, 2021	CEPII	-
	January 30, 2021	European Commission	+
	March 30, 2021	Organisation for Economic Co-operation and Development (OECD)	+
	December 8, 2020	World Trade Organisation	+
	January 10, 2021	World Bank	+
	February 30, 2021	Calculated by authors with data from WB	+
	February 30, 2021	Penn World Table version 10.0	+
	February 30, 2021	Calculated by authors with data from CEPII	+

Table 2. Descriptive statistics of the data

Variable	Mean	Standard deviation	min	Max
X_{Colj}	127	244	0	1,700
M_{Colj}	193	344	0	1,950
$DIST_{Colj}$	9,422	811	7,506	11,268
$COMLANG_{Colj}$	0.036	0.186	0	1
$COMLEG_{Colj}$	0.321	0.468	0	1
$LANDLOCK_j$	0.179	0.383	0	1
$EUROAREA_j$	0.59	0.492	0	1
$OECD_j$	0.752	0.432	0	1
FTA_{Colj}	0.467	0.499	0	1
GDP_{Colj}	911,000	945,000	153,000	4,340,000
RFE_{Colj}	26,115	21,242	60	109,000
HC_{Colj}	0.794	0.283	0.030	1.350
PD_{Colj}	133	245	0.330	1,546
Observations	420			

Note: Exports, Imports and GDP data in millions of constant USD.

Source: Authors' elaboration.

legal origins ($COMLEG_{Colj}$) and whether the EU country is landlocked ($LANDLOCK_j$). We also include economic integration variables, whether the EU country is part of the Eurozone ($EUROAREA_j$), whether the EU country belongs to the Organisation for Economic Co-operation and Development ($OECD_j$) and a variable that denotes if Colombia and the EU country share a trade agreement (FTA_{Colj}). Additionally, as noted by Dixit and Stiglitz (1977), in the endowment-based new trade model,

bilateral trade is an increasing function of the sum of GDP at origin and GDP of destination (GDP_{Colj}), which is a proxy for the economic size of the countries. Moreover, estimations [2], [3] and [4] involve three different measures of factor endowment in each of those equations. The equations also include time fixed effects (δ_t) and time-invariant country fixed effects at the destination country (α_j).

The inclusion of relative factor endowment (*RFE*), human capital (*HC*) and population density (*PD*) variables in the equations proposed, which are measures of the differences between factor endowments of the countries involved, are an effort to determine whether the Heckscher-Ohlin (H-O) model or the Linder hypothesis elucidate the pattern of bilateral Colombian-EU trade. In this regard, the Heckscher-Ohlin (H-O) model suggests that countries with different factor endowments will trade more with each other (Frankel, 1997). Conversely, the Linder (1961) hypothesis states that countries with similar levels of factor endowments have similar preferences and will therefore trade more with each other. Therefore, a positive sign of the coefficient of the factor endowment variables will denote the presence of a bilateral trade pattern linked to the H-O model (inter-industry) and a negative sign of these variables will denote the presence of a bilateral trade pattern related to the Linder hypothesis (intra-industry).

Frankel, Stein, and Wei (1995), and later other authors, used these variables based on the differences between the countries involved in GDP per capita, schooling levels and population density to measure the differences in their factor endowments and, subsequently, determine their commercial patterns. According to Egger (2002), the *RFE* variable represents the factor endowment of production and it is denoted as the absolute value of the difference between the natural logarithms of the GDP per capita of the countries, which is commonly used as a proxy for the capital-labour ratio of those countries.

$$RFE = \left[\text{Log} \frac{GDP_{it}}{POP_{it}} - \text{Log} \frac{GDP_{jt}}{POP_{jt}} \right] \quad [2]$$

In the same vein, Frankel and Rose (2002) state that the variables associated with educational levels are estimates of investment in human

capital and related to factor endowments. In this regard, Erdey and Pöstényi (2017) indicate that the *HC* variable, which is a factor related to average years of schooling and return to education, is another measure of factor endowment based on the index of human capital from the Penn World Table. This variable is calculated as the absolute value of the difference between the *HC* indexes of the countries.

$$HC = \left[\text{Log}HC_{it} - \text{Log}HC_{jt} \right] \quad [3]$$

Finally, Yamarik, Ghosh, and Yamarik Sucharita Ghosh (2005) point out that the variable *PD* indicates the relative endowment of land between the two countries. Moreover, Eicher, Henn, and Papageorgiou (2012) indicate that greater differences in population density are positively related to trade flow. Additionally, Greene (2013) defines this variable as a proxy for infrastructure development. Therefore, this variable is calculated as the population divided by the area of a country.

$$PD = \left[\text{Log} \frac{POP_{it}}{AREA_i} - \text{Log} \frac{POP_{jt}}{AREA_j} \right] \quad [4]$$

Based on the variables set out above, we present the following equations to explain the determinants of Colombian exports to the EU.

First model [1]:

$$X_{Colj} = \exp(\beta_0 + \beta_1 \text{Log}DIST_{Colj} + \beta_2 \text{COMLANG}_{Colj} + \beta_3 \text{COMLEG}_{Colj} + \beta_4 \text{LANDLOCK}_j + \beta_5 \text{EUROAREA}_{jt} + \beta_6 \text{OECD}_{jt} + \beta_7 \text{FTA}_{Coljt} + \beta_8 \text{LogGDP}_{Coljt} + \delta_t + \alpha_j) n_{Coljt} \quad [5]$$

Second model [2]:

$$X_{Colj} = \exp(\beta_0 + \beta_1 \text{Log}DIST_{Colj} + \beta_2 \text{COMLANG}_{Colj} + \beta_3 \text{COMLEG}_{Colj} + \beta_4 \text{LANDLOCK}_j + \beta_5 \text{EUROAREA}_{jt} + \beta_6 \text{OECD}_{jt} + \beta_7 \text{FTA}_{Coljt} + \beta_8 \text{LogGDP}_{Coljt} + \beta_9 \text{RFE}_{Coljt} + \delta_t + \alpha_j) n_{Coljt} \quad [6]$$

Third model [3]:

$$X_{Colj} = \exp(\beta_0 + \beta_1 \text{LogDIST}_{Colj} + \beta_2 \text{COMLANG}_{Colj} + \beta_3 \text{COMLEG}_{Colj} + \beta_4 \text{LANDLOCK}_j + \beta_5 \text{EUROAREA}_{jt} + \beta_6 \text{OECD}_{jt} + \beta_7 \text{FTA}_{Coljt} + \beta_8 \text{LogGDP}_{Coljt} + \beta_9 \text{HC}_{Coljt} + \delta_t + \alpha_j) n_{Coljt} \quad [7]$$

Fourth model [4]:

$$X_{Colj} = \exp(\beta_0 + \beta_1 \text{LogDIST}_{Colj} + \beta_2 \text{COMLANG}_{Colj} + \beta_3 \text{COMLEG}_{Colj} + \beta_4 \text{LANDLOCK}_j + \beta_5 \text{EUROAREA}_{jt} + \beta_6 \text{OECD}_{jt} + \beta_7 \text{FTA}_{Coljt} + \beta_8 \text{LogGDP}_{Coljt} + \beta_9 \text{PD}_{Coljt} + \delta_t + \alpha_j) n_{Coljt} \quad [8]$$

Similarly, four econometric specifications are also proposed to explain the determinants of Colombian imports from EU countries. The structures of these specifications are in line with those proposed to explain the determinants of Colombian exports.

Fifth model [5]:

$$M_{Colj} = \exp(\beta_0 + \beta_1 \text{LogDIST}_{Colj} + \beta_2 \text{COMLANG}_{Colj} + \beta_3 \text{COMLEG}_{Colj} + \beta_4 \text{LANDLOCK}_j + \beta_5 \text{EUROAREA}_{jt} + \beta_6 \text{OECD}_{jt} + \beta_7 \text{FTA}_{Coljt} + \beta_8 \text{LogGDP}_{Coljt} + \delta_t + \alpha_j) n_{Coljt} \quad [9]$$

Sixth model [6]:

$$M_{Colj} = \exp(\beta_0 + \beta_1 \text{LogDIST}_{Colj} + \beta_2 \text{COMLANG}_{Colj} + \beta_3 \text{COMLEG}_{Colj} + \beta_4 \text{LANDLOCK}_j + \beta_5 \text{EUROAREA}_{jt} + \beta_6 \text{OECD}_{jt} + \beta_7 \text{FTA}_{Coljt} + \beta_8 \text{LogGDP}_{Coljt} + \beta_9 \text{RFE}_{Coljt} + \delta_t + \alpha_j) n_{Coljt} \quad [10]$$

Seventh model [7]:

$$M_{Colj} = \exp(\beta_0 + \beta_1 \text{LogDIST}_{Colj} + \beta_2 \text{COMLANG}_{Colj} + \beta_3 \text{COMLEG}_{Colj} + \beta_4 \text{LANDLOCK}_j + \beta_5 \text{EUROAREA}_{jt} + \beta_6 \text{OECD}_{jt} + \beta_7 \text{FTA}_{Coljt} + \beta_8 \text{LogGDP}_{Coljt} + \beta_9 \text{HC}_{Coljt} + \delta_t + \alpha_j) n_{Coljt} \quad [11]$$

Eighth model [8]:

$$M_{Colj} = \exp(\beta_0 + \beta_1 \text{LogDIST}_{Colj} + \beta_2 \text{COMLANG}_{Colj} + \beta_3 \text{COMLEG}_{Colj} + \beta_4 \text{LANDLOCK}_j + \beta_5 \text{EUROAREA}_{jt} + \beta_6 \text{OECD}_{jt} + \beta_7 \text{FTA}_{Coljt} + \beta_8 \text{LogGDP}_{Coljt} + \beta_9 \text{PD}_{Coljt} + \delta_t + \alpha_j) n_{Coljt} \quad [12]$$

The specifications proposed, traditionally estimated in their log-linear form through the Ordinary Least Square (OLS), will be assessed in their multiplicative form following the Santos Silva and Teneyro (2006) proposal. The authors state that the PPML is the most appropriate estimator for gravitational models, mainly because the logarithmic linearization of the models in the presence of heteroscedasticity, endogeneity and other econometric drawbacks leads to inconsistent results. Additionally, the authors state that the removal of zeros through the logarithmic linearization of trade models provide unsatisfactory results. On the contrary, their inclusion in gravity models strengthens the outcomes. The authors also confirm that the PPML approach yields smaller and more suitable results than those obtained by conventional estimators, offering more adequate coefficients for variables such as distance, contiguity, colony tie, and those variables related to economic and trade integration. Furthermore, and based on Gopinath, Helpman, and Rogoff (2014), it is stated that these differences between the coefficients obtained by conventional estimators and PPML are due to the presence of a non-linear effect in the distance factor. Therefore, the OLS estimator reflects more trade for larger economies than for smaller ones. All these reasons explain why renowned authors such as Fally (2015) recommend relying more on gravitational models estimated using the PPML approach than those estimated using conventional approaches. In the same vein, Egger and Nigai (2015) affirm that the PPML estimator has been widely used for the estimation of gravitational models due to its adequate results in recent years. All in all, the PPML estimator is robust to diverse patterns of heteroscedasticity, providing a natural way to deal with zeros in the dependent variable and offering smaller and more consistent coefficients and, therefore, better results for the study (Santos Silva and Teneyro, 2006).

4. RESULTS

Tables 3 and 4 present the results of the proposed models.

Table 3. Regression results for Colombian exports

Variables	Models for Colombian exports			
	[1]	[2]	[3]	[4]
LogDIST_{Colj}	-3.348*	-3.238**	-7.710***	-3.520***
	(1.754)	(1.609)	(2.414)	(0.801)
COMLANG_{Colj}	0.462	0.770**	0.941***	1.541***
	(0.405)	(0.309)	(0.349)	(0.159)
COMLEG_{Colj}	0.912**	1.113**	1.966***	0.436***
	(0.448)	(0.515)	(0.368)	(0.136)
LANDLOCK_j	-3.592***	-4.237***	-4.439***	-3.569***
	(0.465)	(1.098)	(0.721)	(0.437)
EUROAREA_j	-0.169	-0.255	0.260	0.080
	(0.291)	(0.415)	(0.227)	(0.102)
OECD_j	1.617**	0.688	1.198	3.069**
	(0.716)	(0.812)	(0.763)	(1.226)
FTA_{Colj}	0.363	1.216**	0.967**	0.528*
	(0.279)	(0.586)	(0.403)	(0.281)
LogGDP_{Colj}	0.713***	0.606**	0.223	
	(0.232)	(0.246)	(0.277)	
LogRFE_{Colj}		1.210*		
		(0.624)		
LogHC_{Colj}			10.237***	
			(2.980)	

Table 3. Regression results for Colombian exports (continued...)

Variables	Models for Colombian exports			
	[1]	[2]	[3]	[4]
LogPD _{Colj}				0.498*** (0.098)
Constant	27.461* (15.311)	27.499** (12.914)	75.763*** (22.884)	31.671*** (6.806)
Observations	420	420	420	420
R-squared	0.566	0.626	0.771	0.852
Reset test	0.579	0.629	0.001	0.000
Time-invariant country fixed effects	X	X	X	X
Time fixed effects	X	X	X	X

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

By using the PPML estimator, we measure the effects of the proposed variables in Colombian exports. Model [1] shows a notable negative impact from distance in Colombian exports to the EU. In the same vein, if an EU country is landlocked, Colombian exports to them will be negatively affected. On the other hand, the results show that a rise in the GDP_{Colj} variable will have a positive effect on its exports. Additionally, variables that describe whether countries share common legal origins and whether the EU country is part of the OECD will also have a positive impact on Colombian exports. Conversely, variables such as $COMLANG_{Colj}$, $EUROAREA_j$ and FTA_{Colj} are statistically insignificant.

Regarding the effects of factor endowment variables on Colombian exports presented in models [2], [3] and [4], each is statistically significant and they all have a positive sign, whereby the human capital (HC_{Colj}) variable shows a prominent and positive effect on its exports. In particular, the RFE result indicates that the greater the difference in the capital-labour ratio between the countries, the greater the Colombian

exports to the EU. Similarly, the effect of the *HC* variable points out that the greater the difference in investment in human capital between the countries, Colombian exports to the EU will tend to grow. The effect of the *PD* variable is in line with the results of the previous variables, showing that a greater difference in population density between countries will increase Colombian exports to the EU. Consequently, founded on the results of the proposed regressions, we can confirm that the pattern of Colombian exports to EU countries is related to the Heckscher-Ohlin (H-O) model or an inter-industry trade pattern, whereby countries with different factor endowments will trade more with each other.

Table 4. Regression results for Colombian imports

Variables	Models for Colombian imports			
	[5]	[6]	[7]	[8]
LogDIST_{Colj}	0.045 (1.538)	1.317 (1.276)	-0.228 (1.517)	0.360 (1.384)
COMLANG_{Colj}	0.559** (0.257)	0.846*** (0.203)	0.799*** (0.173)	0.882*** (0.132)
COMLEG_{Colj}	-0.026 (0.156)	0.061 (0.153)	0.433 (0.287)	-0.038 (0.110)
LANDLOCK_j	-0.279 (0.354)	-0.360 (0.382)	-0.417 (0.473)	-0.244 (0.375)
EUROAREA_j	0.689*** (0.201)	0.562*** (0.184)	0.771*** (0.230)	0.703*** (0.240)
OECD_j	0.653 (0.793)	0.270 (0.780)	0.453 (0.788)	0.828 (0.945)
FTA_{Colj}	0.327*** (0.102)	0.515** (0.218)	0.577*** (0.155)	0.169 (0.107)
LogGDP_{Colj}	1.414*** (0.155)	1.391*** (0.142)	1.277*** (0.173)	1.325*** (0.131)

Table 4. Regression results for Colombian imports (continued...)

Variables	Models for Colombian imports			
	[5]	[6]	[7]	[8]
LogRFE _{Colj}		0.621** (0.270)		
LogHC _{Colj}			3.557** (1.793)	
LogPD _{Colj}				0.431** (0.188)
Constant	-21.819 (15.720)	-33.762** (13.297)	-16.827 (15.321)	-23.045* (13.387)
Observations	420	420	420	420
R-squared	0.924	0.931	0.938	0.945
Reset test	0.283	0.897	0.777	0.574
Time-invariant country fixed effects	X	X	X	X
Time fixed effects	X	X	X	X

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Similarly, we measure the effects of the included variables on Colombian imports. Model [5] indicates, unlike what is reflected in model [1], that the variables distance and common legal origin are statistically insignificant, as well as the variables that indicate whether the country is landlocked and whether it belongs to the OECD. On the other hand, variables such as $COMLANG_{Colj}$ and $EUROAREA_j$ seemingly exert a positive effect on Colombian imports. In the same line, an increase in the GDP of the pair of economies will have a positive effect on Colombian imports. Furthermore, the FTA factor has a positive effect on Colombian imports, unlike the statistical insignificance that the same factor seemingly has for Colombian exports to the EU.

Concerning the effect of the factor endowment variables on Colombian imports shown in models [6], [7] and [8], considering them as regressions that estimate the effects on Colombian exports, these variables offer statistical significance and a positive sign. Consequently, the greater the difference between the countries in the capital-labour ratio, in investment in human capital and population density, the greater the amount of Colombian imports from the EU. Therefore, based on the results, we can confirm that the pattern of Colombian imports to EU countries is associated with the Heckscher-Ohlin (H-O) model or an inter-industry trade pattern.

5. DISCUSSION

The results obtained by the gravitational model approach yielded some interesting insights on the effects of the process of trade integration between Colombia and the EU, and how the trade pattern developed between the parties based on the differences between their factor endowments.

The models that estimate the determinants of Colombia exports to the EU illustrate a notable negative effect from the distance variable on Colombian exports. This suggests that despite the advances in freight transport and the processes related to this activity, these costs are a critical factor that notably affects Colombian exports to the EU. In the same vein, if the EU country is landlocked, Colombian exports to these destinations will be negatively affected, which explains why most of its exports reach the EU through countries with access to the sea (see Figure 1). Additionally, landlock variable affects Colombian exports to a greater extent when the *RFE* and *HC* variables are considered in the gravitational model (models [2] and [3]), which suggests that their inclusion notably increases the negative effect of the landlock variable on Colombian exports. In contrast, the growth of the sum of the GDP of the pairs of countries has a positive effect on Colombian exports to the EU, which is in line with most of the related empirical research. Similarly, if the EU country belongs to the OECD, Colombian exports tend to increase notably. This elucidates why the largest amount of Colombian exports go to EU countries that belong to the OECD. Nonetheless, the most striking result to emerge from the results is that the *FTA* variable is

statistically insignificant, which indicates that the entry into force of the trade agreement between Colombia and the EU countries has had no impact (neither positive nor negative) on national exports. This result calls into question the effectiveness of the trade agreement between the parties in force since 2013 as a measure to increase Colombian exports and, subsequently, reduce its trade deficit with EU countries.

The following models, wherein we include different factor endowment measures, provide clear evidence for the relationship between the pattern of Colombian exports to EU countries and the Heckscher-Ohlin (H-O) model. Concerning this, the *RFE* and *PD* variables suggest that an increase in the differences between these measures would have a notable positive effect on Colombian exports to the EU. Similarly, the effect of the *HC* factor on Colombian exports would be outstanding, suggesting that the complementary structure of trade between the parties benefits from this dissimilarity. Based on the results from the differences in the factor endowments between the parties, it is possible to corroborate that the pattern of Colombian exports to the EU is related to the Heckscher-Ohlin (H-O) model since 50.2% of these are made up of oil and mining goods. The remaining exports are mostly made up of goods from the agricultural sector (69.3%) [MinCIT, 2021], statistical information that collectively supports our findings.

On the other hand, the models that estimate the determinants of Colombian imports mostly show results opposite to those reflected by the regressions that estimate the determinants of exports. Firstly, the distance factor is statistically insignificant, which indicates that the cost of transport does not affect the flow of imports from the EU. Second, if Colombia and an EU country share the same language, as is the case with Colombia and Spain, imports of the former will grow. Moreover, it is important to mention that, unlike the models that estimate Colombian exports, the landlock variable is insignificant in each of the models that estimate Colombian imports, which suggests that this factor neither harms nor promotes Colombian imports from the EU. This finding is supported by the evolution of Colombian imports from Spain, where constant growth can be appreciated in the analysed period (see Figure 2). Similarly, if the EU country belongs to the Eurozone, Colombian imports from these countries will grow, which explains why most of these flows come from countries that have the euro as their currency. Furthermore,

as in the export models, the effect of the sum of the GDP of the pairs of countries is positive, and therefore, its growth generates a favourable effect on Colombian imports from EU countries, an effect that is greater than that observed in Colombian exports (see Tables 3 and 4). As a final point, the FTA factor yields a positive effect on Colombian imports, suggesting that a trade agreement between the parties will increase these flows. This finding is opposite to what is reflected in our results for the export models and in line with the positive effects of FTAs in promoting trade flows between countries established by several authors.

Consistent with the results of the models of Colombian exports to the EU, in which we include measures for factor endowment, the Colombian import models also exhibit solid evidence for the relationship between the pattern of Colombian imports from the EU countries and the Heckscher-Ohlin (H-O) model. Similarly, the *RFE* and *PD* variables suggest a positive impact on Colombian imports; however, the *HC* factor provides a greater effect on the same. These results show, as in the export models, that the pattern of Colombian imports from EU countries is related to the Heckscher-Ohlin (H-O) model since the vast majority of imports originating in the EU are made up of capital goods, construction materials, goods of consumption and intermediate goods (MinCIT, 2021), statistical information that once again confirms the existence of a complementary trade structure between the parties.

In summary, these results show that, on the one hand, the trade agreement between Colombia and the EU has no effect on Colombian exports and, on the other hand, promotes Colombian imports from that destination, increasing the deficit in the trade balance between the parties (see Figure 3). Furthermore, the pattern of export and import flows between Colombia and EU countries are strongly related to the Heckscher-Ohlin (H-O) model, which suggests that in a complementary trade structure their bilateral trade is more likely to grow through inter-industry trade (Kabir and Salim, 2010).

6. CONCLUDING REMARKS

The purpose of this research is to determine the factors that drive Colombian trade (export and import flows) with the EU countries. Therefore, the authors present the results of applying a gravity model approach

to foreign trade among the parties between 2005 and 2019. The study yields insights into the trade effects resulting from the entry into force of the FTA between the parties and the trade patterns established by the differences in their factor endowments.

The research identifies factors that generate a positive effect on Colombian exports to the EU, such as sharing a common legal origin or that the EU destination belongs to the OECD or the sum of the GDP of the pairs of countries. Conversely, the distance factor between countries has a notably negative effect on their exports as well as the country of destination does not have access to the sea. Surprisingly, the FTA factor is statistically insignificant, which suggests that this variable does not have any impact on Colombian exports to the EU. Furthermore, Colombian imports from the EU are promoted by factors such as having a common language, that the EU country has the euro as its currency, the sum of the GDP of the pairs of countries and having an FTA in force. Regarding this last factor, unlike Colombian exports, this variable promotes imports from the EU. Additionally, models for Colombian exports to the EU and imports from the EU in which we measure the effect of the differences in their factor endowments in order to recognize trade patterns indicate a clear connection with the Heckscher-Ohlin (H-O) model, thereby proving the relevance of inter-industry trade between the parties.

Finally, our research determines the factors that explain the deepening of the deficit in Colombia's trade balance with EU countries, among which we highlight the positive effect of the trade agreement on the increase in its imports from the EU and the statistical insignificance of this variable in its exports to the EU. Additionally, we identify that Colombia and the EU countries carry out inter-industry trade based on their factor endowments, which should be considered by the Colombian government as an instrument that allows it to focus its trade policy towards those EU countries with different factor endowments. ◀

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Appendix A. Correlation matrix

	LogDIST_{Colj}	COMLANG_{Colj}	COMLEG_{Colj}	LANDLOCK_j	
LogDIST_{Colj}	1.000				
COMLANG_{Colj}	-0.332	1.000			
COMLEG_{Colj}	-0.472	0.280	1.000		
LANDLOCK_j	0.070	-0.090	-0.121	1.000	
EUROAREA_j	-0.310	0.160	0.542	-0.042	
OECD_j	-0.503	0.110	0.218	0.268	
FTA_{Colj}	0.000	0.000	0.000	0.000	
GDP_{Colj}	-0.477	0.237	0.274	-0.208	
LogRFE_{Colj}	-0.510	0.039	0.329	0.078	
LogHC_{Colj}	0.182	-0.260	-0.508	0.326	
LogPD_{Colj}	-0.243	-0.086	0.511	0.011	

Appendix B. Sample countries

AUT	FIN	LVA
BEL	FRA	MLT
BGR	GBR	NLD
COL	GRC	POL
CYP	HRV	PRT
CZE	HUN	ROM
DEU	IRL	SVK
DNK	ITA	SVN
ESP	LTU	SWE
EST	LUX	

	<i>EUROAREA_j</i>	<i>OECD_j</i>	<i>FTA_{Colj}</i>	<i>GDP_{Colj}</i>	<i>LogRFE_{Colj}</i>	<i>LogHC_{Colj}</i>	<i>LogPD_{Colj}</i>
	1.000						
	0.330	1.000					
	0.139	0.061	1.000				
	0.243	0.485	0.139	1.000			
	0.414	0.559	-0.136	0.364	1.000		
	-0.345	0.229	-0.168	0.092	0.171	1.000	
	0.246	0.084	-0.026	0.265	0.357	0.063	1.000