VICTOR HENRIQUE LANA PINTO

TWO ESSAYS ON TRADE AND QUALITY UPGRADING

Dissertação apresentada à Universidade Federal de Viçosa como parte das exigências do Programa de Pós-graduação em Economia Aplicada para a obtenção do título de *Magister Scientiae*.

Orientadora: Fernanda Aparecida Silva

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To my parents, Maisa and Luiz,
my sister, Lorena, and to my girlfriend, Júlya.

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ABSTRACT

PINTO, Victor Henrique Lana, M.Sc., Universidade Federal de Viçosa, October, 2019. **Two essays on trade and quality upgrading**. Advisor: Fernanda Aparecida Silva.

International trade represents an important driver to the development of nations. It raises living standards, creates employment, and enables consumers to enjoy a greater variety of products. However, countries do not pursue to engage in international trade solely targeting higher trade flow levels. Many economies seek to raise the quality of their products in order to gain improved access to the importing market, enhance competitiveness in international trade, increase productivity, pay higher wages, and raise product prices. Given the importance of quality upgrading, this master's thesis aimed to investigate the relationship between differing levels of economic integration agreements (EIAs) and the quality of exports as well as the link connecting import competition, quality upgrading and wages paid in the destination country. This research is comprised of two chapters. The first of them entitled 'Economic trade agreements and quality upgrading: does depth matter?' and the second of them 'Import competition induced quality change? The impact of imports on Brazilian wages'. The investigation conducted in the first chapter intended to contribute to the debate with respect to the quality of exports and how it is affected by the most varied types of EIAs. The main results collected evidence that regardless of the exporter or importer income structure, there exists a positive association between most levels of EIAs and the quality of exports. On the other hand, the analyses documented in the second chapter of this thesis sought to establish a relationship between the quality of imports and wages paid in Brazil. The main findings suggested that as the quality of imports increases, products facing foreign competition lead to a rise in wages paid in Brazil. In order to fight international competition, local firms might resort to quality upgrading by hiring skilled workers who, in turn, earn higher wages.

RESUMO

PINTO, Victor Henrique Lana, M.Sc., Universidade Federal de Viçosa, outubro de 2019. **Dois ensaios sobre o comércio e a melhoria da qualidade**. Orientadora: Fernanda Aparecida Silva.

O comércio internacional representa um importante prepulsor para o desenvolvimento das nações. Ele eleva o padrão de vida, gera empregos e permite que os consumidores desfrutem de uma variedade maior de produtos. No entanto, os países não buscam se engajar no comércio internacional visando apenas níveis mais elevados de fluxo comerciais. Muitas economias procuram elevar a qualidade de seus produtos para obter melhor acesso ao mercado importador, aumentar a competitividade no comércio internacional, obter maior produtividade, pagar salários mais altos e elevar os preços dos produtos. Dada a importância da melhoria da qualidade, esta dissertação de mestrado teve como objetivo investigar a relação entre diferentes níveis de acordos de integração econômica (AIE) e a qualidade das exportações, bem como o elo entre concorrência de importação, melhoria da qualidade e salários pagos no país de destino. Esta pesquisa é composta de dois capítulos. O primeiro deles intitulado *Economic trade agreements and quality upgrading: does depth matter?* e o segundo deles *Import competition induced quality change? The impact of imports on Brazilian wages*. A investigação realizada no primeiro capítulo pretendeu contribuir para o debate a respeito da qualidade das exportações e como ela é afetada pelos mais variados tipos de AIE. Os principais resultados evidenciaram que, independentemente da estrutura de renda do exportador ou do importador, existe uma associação positiva entre a maioria dos AIE e a qualidade das exportações. Por outro lado, as análises conduzidas no segundo capítulo desta dissertação buscaram estabelecer a relação entre a qualidade das importações e os salários pagos no Brasil. As principais conclusões sugeriram que, à medida que a qualidade das importações aumenta, os produtos que enfrentam a concorrência externa levam a um aumento nos salários pagos no Brasil. Para combater a concorrência internacional, as empresas locais podem recorrer à melhoria da qualidade contratando trabalhadores mais qualificados que por sua vez ganham salários mais altos.

LIST OF TABLES

LIST OF FIGURES

TABLE OF CONTENTS

1. Introduction

1.1. Background

Recent works have long discussed the importance of quality upgrading (BASTOS; SILVA, 2010; JAIMOVICH; MERELLA, 2015; VERHOOGEN, 2008). However, the understanding of what the quality of the output in fact represents, and how it can be estimated, remains a challenge for several researchers due to its subjective nature (RAMOS FILHO; MEDEIROS; ALBUQUERQUEMELLO, 2017).

Pinheiro, Markwald and Pereira (2002) note that the quality of the output represents a multidimensional concept that can be determined by measurable and immeasurable features. For these authors, measurable characteristics include performance, conformity and the durability of the product, while the immeasurable ones comprise, for example, tradition, reputation and the cultural aspects of a country, making measurement difficult. For this reason, many researchers have attempted to proxy the quality of the output through unit prices (i.e., the total industry export/import value divided by the quantity exported/imported by the industry), suggesting that higher unit prices indicate higher-quality goods (ALCALÁ, 2016; ANWAR; SUN, 2018; BRAMBILLA; PORTO, 2016; FLACH, 2016; HALLAK, 2006; HUMMELS; KLENOW, 2005).

A common observation on the theme is that countries aim to produce higher-quality goods to gain improved access to new markets and become more competitive in international trade. Producing higher-end varieties stimulates firms to become more productive, make use of skilled workers, pay higher wages, and helps to boost export revenues (BRAMBILLA; PORTO, 2016; HENN; PAPAGEORGIOU; SPATAFORA, 2015).

Several studies have examined the links between quality upgrading and international trade (BASTOS; SILVA, 2010; FLACH, 2016; HALLAK, 2006; MARTIN, 2012; VERHOOGEN, 2008). Among the existing literature, some researches have focused on the relationship between quality and trade liberalization and on the association between quality upgrading and wages (AMITI; KHANDELWAL, 2013; BAS; STRAUSS-KAHN, 2015; BRAMBILLA; PORTO, 2016; VERHOOGEN, 2008).

Accessing high-quality inputs could prove difficult if it incurs high costs. Amiti and Khandelwal (2013), Bas and Strauss-Kahn (2015) and Fan, Li and Yeaple (2015) argue that even though upgrading exports quality might help firms enter profitable markets, access to these markets can be costly. For this reason, firms may take advantage of trade liberalization to

upgrade the quality of their exports through facilitated accession (lower tariffs) to high-end imported intermediate goods (BAS; STRAUSS-KAHN, 2015; FAN; LI; YEAPLE, 2015).

Similarly, firms might also take advantage of economic integration agreements (EIA)[1] to upgrade the quality of their exports. This link relies on the idea that EIAs embody other aspects, besides trade liberalization, that might exert an influence over the quality of exports. For instance, countries trading under an EIA often experience enhanced competitiveness due to improved access to more advanced technologies and efficient allocation of production factors, which could potentially result in higher-quality exports. Moreover, countries involved in a monetary union, for example, being exempt from currency risk or exchange rate volatility when trading with partner markets, might reduce or even bring trade risk to zero when engaging in international trade. Baier and Bergstrand (2007) and Eicher and Henn (2011) note that EIAs increase members' international trade flows. For this reason, it was reasonable to expect a positive relationship between EIAs and quality upgrading due to the same benefits these agreements bring to trade.

The formation of the most varied levels of EIAs has certainly affected the way countries trade worldwide. According to data available on Comtrade (2018), the United States, for example, experienced a 112% increase in their exports to Canada and Mexico ten years after the creation of the North American Free Trade Agreement (NAFTA). Brazilian exports to Argentina, Paraguay and Uruguay reached an increase of approximately 382% a decade after the formation of the Southern Common Market (Mercosur). Similarly, Germany more than doubled its exports to the Eurozone countries ten years after the adoption of a common currency[2]. These figures per se do not point to firm conclusions; however, they provide an association between EIAs and the growth in traded volume among their member countries, as found in Baier and Bergstrand (2007), Baier, Bergstrand, Feng (2014) and Eicher and Henn (2011).

In respect of the relationship between quality upgrading and EIAs, data available on Comtrade (2018) also provide some indication of a possible association between high-end varieties and trade agreements. Two decades after the formation of the Mercosur, for example, the average quality (unit price) of Brazilian exports to Argentina, Paraguay, and Uruguay virtually doubled. Similarly, the average quality of German exports to the Eurozone exhibited

[1]Economic integration agreements (EIA) broadly refer to partial scope agreements, free trade agreements, customs unions, and common markets and monetary unions.

[2]Figures refer to percentage increase in total value of US exports to members of the NAFTA; Brazilian exports to members of the Mercosur; and German exports to members of the Eurozone. This analysis considers the year prior to the formation of the NAFTA, the Mercosur, and the adoption of the euro and ten years after each event.

a nearly 76% rise in 2009, twenty years after the adoption of the euro[3]. Furthermore, the number of EIAs has gradually increased over the past decades reaching more than 290 agreements in 2018 (WTO, 2018). As mentioned above, albeit partial, these figures might represent an early indication of a positive association between quality upgrading and the formation of differing levels of EIAs (GHAZALIAN; 2013; MATSUURA *et al.*, 2014).

Besides trade liberalization, income differentials have also shown to wield influence on the quality of a country's exports. Hallak (2006), Fieler (2012) and Crinò and Epifani (2012) verify that the income of a country can affect the quality of the output. These authors argument that the purchasing power impacts the choice pattern and the consumption of quality. In other words, the authors convey that higher-end varieties are generally destined to more developed, richer nations. Additionally, Schott (2004) and Hummel and Klenow (2005) uncover that higher-income countries are more inclined to producing and exporting higher-end varieties, especially due to their technological development and skilled workforce.

Another strand of the literature on quality, indicates that quality upgrading has a significant impact on wages in exporting countries (BRAMBILLA; PORTO, 2016; FLACH, 2016; VERHOOGEN, 2008). Brambilla and Porto (2016) establish that exporting higher-quality varieties require technologies and tasks that are skill intensive. Verhoogen (2008) highlights that skills play an important role in wage differentials. In consequence, high-quality exporters demand relatively higher levels of skills and pay higher wages.

Relatedly, exports might also have an impact on wages in their destination markets through intra-industry import competition. As in Aghion and Howitt (2005) and Aghion *et al.* (2009), productive firms in the importing market might seek to improve quality to compete against foreign-made varieties. Consequently, quality upgrading in the importing market creates a demand for skills that might translate into higher wages in destination countries. These authors also indicate an alternative scenario in which there exist short-run adjustment costs for workers who may lose their jobs in plants that close because of import competition.

Hallak (2006) and Schott (2004) observe that richer countries tend to produce and export high-end products. In the context of Brazil, between 1997 and 2016, most of the country's imports originated from high- and upper middle-income nations namely, the US, China, Argentina and Germany (COMEXSTAT, 2019). Thus, it is possible to assume that some of the products sourced in these countries may be of higher quality and might enter the Brazilian

[3]Figures refer to percentage increase in total average unit price (export trade value/quantity) computed as the mean value of all products exported by Brazil and Germany to the Mercosur and the Eurozone, respectively, corresponding to the 4-digit level of the Harmonized System (HS).

importing market stimulating competition against the domestic output. Along the years, for example, the average quality (unit price) of Brazil imports increased by nearly 67% between 2010 and 2014 (COMTRADE, 2018). During the same timeframe, wages paid in the country reported a 30% rise, approximately (PIA, 2018)[4]. Therefore, a deeper investigation into the quality of Brazilian imports and wages became pertinent.

This master's thesis is comprised of two chapters on international trade and quality upgrading. The first chapter aimed to investigate the relationship between various types of economic integration agreements and the quality of exports, whereas the second chapter looked to the link between import competition, quality upgrading and wages paid in Brazil.

1.2. Problem definition

Recent literature recognizes the importance of quality upgrading so that countries are able to gain access to larger markets and increase their trade values (AMITI; KHANDELWAL, 2013; BAS; PAUNOV, 2018; BASTOS; SILVA, 2010; BRAMBILLA; PORTO, 2016). For this reason, it is relevant to explore how the quality of exports affects and is affected by some variables. The following subsections elaborate on the problem definition of chapters one and two and contextualize the motivation behind each investigation. The first chapter inquired whether differing stages of economic integration promote quality upgrading; in other words, how do contrasting levels of EIAs affect the quality of exports of member countries? The second chapter examined whether the quality of imports results in higher wages in the destination country. More precisely, does import competition stimulate quality upgrading and affect wages paid in Brazil?

1.2.1. Economic integration and quality upgrading

Given the relevance of quality upgrading[5] and considering the growing number of EIAs, a more in-depth study on such a theme became timely. Economic integration represents a central feature of global trade dynamics. Countries in a mutual EIA benefit from more effective resources distribution, larger markets, income gains, foreign investment, and increased trade flows. Nevertheless, EIAs might also produce indirect effects on participating members, such as quality upgrading. This indirect effect certainly has the potential for significant debates.

[4]Figures refer to percentage increase in total average unit price (import trade value/quantity) computed as the mean value of all products imported by Brazil corresponding to the 4-digit level of the HS. Average wage computed as the sum of wages paid by all firms producing a given product divided by the aggregate number of workers employed by those firms available in the *Pesquisa Industrial Anual* (PIA).
[5]See Bas and Paunov (2018); Bastos and Silva (2010); Flach (2016); Hallak (2006).

Therefore, this subsection covered a deeper understanding of the topic, advanced on this channel and led to the problem definition of the first chapter.

Economically integrated areas enjoy considerable advantage in terms of tariffs reduction, modern technologies dispersion, increased firm productivity, and consequently stimulated domestic competition against imports[6]. Bastos and Silva (2010) and Verhoogen (2008) highlight that the most productive firms produce and export higher-quality varieties. Thus, higher productivity achieved through economic integration may represent one possible channel leading firms towards quality upgrading. Another probable channel linking EIAs and the quality of exports relies on the improved accession to more advanced technologies and foreign expertise embodied in high-end imported inputs.

The underlying idea is that, as countries become more integrated they gain easy access to more advanced production techniques, and are able to produce higher-quality goods. In addition, higher levels of EIAs, such as a currency union, enjoy the benefit of reduced trade risk. A fixed exchange rate system, and ultimately a common currency, indicate a means to promote trade and other forms of cross-border exchange via the reduction of transaction costs (FEENSTRA; TAYLOR, 2014). Consequently, economically integrated countries become highly competitive and might perceive quality upgrading as a necessary condition to resist market pressure.

A growing body of literature has examined the relationship between trade liberalization and quality upgrading[7]. Bas and Strauss-Kahn (2015) find that firms exploit input tariff cuts to upgrade the quality of their inputs in order to upgrade the quality of their exported varieties. Henn, Papageorgiou and Spatafora (2015) find that trade liberalization leads to faster quality upgrading, in both agriculture and manufacturing. Henn, Li and Yeaple (2015) find robust evidence that those industries that experienced the largest tariff reductions on their imported inputs increased the price and quality of their outputs. This study takes one step further and incorporates other advantages of EIAs, besides trade liberalization, that might exercise influence on the quality of exports.

The main contribution of this study is a systematic analysis of various types of EIAs and their impacts on the quality of exports. More specifically, this analysis examined the effects of partial scope agreements (PSA), free trade agreements (FTA), customs unions (CU), and

[6] Bustos (2011) highlights that trade liberalization can increase productivity by inducing a better allocation of production factors or the adoption of more advanced technologies.
[7] See Amiti and Khandewal (2013); Bas and Paunov (2018); Bas and Strauss-Kahn (2015); Bas (2012); Fan, Li and Yeaple (2015), Henn, Papageorgiou and Spatafora (2015).

common markets and monetary unions (CMMU)[8] on the quality of bilateral exports for a large number of goods and countries pairs between 2000 and 2017[9].

Baier, Bergstrand and Feng (2014) observe, for instance, that differing stages of EIAs have a positive effect on trade flows among partner countries yet other studies note that trade liberalization results in exports of higher quality (BAS; PAUNOV, 2018; BAS; STRAUSS-KAHN, 2015; FAN; LI; YEAPLE, 2015). As a whole, the general idea in this study was that countries engaged in deeper stages of EIAs produce and export higher-quality varieties.

1.2.2. Wages and quality upgrading

Considering the potential influence of import competition on wages paid in Brazil and the prominence of quality upgrading in modern trade dynamics, the analysis of the relationship between foreign-made goods and wages commands further attention. Hence, this subsection develops this idea and expands on the problem definition of the second chapter

Recent trade literature has explored the relationship between wages and the quality of exports[10]. Verhoogen (2008) finds that productive plants produce higher-quality varieties and pay higher wages to maintain a higher-quality workforce. Brambilla, Lederman and Porto (2012) find that firms exporting to high-income countries hire more skilled workers than other exporters and domestic firms[11]. Brambilla and Porto (2016) obtain evidence that industries that ship products to high-income destinations do pay higher average wages. Previous studies have found that exporters willing to access richer markets, for instance, need to become more intensive in skilled labor (BRAMBILLA; PORTO, 2016; FLACH, 2016; VERHOOGEN, 2008). This creates a demand for skills that turns into higher average wages in origin countries.

This second chapter of this study adds to the trade literature by exploring how quality upgrading affects wages through a novel perspective. The main contribution of the second

[8]Due to few observations on common markets and monetary unions, these two types of "deeper" EIAs form the variable CMMU, representing "deep" EIAs along with CUs, similarly to Baier, Bergstrand, and Feng (2014). A partial scope agreement denotes a group of economies who agrees to reduce tariffs on only certain products between themselves. A free trade agreement refers to a set of countries who voluntarily agrees to remove trade barriers between themselves. A customs union refers to a free trade area in which the countries also adopt identical tariffs between themselves and the rest of the world. A common market describes a group of countries that aim to promote duty free trade and the free movement of labor and capital among its members. A monetary union expands the idea of a common market to all goods and services, capital and labor markets and adopts a common currency among members (FEENSTRA; TAYLOR, 2014; WTO, 2019). Table 13 in Appendix provides a list of the EIAs included in the analyses of the first essay.

[9]Because firm-level data are not available, this study is constrained to investigating EIAs impacts on products defined at the 4-digit HS category level, as in Hillberry and McDaniel (2002), Kehoe and Ruhl (2009), and Foster et al. (2011). Country pairs consist of 40 countries or nearly 96% of the world's exports (WITS, 2019). Table 11 in Appendix shows the list of countries included in this analysis. The timeframe provides complete coverage from the expansion in the number of countries involved in EIAs as of 1990s to the most recent date (WTO, 2018).

[10]See Brambilla and Porto (2016); Flach (2016); Schank, Schnabel and Wagner (2007); Verhoogen (2008).

[11]Countries value quality differently, with richer countries valuing higher quality varieties more than poor. This creates a demand for quality products, especially in high-income destinations (BRAMBILLA; PORTO, 2016).

chapter is the investigation of the relationship between quality upgrading and wages in the destination country. Specifically, this chapter analyzed the effect of the quality of imports on wages paid in Brazil from 1997 to 2016[12] according to the product classification of the PIA[13]. This investigation examined exports to Brazil from its main trade partners[14], provides wide time coverage, and thus allows a deeper comprehension of the topic.

The choice of the destination country lies in the fact that Brazil has imported along the period mostly capital-intensive goods – nearly 65% of the country's total imports from 1997 to 2016 (WITS, 2018). Moreover, it is sensible to consider that the production of these goods (capital-intensive) normally entails skill- and capital-intensity and tends to originate from high-income exporters (SCHOTT, 2004), which are often capital-abundant. According to Falvey (1981) and Falvey and Kierzkowski (1987), the production of higher-quality goods requires higher capital-intensity, leading to the assumption that a significant share of Brazil imports might be of higher quality.

The channel connecting these ideas establish that imports exert pressure in destination markets. In other words, industries in destination countries must deal with competition against imports. As a result, firms in importing countries may need to modify the production process and become more intensive in skilled labor.

Firms in the importing market experience one of the two following situations: (i) they resort to new technologies and employ skilled workers, which might lead to an increase in wages, or (ii) they are unable to incorporate new production technologies or hire skilled workers, and thus, do not have the means to quality-upgrade. In such a case, firms may terminate their operations and workers are likely to lose their jobs (AGHION; HOWITT, 2005; AGHION *et al*., 2009; AMITI; KHANDELWAL, 2013).

Some studies relate the situations mentioned above to the trade liberalization agenda implemented in Brazil in 1990. Feijó and Carvalho (1994) argue that the opening of the Brazilian economy stimulated firms to undergo a managerial revolution, and to acquire modern machines and equipment. Contrarily, Chamon (2015) reports a strong decrease in employment during the following years of the trade liberalization in the country. For him, firms in which productivity was low were the most likely to close down, causing employment to inevitably decline.

[12]This timespan comprises the data commonly available in the PIA and Comexstat databases.
[13]The PIA database considers numerous product groups namely, food products, animal, vegetable, textiles and clothing, hides and skins, wood, footwear, chemicals, machines and electronics, plastic and rubber, transportation, and miscellaneous, minerals, metals, stones and glass, and fuel at the 8-digit *Nomenclatura Comum do Mercosul* (NCM) category level.
[14]These represent 60 countries or nearly 90 % of Brazil's total imports (COMEXSTAT, 2019). Table 14 in Appendix shows the list of countries included in this analysis.

1.3. Hypotheses

a) As countries engage in deeper levels of economic integration, they trade higher-quality goods.
b) Import competition stimulates quality upgrading and causes a wage increase in Brazil.

1.4. Objectives

1.4.1. General objectives

a) To investigate the relationship between EIAs and the quality of exports from 2000 to 2017.
b) To verify the relationship between the quality of imports and wages in Brazil from 1997 to 2016.

1.4.2. Specific objectives

a) To analyze the effect of contrasting stages of economic integration agreements on the quality of bilateral exports.
b) To evaluate the impact of the quality of Brazilian imports on wages paid in Brazil.

CHAPTER 1

ECONOMIC TRADE AGREEMENTS AND QUALITY UPGRADING: DOES DEPTH MATTER?

1. Introduction

In the past few decades, researches on international trade have sought to investigate the most varied drivers of exports as well as their performance through time. International trade represents one of the key factors of macroeconomic prosperity for most nations worldwide. However, some of its aspects have not yet been fully explored and need to be submitted to critical analyses regarding the constantly changing global economic environment.

Krugman (1981) noted that most of the world's trade consists of the exchanging of products within the same industry, i.e. intra-industry trade. This type of commerce is made possible because in the past decades products within the same industry have become highly differentiated, and intra-industry trade provides the opportunity of having a vast range of vertically superior goods[15]. Thus, the investigation of quality upgrading has gained importance in the trade literature[16].

Various authors looked to establish a relationship between the quality of exports and economic variables (FLACH, 2016; JAIMOVICH; MERELLA, 2015; MARTIN; MEJEAN, 2014; VERHOOGEN, 2008). More specifically, some researchers attempted to investigate trade liberalization and its impacts on the quality of exports (BAS; PAUNOV 2018; BUSTOS, 2011). The motivation of these authors relies on the idea that trade openness results in the adoption of foreign know-how embodied in imports that could stimulate the production of new and better products.

According to the World Trade Organization (2019), as of the 1990s trade liberalization has increased significantly through the intensification of EIAs. More precisely, this number rose from 25 in 1990 to 289 in 2017. Countries involved in the most varying types of EIAs benefit from the dynamic gains of trade as tariffs are reduced, new products are introduced in the domestic economy, and as countries gain access to higher-quality inputs, which support firms in expanding their product range and set a context for quality upgrading (BAS; PAUNOV, 2018).

[15] Products can be horizontally or vertically differentiated. The horizontal dimension refers to the different types of goods while the vertical dimension refers to the intrinsic quality of each specific product, that is, characteristics that present substantial differences from one product to another (JAIMOVICH; MERELLA, 2015).

[16] See Bas and Strauss-Kahn (2015); Bas and Paunov (2018); Khandelwal (2010).

Analyzing data from the WTO on EIAs allows for a better understanding of the various stages of economic integration and the provisions that they provide their member countries. The WTO reports on bilateral and multilateral associations varying from 'shallower' to 'deeper' levels of EIAs. As noted in Baier, Bergstrand and Feng (2014), the former term refers to lower levels of trade agreements, such as a partial scope agreement and a free trade area, yet the latter indicates highly integrated economies such as a customs union, a common market or a monetary union.

According to the WTO (2019) a partial scope agreement denotes a group of nations who agree to reduce import tariffs on a limited set of products between themselves. A free trade area refers to a set of economies who voluntarily decide to remove trade barriers between member countries. Scaling up to a deeper level of EIA, a customs union describes a group of countries who aim to eliminate barriers and also adopt identical import tariffs between themselves and the rest of the world. Countries gathered in a common market seek to promote duty free trade and the free movement of labor and capital among its members. Ultimately, a monetary union expands the idea of a common market to all goods and services, capital and labor markets, and adopts a common currency among members (FEENSTRA; TAYLOR, 2014).

Primarily, all types of agreements aim to stimulate trade via a reduction or even elimination of import tariffs (WTO, 2019). However, each level of EIA (as mentioned above) includes benefits that exceed trade liberalization. These provisions have the potential to not only boost trade flows but also produce an effect on the quality of a country's exports (GHAZALIAN; 2013; MATSUURA *et al.*, 2014). Economies involved in a common market, for instance, profit from free international factor movements. This could be translated into a better allocation of production factors stimulating quality upgrading via the dispersion of more skilled workers, for instance.

Rough time series data from UN Comtrade (2019) and Larch (2008) combining information on the quality of exports (export trade value/quantity) and EIAs, respectively, allowed to observe the average quality of goods traded under each type of EIA over time. For instance, this early investigation revealed that the quality of products traded between countries engaged in a customs union and in a common market or monetary union increased approximately 22% and 31% between 2000 and 2017, correspondingly. This analysis threw some light on the possible association between contrasting types of EIAs and the quality of exports; however, such a relationship still commands further attention.

Unlike the existing researches in the trade literature, the study carried out in this chapter aimed to investigate the link between different stages of EIAs and the quality of exports of the

world's 40 main exporters between 2000 and 2017[17]. More specifically, this chapter analyzed the quality of bilateral exports of countries mutually involved in partial scope agreements, free trade areas, customs unions, common markets and monetary unions. The analyses conducted in this chapter cover nearly 96% of global trade between 2000 and 2017 and mostly distinguishes from the related literature by delivering a country product-level investigation.

Baier, Bergstrand and Feng (2014) observe that both shallower and deeper levels of economic integration arrangements have a positive effect on trade flows. Additionally, Bas and Paunov (2018) note that a reduction in tariffs offers firms with stronger incentives to quality upgrade. This study advances on the aforementioned researches by expanding the exploration of various types of EIAs into how they can affect quality. Furthermore, this chapter adds to Bas and Paunov (2018) by analyzing the full effect of EIAs, i.e. the effects of trade liberalization and also the adjacent provisions included in trade agreements that could affect the quality of exports of participating countries.

In general, this chapter attempts to contribute to the comprehension between EIAs and the quality of exports. Moreover, it yields motivating policy suggestions. Policymakers focusing on reducing barriers to trade ought to consider that EIAs might have an end effect on the quality of a country's output. Alternatively, policies focusing upon quality upgrading may regard EIAs as a means to producing and exporting higher-end varieties. Either way, quality upgrading benefits participants indirectly through the access to modern technology, enhanced production techniques, skill-based workforce incentives, to name a few.

The remainder of this chapter is organized as follows. The second section presents a general theoretical framework that summarizes related trade models of trade liberalization and quality. The third section describes the methodology. The fourth section presents the main results. To end, the fifth section concludes.

2. Theoretical framework

The first studies to investigate quality-upgrading specialization focused on differences in technology and/or factor endowments[18]. These researches have broadly concluded that better-endowed nations show considerable potential for high-quality exports. Nevertheless, other aspects rather than technology differentials or the distribution of resources also affect the quality of a country's exports. For Amiti and Konings (2007), Pavcnik (2002), and Tybout and Westbrook (1995) reducing tariffs on final goods and/or on intermediate inputs promote

[17]A detailed list of the EIAs and countries used in this chapter is available in Tables 13 and 11 in Appendix, respectively.
[18]See Falvey (1981); Falvey and Kierzkowski (1987); Flam and Helpman (1987); Grossman and Helpman (1991).

productivity gains. These authors note that lower output tariffs can increase productivity through tougher import competition, whereas cheaper imported inputs can raise productivity via knowledge transfer, variety, and quality effects.

For Bustos (2011), trade liberalization can affect the choice of a firm to technology-upgrade. The author notes that trade integration reallocates market shares towards exporters and the most productive firms, increasing aggregate productivity. Bustos (2011) shows that, in addition, the resulting increase in revenues (via improved productivity) may induce exporters to invest in new technologies. Thus, the author introduces a model of trade in which more productive firms make higher revenues and consequently are the ones willing to pay the fixed costs to enter the export market. Her model considers that technology upgrading is proportional to revenues, therefore only the most productive firms are able to adopt the most advanced technology.

Fan, Li and Yeaple (2015) advance on the theoretical model proposed in Bustos (2011) by rationalizing the relationship between trade liberalization and quality upgrading. The authors consider the behavior of a firm that is sufficiently productive to incur fixed costs to both export a final good and to import intermediate inputs. For them, a reduction in import tariffs lowers the marginal costs incurred by the firm on its existing set of imported inputs and induces the firm to enlarge the set of goods imported. The authors consider that tariffs reduction on imports (via trade liberalization) promote an increase in the quality of exports that is sufficiently large that the price of exports increases.

Similarly to Fan, Li and Yeaple (2015), Bas and Paunov (2018) provide a simple framework establishing a link between input-trade liberalization, access to new input varieties and quality upgrading. Bas and Paunov (2018) consider in their theoretical model that firms can produce numerous products paying fixed costs of product differentiation. The assumption is that product design incurs fixed costs paid in units of labor and that firms produce each final good combining intermediate inputs and labor. Firms choose inputs optimally to maximize profits and produce a final good as long as the profits generated are equal to or greater than the fixed costs of production. Since there exist variable and fixed costs of importing foreign-made input varieties, only the most profitable firms are able to source inputs from abroad.

The existing theories investigate the relationship between trade liberalization and the quality of exports. However, such theories could also mirror the link between EIAs and quality upgrading given that trade liberalization represents one of the multiple benefits of trade agreements. Bas and Paunov (2018) establish two theoretical mechanisms through which input-trade liberalization affects the scope of a product. First, the authors assume that imported inputs

are of a higher quality than domestic ones, and second, that the access to new foreign-made inputs represents an investment in a more advanced technology that reduces the marginal costs of production.

To simplify the model, the authors assume that producers are price-takers in input markets and that the price of domestic inputs equals the wage, which is used as a numeraire, whereas the price of imported inputs takes into account the input tariff. Firms come to the decision to either use domestic or imported inputs. Firms relying on domestic inputs face a cost index as follows:

$$C_d = 1 \tag{1}$$

Those relying on imported inputs assume the following cost index:

$$C_m = \left(1 + \left(\frac{\tau_m}{\gamma_m}\right)^{\frac{\alpha}{\alpha-1}}\right)^{\frac{(\alpha-1)\eta}{\alpha}} \tag{2}$$

where C_d and C_m represent the costs of domestic and importing firms, respectively; τ_m is the input tariff; and γ_m indicates the quality of foreign inputs.

The idea is that as importing firms gain access to high-quality imported inputs, their efficiency increases. Thus, the relative cost faced by importing firms in comparison with domestic firms denotes an increasing function of input tariffs[19]:

$$\frac{c_m}{c_d} = c_m \tag{3}$$

It is possible to note in Eq. (2) that as τ_m reduces, via trade liberalization and via the formation of EIAs, the relative unit costs of importing firms in relation to non-importing firms, Eq. (3), tends to C_m, *ceteris paribus.*

In the context of reduced input tariffs, trade liberalization or the formation of an EIA allows domestic firms to have easy access to higher-quality inputs sourced abroad (member countries). Consequently, these inputs provide domestic firms with the means to produce and export higher-quality varieties. Furthermore, as tariffs are reduced, domestic and foreign firms become more competitive given that national goods compete directly against imported varieties. For this reason, the formation of an EIA (via trade liberalization) has the potential to encourage firms in the domestic and foreign countries to quality-upgrade their outputs.

The theoretical framework proposed by Bas and Paunov (2018) clearly presents the mechanism through which input tariff reductions affect the decision of firms to expand the set of imported varieties and high-quality imported inputs. Such a mechanism also tends to occur

[19] Partially differentiating c_m with respect to the input tariffs: $\frac{\partial c_m}{\partial \tau_m} > 0$.

with the formation of economic integration agreements. The model shows that input tariff cuts reduces the relative cost of using high-quality imported intermediate goods and increase variable profits. Such an increase in turn allows firms to have access to a larger number of imported varieties. The imported inputs of higher quality also boost the variable profits of the firms due to the efficiency gains of foreign-made inputs in the production process. In consequence, firms can cover the fixed costs of production to introduce new final goods and widen the scope of their products (BAS; PAUNOV, 2018).

3. Methodology

This section is distributed in four parts. The first subsection elaborates on the proxy used to estimate the quality indicator. The second part shows the empirical model used in the analysis of differing levels of EIAs and the quality of exports. The third part expands on the strategy used in the empirical estimations. Finally, the fourth subsection demonstrates the source of the data used in this chapter.

3.1. Unit price as the quality indicator

Recent trade literature has broadly discussed and attempted to find an adequate proxy for the variable quality (SCHOTT, 2004, HUMMELS; KLENOW, 2005; HALLAK, 2006). According to Pinheiro, Markwalk and Pereira (2002), the quality of a product relates to the product's durability, reputation, performance, branding, and cultural aspects of its exporter, which are not simple to measure. Altogether, these denote a common obstacle in defining the quality of the output. Ramos Filho, Medeiros and Albuquerquemello (2017) note, for instance, that data on the quality of worldwide traded varieties are rare, possibly due to the subjective nature of quality. For these authors, information on quality involves different countries, each with its particular features, making such a measurement even more difficult to attain.

Numerous studies endeavored to infer the quality of the output indirectly, by observing, for instance, output prices or unit values[20]. The unit price, in other words, the export/import trade value divided by the exported/imported quantity, indicates a common variable to proxy quality, suggesting that higher unit prices result in higher-quality goods. Thus, this study used unit prices to proxy for the quality of the output and assess the mechanisms linking EIAs to this variable.

[20] See Alcalá (2016); Bastos and Silva (2010); Brambilla and Porto (2016); Flach (2016); Hallak (2006); Hallak and Schott (2011); Hummels and Klenow (2005).

Some authors have felt the need to provide convincing arguments as to why the use of unit prices could be an adequate measurement for the variable quality. Schott (2004) and Anwar and Sun (2018) demonstrate that because higher-quality goods are relatively capital and skill intensive, they exhibit enhanced features, which result in higher prices. For the former author, countries use their endowment lead to produce higher-end varieties and charge higher prices. In their recent work, Anwar and Sun (2018) prove that the quality of exports is closely intertwined with the industry export prices, confirming that foreign direct investment affects the quality of exports and that it can be recognized from its effect on export prices.

Feenstra and Romalis (2014), contrarily, attempt to disentangle quality from trade unit values and rely on the demand side to identify quality together with a simple supply side to control for the extensive margin. Nonetheless, these or other researchers have not yet found a common ground in the trade literature so as to establish the most accurate estimation procedure to quality.

3.2.Empirical specification

The following model inspired by the studies of Bas and Paunov (2018), Bas and Strauss-Kahn (2015), Bustos (2011) and Fan, Li and Yeaple (2015) aimed to investigate the relationship between contrasting levels of economic integration agreements and the quality of exports of their member countries.

$$\ln\left(P_{kij,t}^{EXP}\right) = \beta_0 + \beta_1 PSA_{ij,t} + \beta_2 FTA_{ij,t} + \beta_3 CU_{ij,t} + \beta_4 CMMU_{ij,t} + \beta_5 \ln\left(GDP_{i,t}\right) + \beta_6 \ln\left(GDP_{j,t}\right) + \varepsilon_{kij,t} \quad (4)$$

where $P_{kij,t}^{EXP}$ refers to the quality indicator, as in Alcalá (2016), Bas and Strauss-Kahn (2015) and Brambilla and Porto (2016), and corresponds to the unit price of product k[21] from country i to country j at time t (2000-2017)[22].

$PSA_{ij,t}$, $FTA_{ij,t}$, $CU_{ij,t}$ and $CMMU_{ij,t}$, the main explanatory variables, are dummies that equal one if both exporting and importing countries are mutual members of the respective EIA and zero otherwise. One relevant characteristic feature of Eq. (4) is a more disaggregated analysis of the effects of deeper levels of EIAs on the quality of exports. For instance, due to few observations on common markets and monetary unions, Baier, Bergstrand and Feng (2014) combined these two types of deeper EIAs with customs unions to form a single dummy variable

[21] This study includes information on all reported products corresponding to the 4-digit level of the HS.
[22] The list of exporting and importing countries analyzed in this chapter is included in Table 11 in Appendix. This list comprises the world's top 40 exporting nations trading globally between 2000 and 2017 or nearly 96% of the global trade.

representing deep EIAs. Furthermore, these authors analyzed a gravity equation in which their dependent variable was trade flows and not quality.

Coefficients for the dummy variables were expected to be positive and statistically different from zero meaning that as countries engage in profounder levels of EIAs they tend to trade higher-quality varieties. Relatedly, Baier, Bergstrand and Feng (2014) find that deeper EIAs have larger impacts on aggregate trade flows in comparison with shallower agreements. Therefore, it was possible to presume that EIAs through enhanced competitiveness could also affect the quality of exports positively.

$GDP_{i,t}$ and $GDP_{j,t}$ correspond to the gross domestic product of exporting and importing countries, respectively, in *t*. These variables, as in Henn, Papageorgiou and Spatafora (2015), were expected to deliver positive and statistically significant estimates in Eq. (4). These authors note that unit values increase with income at a relatively constant rate and highlight that among high-income countries average export quality levels vary within a narrower band. Moreover, their findings suggest that developing countries experience larger effects on quality levels, even when controlling for income.

Lastly, $\varepsilon_{kij,t}$, indicates the error term.

3.3.Empirical strategy

A standard econometric issue addressed in several empirical studies is the potential endogeneity of right-hand-side variables (ALCALÁ, 2016; HALLAK, 2006; HALLAK; SCHOTT, 2011). In this study, dummies representing EIAs are potentially endogenous. According to Baier and Bergstrand (2007), self-selection of country-pairs into trade agreements likely creates a significant endogeneity bias in estimates of the effects of EIAs on trade flows. From the understanding that economic integration promotes trade flows (BAIER; BERGSTRAND, 2007; BAIER; BERGSTRAND; FENG, 2014; EICHER; HENN, 2011) and that in consequence, intense market competition might yield higher-quality varieties, it was reasonable to consider that such an issue would too hold for the relationship between EIAs and quality upgrading.

Given the problems associated with accounting for endogeneity of EIAs using instrumental variables and cross-section data, Baier and Bergstrand (2007) incorporated a panel technique and data with fixed effects (FE). The authors note that FE could represent a suitable way to obtain consistent estimates, solve the endogenous self-selection of country pairs into EIAs, and offer an alternative approach to instrumental variables.

Interestingly, Baier, Bergstrand and Feng (2014) incorporate an alternative specification using first-differencing. These authors discuss that the effect of EIAs on trade flows increases dramatically after 10-15 years from their formation, which led this research to taking into account that quality upgrading might reap the benefits of economic integration over time and not immediately after the creation of a trade agreement. Accordingly, Cheng and Wall (2005) and Wooldridge (2000) both argue in favor of using data differenced over a longer period than annually. Cheng and Wall (2005, p. 8) note that "Fixed-effects estimations are sometimes criticized when applied to data pooled over consecutive years on the grounds that dependent and independent variables cannot fully adjust in a single year's time."

Baier, Bergstrand and Feng (2014) explain that one possible reason is that most EIAs are 'phased-in' over 5-10 years. Therefore, using first differencing over five-year intervals instead of yearly differencing or a FE model allows for separating the shorter- from the longer-term effects (5-10 years) and for delivering consistent results to the effects of EIAs on quality.

For these reasons, this study followed Baier, Bergstrand and Feng (2014) and incorporated first differencing over five years (FD henceforth), as shown in Eq. (5).

$$\Delta_5 \ln (P_{kij,t}^{EXP}) = \beta_0 + \beta_1 \Delta_5 PSA_{ij,t} + \beta_2 \Delta_5 FTA_{ij,t} + \beta_3 \Delta_5 CU_{ij,t} + \beta_4 \Delta_5 CMMU_{ij,t} + \beta_5 \Delta_5 \ln (GDP_{i,t}) + \beta_6 \Delta_5 \ln (GDP_{j,t}) + \varepsilon_{kij,t} \quad (5)$$

where Δ_5 corresponds to first differencing over five years for each of the variables included in Eq. (4).

Baier, Bergstrand and Feng (2014) also note that first-differencing the panel data yields some potential advantages over fixed effects. First, it is relatively reasonable that the unobserved factors influencing the likelihood of an EIA are likely slow moving and for this reason the error term is serially correlated. The authors note that in case $\varepsilon_{kij,t}$ is highly serially correlated, the inefficiency of FE is exacerbated as T gets large. This suggests that differencing the data increases estimation efficiency for the panel considered in this study.

3.4.Data

This study was carried out with product-level yearly data from 2000 to 2017. The timeframe comprises the years after the expansion in the number of EIAs from when several economies began a prominent engagement into varying levels of trade arrangements (WTO, 2019).

Data in this chapter were merged from various sources. Product-level data on export values (US$) and export quantity (kg) for both reporting and partner countries are from the

World Integrated Trade Solutions, corresponding to the 4-digit level of the HS classification. Data on economic integration agreements come from Mario Larch's regional trade agreements database. Lastly, data on GDP, PPP (current international US$) of exporting and importing countries are from the World Bank.

4. Results and discussion

This section is comprised of two parts. Initially, the first of them presents an analysis of the descriptive statistics for the variables included in both Eqs. (4) and (5). The second subsection displays the results of the first-differencing specification used to investigate the relationship between varying levels of EIAs and the quality of bilateral exports for a selected group of countries.

4.1. Descriptive statistics

This subsection precedes the econometric results of Eq. (5) and provides a detailed observation of the sampled countries and the product-level data. Table 1 shows averages, standard deviations and extreme values for the quality of bilateral exports, export values between 2000 and 2017, export quantity, information on the dummy variables indicated in Eq. (5), the gross domestic product and the number of observations included in the baseline sample.

Table 1 – Summary statistics of the variables included in this study.

Variable	Obs.	Mean	Std. Deviation	Min	Max
Quality (log of unit price)	14,062,266	2.36	1.99	-15.79	20.29
Export value (US$)	14,062,266	9,37 mi	155 mi	1	85,2 bi
Net weight (tons)	14,062,266	7,845.20	848,000	0.001	1,57 bi
PSA	14,062,266	0.07	0.25	0	1
FTA	14,062,266	0.23	0.42	0	1
CU	14,062,266	0.28	0.45	0	1
CMMU	14,062,266	0.39	0.48	0	1
GDP exporter (US$)	14,062,266	2,29 tri	3,69 tri	61 bi	23,4 tri
GDP importer (US$)	14,062,266	2,10 tri	3,62 tri	61 bi	23,4 tri

Source: Author's calculations.
Note: Quality refers to the logarithm of the unit price (export value divided by net weight). Numbers rounded to two decimal places.

Quality presented extreme values varying from -15.79 to 20.29. The highest-quality product was observed for exports of 'Diamonds, whether or not worked, but not mounted or set' (HS 7102) originated in Canada destined to the United Kingdom in 2008. The product registering the lowest-quality value refers to exports of 'Sulphur of all kinds; other than

sublimed, precipitated and colloidal sulphur' (HS 2503) shipped from Denmark to Norway in 2013.

The average export value among the world's main exporters between 2000 and 2017 was approximately 9,37 million dollars. The highest export volume was sent from Canada to the United States in 2014 and refers to exports of 'Petroleum oils and oils obtained from bituminous minerals; crude' (HS 2709). The mean quantity value was 7,845.20 tons and corresponds to exports of 'Springs and leaves for springs, of iron or steel' (HS 7320) traded between Malaysia and Singapore in 2013.

The sample covers 1560 (40 x 39) country pairs and a large set of products from 2000 and 2017 resulting in over 14 million observations. Information presented in Table 1 for all variables of interest – PSA, FTA, CU, and CMMU dummies – indicates that only a minor portion of the sampled country pairs are involved in a partial scope agreement. The mean value shows that PSA accounts for 7% of the baseline sample. Table 1 also shows that 23% of the sampled country pairs are engaged in a mutual free trade area. Average figures for these variables imply that 30% of the country pairs under analysis have shared a mutual PSA or FTA in the 2000-2017 timeframe. In other words, nearly one third of the sampled countries are involved in 'shallower' economic integration agreements.

Conversely, turning now to the descriptive analysis for 'deeper' EIAs, shown in Table 1, the mean value for customs unions and common market and monetary union exhibit that these types of EIAs correspond, respectively, to 28% and 39% of the country pairs analyzed. Altogether, these figures imply that 67% of the sampled countries are members of a 'deeper' economic agreement. This perception could be understood by the fact that higher levels of EIAs generally involves a larger number of participating countries (WTO, 2019).

When it comes to the gross domestic product of the sampled countries, the mean value between exporters and importers slightly varied due to the number of products traded between them. However, given that the data included in this study consider the same set of exporting and importing countries (bilateral data), extreme values are unsurprisingly identical. In Table 1, the lowest figure for this variable was 61 billion dollars corresponding to the GDP of the Slovak Republic in 2000. The highest GDP in the sample equaled 23,4 trillion dollars and was registered for China in 2017.

Table 2 shows descriptive statistics for the variable quality and the EIA dummy variables considering the income groups of exporting and importing countries[23]. Various papers

[23] High-income economies are those with a gross national income (GNI) *per capita* of $12056 or more (WORLD BANK, 2019).

on quality upgrading have foreseen a positive relationship between a country's income and average trade prices (quality), meaning that richer economies consume, produce and export higher-quality goods (CRINÒ; EPIFANI, 2012; FIELER, 2012; HALLAK, 2006; HUMMELS; KLENOW, 2005; SCHOTT, 2004). For this reason, taking into account the income structure of exporting and importing countries allowed for a better comprehension of the quality a country's output.

Table 2 - Mean values of variable quality and EIA dummies for income subsamples

Variable / Income group	Full sample	High-income exporter High-income importer	High-income exporter	High-income importer
	(1)	(2)	(3)	(4)
Quality (log of unit price)	2.36	2.47	2.50	2.35
PSA	0.06768520	0.0091806	0.0261154	0.0310001
FTA	0.23487130	0.2621360	0.2451375	0.2487565
CU	0.23824302	0.4391041	0.3449173	0.3601098
CMMU	0.38632550	0.5783994	0.4617404	0.4760074
Observations	14,062,266	8,077,060	10,879,964	10,291,683

Source: Author's calculations.
Note: Quality refers to the logarithm of the unit price (export value divided by net weight).

Table 2 allows to compare the mean values of the variable quality as well as each dummy variable representing a type of EIA. It is possible to note in column (3) of Table 2 that the highest quality level was observed for products originating in higher-income countries. This early finding is in line with Hummels and Klenow (2005) and Schott (2004) who have noticed that more developed nations tend to export higher-quality products, mainly due to technological development capacity and skilled labor.

When the analysis solely regarded trade between richer nations, shown in column (2), the average quality level was 2.47, suggesting that richer economies indeed traded higher-end varieties between 2000 and 2017. The mean value of the variable quality shown in column (4) indicates that the income of the importer delivers a slightly similar quality level with respect to the full sample. Bils and Klenow (2001) have unveiled comparable findings. These researchers note that such a specialization occurs because richer individuals tend to consume higher-quality goods.

The examination of income subsamples, shown in Table 2, allows for interesting assumptions in respect of the EIA dummies. Column (2) displays a tendency of richer countries in joining 'deeper' types of economic integration agreements. It is possible to clearly note that most countries in this subsample are involved either in a customs union or a common market

and monetary union. The mean figure for customs union, for instance, demonstrated that virtually 44% of the richest countries are mutually engaged in this type of EIA. The mean value for the highest level of economic integration (CMMU) revealed that more than half of the richest economies under study, or nearly 58%, are partners in a common market and monetary union.

Turning now to the analysis of 'shallower' levels of trade agreements, columns (1) through (4) explicit that between 2000 and 2017 only a small share of the sampled countries participated in partial scope agreements. When the analysis was narrowed down to richer exporting and importing economies this number reached zero, indicating that higher-income economies do not tend to participate in this type of EIA, as noted in column (2). When either the exporting or the importing country shows a higher-income structure, figures indicated that the participation of countries in a mutual PSA equals 2.6% and 3.1%, correspondingly.

Therefore, the analysis of Table 2 provided an initial indication of how countries are distributed among the varying types of economic agreements. Table 2 allowed to roughly infer that, between 2000 and 2017, richer economies were more focused on joining higher or 'deeper' levels of EIAs and that only a small portion of the sampled countries, regardless of their income structure, was engaged in 'shallower' types of trade arrangements, such as PSAs. The analysis of Table 2 also suggested that free trade agreements might not be affected by the income structure of partner countries. However, these still represent prima facie evidence and thus do not establish a solid relationship between income structure and the quality of the output.

Figure 1 complements the previous analyses and shows the distribution of variable quality for each type of EIA. The top-left panel refers to the average quality of exports of countries involved in a partial scope agreement. The top-right panel corresponds to the average quality of exports of countries engaged in a free trade agreement. The bottom panels analyze the distribution of the variable quality of those countries that are mutual members of a customs union (bottom-left) and a common market and monetary union (bottom-right).

It is possible to note in Fig.1 that the quality variable resembles a normal distribution. The average quality of exports among the panels did not exhibit major dissimilarities, especially for the FTA, CU, and CMMU panels. The analysis of the mean values of the quality of exports shown in Fig. 1 perfectly align with the descriptive statistics described in Table 2. On the whole, all panels seem to indicate that most observations lie in a higher-density region, meaning that a greater number of observations concentrates around the mean.

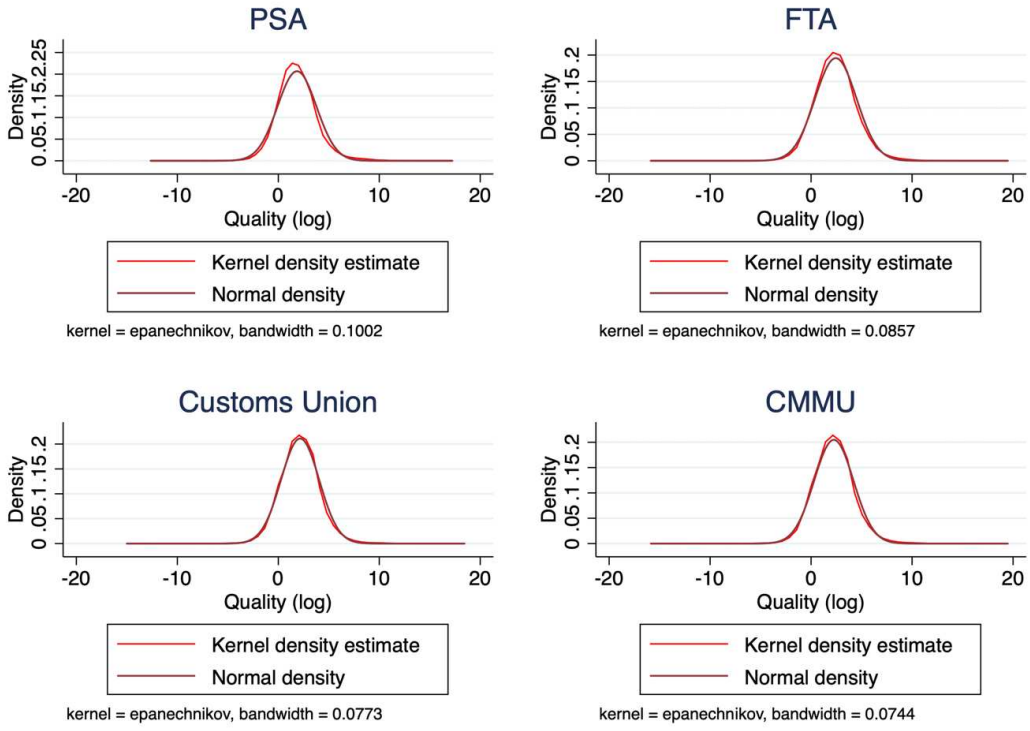

Figure 1 – Density distribution of the variable quality for each type of economic integration agreement
Source: Author's calculations

The top-right and bottom panels also reveal some differences in the left tail in comparison to the top-left panel. This perception indicates that the average quality of exports for countries involved in FTAs, CUs, and CMMUs reaches lower quality values with respect to those economies in a PSA. Given that countries celebrating a partial scope agreement benefit from trade liberalization only on certain products, it is possible to conceive that these countries trade a limited set of varieties, restraining the possibility for quality-upgrading.

Figure 2 looks to evaluate how the quality of exports for each level of EIA changed over time. For that, Fig. 2 relates the mean value of the variable quality per year for those countries taking part in a partial scope agreement, a free trade agreement, a customs union and lastly a common market and monetary union.

Fig. 2 shows that, between 2000 and 2017, all types of economic integration agreements considered in this study have mostly shown a positive tendency. This means that the average product quality increased in time among member countries of mutual EIAs. The analysis of Fig. 2 points out that the average quality of countries participating in partial scope agreements

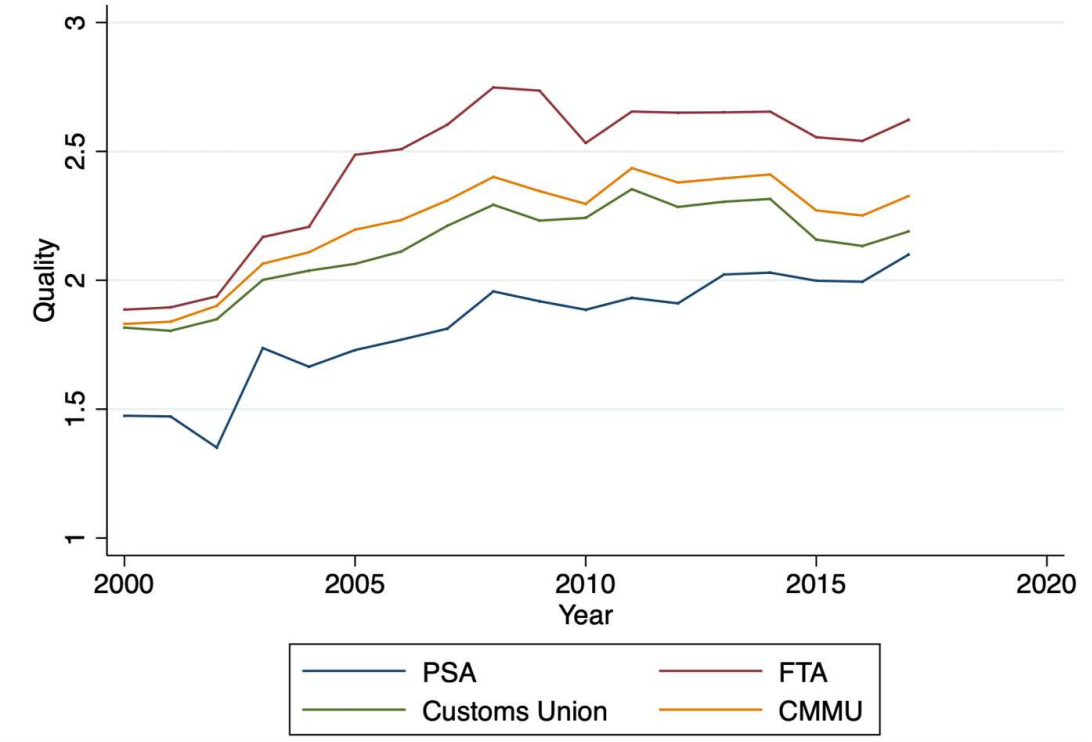

Figure 2 – Average quality for each type of economic integration agreement between 2000 and 2017
Source: Author's calculations.

was the lowest in respect of the mean quality level observed for economies in free trade agreements, customs unions and common markets and monetary unions. The green and orange lines highlight that countries in a customs union as well as those in a higher level of economic integration, such as a common market and monetary union, presented higher average quality of exports in comparison with PSAs.

Surprisingly, the red line in Fig. 2 indicates that the highest mean value of the quality of exports was expressed for free trade agreements. One possible explanation for this finding is that world top exporters, such as the United States, China and Germany are involved in this type of EIA (WTO, 2019). Given that these countries trade large volumes of exports and serve numerous markets worldwide, they might as well have the necessary resources to produce and ship higher-end varieties. Based on factor endowment differentials, Falvey (1981) and Falvey and Kierzkowski (1987) note that capital-intensive nations tend to specialize in the production of higher-end varieties, which may rationalize such a finding.

In an attempt to better comprehend the results exhibited in Fig. 2, Table 3 shows the mean values for some selected variables that could potentially shed light on the prominence of the average quality of exports of countries involved in free trade agreements in respect of other types of EIAs. More exactly, Table 3 displays the average quality of exports, export values and export quantity for each level of EIA. Table 3 also indicates the percentage of high-, upper-middle and lower-middle income countries (included in the baseline sample) involved in PSAs, FTAs, CUs and CMMUs (See Appendix) .

Table 3 - Mean values for selected variables by type of economic integration agreement between 2000 and 2017.

	PSA	FTA	CU	CMMU
Quality (log of unit price)	1.85	2.45	2.16	2.25
Export value (US$)	10,8 mi	9,2 mi	11,6 mi	12,7 mi
Net weight (tons)	15,000	10,900	6,145.83	10,000
% of high-income economies	29.85	80.75	94.49	92.47
% of upper-middle income economies	34.19	6.47	5.51	2.73
% of lower-middle income	35.96	12.78	0	4.80

Source: Author's calculations.
Note: Quality refers to the logarithm of the unit price (export value divided by net weight). Numbers rounded to two decimal places.

Confirming data shown in Fig. 2, Table 3 indicates that the average quality of exports between 2000 and 2017 is the highest between those countries involved in FTAs. For this reason, it is sensible to investigate other variables analyzed in this chapter so as to try and understand what could be inducing high figures for the quality of exports between countries engaged in this type of EIA. Hence, given that this study uses unit prices (export value/net weight) to proxy for quality, discrepancies in the volume of exports and quantity could yield interesting assumptions.

The analysis of Table 3 demonstrates that it is not possible to associate the average export value or quantity with higher levels of quality. Had Table 3, for instance, shown an exceptionally high mean value of exports for those countries in a mutual FTA, then it would have been conceivable to assume that such extreme value could be affecting the mean towards a higher figure. Additionally, figures shown in Table 3 were also computed excluding the world's main exporters – the US, China and Germany – so as to verify whether these exporters could be influencing the average quality of exports of those economies sharing a common FTA. No major alterations were noted, meaning that these economies do not seem to affect the average quality of exports of nations in a free trade area.

Table 3 also analyzes the percentage of high-, upper middle- and lower middle-income countries involved in all types of EIAs. It is possible to note that except for PSAs, most countries engaging in FTAs, CUs and CMMUs have a high-income structure, which could provide an indication as to why they export higher-end goods. When it comes to the analysis of FTAs, nearly 81% of the countries have a high-income living standard, which once more does not allow for further conclusions regarding the average quality of exports observed for this type of shallower EIA. Such a figure could have been a driver of higher levels of average quality had it shown a more intense concentration of high-income economies.

The analyses of Fig. 2 and Table 3 relate the quality of exports of those countries involved in different levels of EIA over the years. In other words, Fig. 2 and Table 3 solely indicate that the quality of exports of countries in a FTA is higher with respect to economies in a PSA, CU, and CMMU, for instance. The analyses conducted in this section could only imply that the data investigated in this chapter do not allow for firm conclusions towards the quality of exports of those countries in a FTA. Unobserved exogenous aspects such as factor endowment and technology differentials could be some of the drivers of quality upgrading for this level of EIA.

Nonetheless, the effect of being a member of a mutual EIA on quality could only be substantiated through further econometric estimations. Therefore, for more categorical evidence, the following subsection leads to the results of the econometric estimations, which allow for a more precise verification of the assumptions and analyses here presented.

4.2.EIAs and the quality of exports

This subsection presents the results of the FD estimations of Eq. (5) and looks to verify the relationship between differing levels of EIAs and the quality of bilateral exports among the world's lead exporters.

Estimation of Eq. (5) was also run for opposing income groupings so as to better verify the existence of a relationship between the income structure of countries involved in an EIA and the quality of their exports. Table 4 presents the results obtained through the FD model regarding the full sample, trade exclusively among higher-income nations, exports originating from richer economies, and exports destined to higher-income importers.

From the analysis of Table 4, it is possible to note that partial scope agreements do not show a positive effect on the quality of exports indicated in columns (1) and (6). Coefficients for these two columns, concerning the full sample and high-income importers, do not vary greatly. These results indicate that the income structure of the importer does not seem to

characterize any changes in quality for this specific type of EIA. As shown in Table 3, given that most countries involved in PSAs have a lower-middle income structure, their potential to quality-upgrade might be limited. Hence, upon foreign competition, domestic firms might compromise their quality product levels so as to adopt a competitive pricing strategy. Schott (2004) and Hummel and Klenow (2005) note that advanced nations show a more considerable potential to producing and exporting products with a larger scope for differentiation or a 'longer' quality ladder. Results in column (4) are in line with the findings in Baier, Bergstrand and Feng (2014) who uncovered a negative non-significant relationship between this type of EIA and trade flows.

Column (3), in Table 4, shows that when only rich exporting and importing economies are considered, the coefficient is naturally omitted. This outcome was not unprecedented given that nearly zero high-income countries are members of a common PSA, validating early results displayed in Table 2. Additionally, columns (2), (5), and (7) show estimates of Eq. (5) run without variable PSA so as to check for possible discrepancies in the remaining coefficients. Nevertheless, no major alterations were noted, confirming the consistency of the overall analyses.

Table 4 also allows to gather evidence on the relationship of FTAs and the quality of bilateral exports. Columns (1) through (5) show that coefficients for $\Delta_5 FTA$ are economically and statistically significant and reveal a positive association with the dependent variable. It is possible to observe that when two countries are involved in a mutual free trade agreement, the quality of their exports tends to increase, on average, nearly 10% over the years, as shown in columns (1) and (2). These results are similar to the findings in Baier, Bergstrand and Feng (2014) who also note a positive relationship between FTAs and trade flows.

When comparing columns (3) and (4), coefficients for $\Delta_5 FTA$ suggest that the effect of free trade agreements on quality is larger when both member countries of this type of EIA have a high-income structure. In other words, when richer countries are involved in a free trade agreement, the quality of their exports increases, on average, 6% against 4% when only the exporting economy has a high-income structure. These results are in line with Hummels and Klenow (2005) and Schott (2004) who note that richer countries tend to consume and produce higher-quality goods.

Columns (6) and (7) show that high-income importers do not seem to exercise any influence on the quality of exports of countries involved in a FTA. Coefficients for $\Delta_5 FTA$ were not statistically different from zero for this income group. Such results could indicate that even

Table 4 - Five-year differenced data estimations

	Full sample	Full sample	High-income exporter High-income importer	High-income exporter	High-income exporter	High-income importer	High-income importer
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Δ_5 *PSA*	-0.1145116***		(omitted)	-0.0518765^{NS}		-0.1050553***	
	(0.0137850)			(0.0405615)		(0.0290191)	
Δ_5 *FTA*	0.0961662***	0.0956005***	0.0601721***	0.0460424***	0.0460453***	0.0110687^{NS}	0.0110708^{NS}
	(0.0079564)	(0.0079562)	(0.0124473)	(0.0110144)	(0.0110144)	(0.0108093)	(0.0108094)
Δ_5 *CU*	0.3631238***	0.3632969***	0.2918410***	0.2971344***	0.2972251***	0.2519488***	0.2522876***
	(0.0102203)	(0.0102205)	(0.0148648)	(0.0134191)	(0.0134189)	(0.0131469)	(0.0131466)
Δ_5 *CMMU*	0.0107143^{NS}	0.0123991*	0.0996521***	0.0793578***	0.0794234***	0.1116044***	0.1119309***
	(0.0071607)	(0.0071579)	(0.0114745)	(0.0103777)	(0.0103775)	(0.0100504)	(0.0100500)
Δ_5 *GDP exporter*	0.2511036***	0.2400850***	0.4095598***	0.3286911***	0.3279738***	0.2879472***	0.2841686***
	(0.0082991)	(0.0081926)	(0.0162663)	(0.0145528)	(0.0145420)	(0.0094486)	(0.0093909)
Δ_5 *GDP importer*	0.2216646***	0.2141105***	0.3703812***	0.2433038***	0.2424269***	0.3296237***	0.3270641***
	(0.0082783)	(0.0082284)	(0.0147374)	(0.0092191)	(0.0091935)	(0.0132945)	(0.0132757)
Intercept	0.0275654***	0.0315346***	-0.0271915***	0.0114223***	0.0117514***	0.0013897^{NS}	0.0026886^{NS}
	(0.0030189)	(0.0029809)	(0.0046874)	(0.0038655)	(0.0038569)	(0.0037439)	(0.0037267)
Observations	1,802,599	1,802,599	1,085,466	1,433,929	1,433,929	1,359,288	1,359,288
R-squared	0.0027	0.0027	0.0045	0.0032	0.0032	0.0037	0.0037
Adj. R-squared	0.0027	0.0027	0.0045	0.0032	0.0032	0.0037	0.0037

Source: Research results.

Note: Dependent variable is Δ_5 *Quality*. Standard errors in parentheses. Significance at 1%, 5% and 10% levels indicated by ***, ** and *. Statistically non-significant indicated by NS.

though richer importers demand higher-quality products, the counterpart – in this case, a poorer exporter – might just not have the adequate means to quality-upgrade and export higher-end varieties. More clearly, these results suggest that although richer importers might demand higher-end goods, as noted in Hummels and Klenow (2005), the production of quality (the supply side) seems to lean on the income structure of the exporting country.

Turning now to the analysis of higher levels of EIAs, Table 4 shows coefficients for the variable $\Delta_5 CU$. Columns (1) through (7) exhibit estimates that are both statistically different from zero and positive. These results reveal that being partners in a customs union affects the quality of exports positively. Coefficients for this higher level of EIA unveiled a larger effect on the dependent variable in comparison to the remaining variables of interest, as expected. At this level of economic integration countries are provided with a set of incentives to trade, such as tariffs reduction on a larger group of products and the adoption of a common external tariff (WTO, 2019). These benefits have the potential to stimulate trade between the participating economies, enhance competition among firms and thus have an end effect on quality (BAS; STRAUSS-KAHN, 2015; FAN; LI; YEAPLE, 2015).

Estimates for $\Delta_5 CU$ shown in columns (1) and (2) expose that by participating in a mutual CU, countries benefit from a 36% increase in the quality of their exports over five years. This outcome aligns with the gravity model estimated in Baier, Bergstrand and Feng (2014). These authors noticed a larger impact of higher types of EIAs on trade flows and on both the intensive and extensive margins of trade. The analysis of quality advances on these findings and unveil that higher levels of EIA affect the quality of exports positively. Furthermore, in respect of Baier, Bergstrand and Feng (2014), this study also provides a more detailed investigation and separates higher levels of EIAs into two groups: CU and CMMU.

Coefficients for $\Delta_5 CU$ in columns (3)-(5), in Table 4, show more or less no variations when regarding contrasting income levels of the exporters and importers. Among the sampled countries, it is possible to note that trade between rich nations (column 3) and exports shipped from high-income economies (columns 4 and 5) involved in a CU reveal a somewhat similar impact on the quality of exports, nearly 29%. Comparably, the analysis of the income structure of the importing country also exhibited, in columns (6) and (7), that high-income importing nations involved in a customs unions tend to experience a 25% increase in the quality of their exports. This means that by engaging in a CU with a richer importer, a poorer exporting country tends to rise the quality of its exports in nearly 25% over time. The outcome of this analysis corroborate the assumptions presented in Bils and Klenow (2001), Hummels and Klenow

(2005), and Schott (2004) who note that income differentials play an important role in determining quality levels.

Advancing on Baier, Bergstrand and Feng (2014), separate CMMU dummies were included in Eq. (5) and coefficients for this variable were duly presented in Table 4. Estimates for Δ_5 *CMMU* shown in column (2) indicate a statistically significant and positive effect of being involved in this type of EIA on the quality of the exports. The coefficient for this variable showed for the full sample that such an effect is rather small. This outcome is not surprising given that most countries engaged in 'deeper' types of economic agreements belong to high-income groups, as exposed in Tables 2 and 3.

The analyses presented in the remaining columns (3)-(7) of Table 4 provide some interesting results. Coefficients for differing groups of income verified that when two countries are involved in a CMMU and the exporting country has a higher income, exports tend to increase 8% in quality over time (columns 4 and 5). When both countries in a mutual CMMU have a higher-income structure the quality of products between these partners reaches a 10% increase (column 3). Lastly, when a richer importer engages in a CMMU with a poorer partner, the quality of exports is also positively affected and achieves an 11% increase (columns 6 and 7).

On the whole, it is possible to observe that coefficients for Δ_5 *CMMU* throughout all estimations unveiled a rather small impact of belonging to the 'deepest' type of EIA on quality. However, such an outcome probably relates to the construction of the dummy variable for CMMU. To avoid the problem of double counting, this variable exclusively captures the influence of common markets and monetary unions that go beyond a customs union (WTO, 2019). In other words, given that 'deeper' levels of EIAs represent a gradual change and development of a 'shallower' trade arrangement over time, it is reasonable to notice that a CMMU represents an evolved stage of a CU.

For this reason, had this issue not been accounted for, the variable Δ_5 *CMMU* would have also reported the influence of customs union on quality and not solely the benefits of 'deeper' EIAs that surpass those observed in a customs union, for instance. Furthermore, by not excluding the effect of CUs on CMMU, this study would have possibly incurred bias due to high collinearity. Similary, Baier, Bergstrand and Feng (2014) disclose a positive effect of 'deeper' stages of EIAs on trade flows. However, these authors gathered CU and CMMU in a single dummy variable because of the small number of countries engaged in these types of arrangements among the countries and years they analyzed.

To end, Table 4 also reports on the relationship of exporter and importer GDPs and the quality of bilateral exports for both the full sample and varying income groups over time. Δ_5 *GDP exporter* and Δ_5 *GDP importer* showed throughout all estimations a positive correlation with the dependent variable confirming the findings in Henn, Papageorgiou and Spatafora (2015). These researchers observe that quality tends to increase with income, which are consistent with the findings uncovered in Table 4. The underlying idea is that as the product of the country increases, the intensification of the economic activity allows for the production of vertically superior goods and also the acquisition of higher-end goods as a result of an increase in the average income level.

Column (3) exposed that the effect of GDP is the largest when only richer exporting and importing countries are taken into account. For the exporting country, for instance, an increase in its gross domestic product would result in a 41% increase in the average quality of bilateral exports. The coefficient for the importing economy did not exhibit a drastic dissimilarity, meaning that as the GDP of the importer country rises, the quality of exports of the partner country is positively affected by nearly 37%.

The analyses shown in columns (4) through (7) regard either high-income exporters or high-income importers. Naturally, the effect of an increase in the gross domestic product of the exporting nation affects the quality of its exports more intensively than an increase in the GDP of the importing country. An increase in the GDP of the exporting country, for example, could relate to an earlier increase in the productive capacity and thus result in quality upgrading. This outcome is shown in columns (4) and (5) indicating a 33% and 24% increase in the quality of exports as the GDP of exporters and importers increase, respectively. Conversely, columns (6) and (7) present the opposite results. When only high-income importers are regarded, the effect of Δ_5 *GDP importer* is greater than the effect of Δ_5 *GDP exporter.* The idea is that as importers increase their GDP, they are more apt to consume either higher-end inputs or consumer goods as noted in Bils and Klenow (2001).

In a nutshell, Table 4 reported on the results of the FD model. The outcome of the analyses presented here verified that deeper EIAs have larger effects on the quality of bilateral exports than FTAs, and the latter have larger effects on quality than PSAs, as expected. Most coefficients for the variables presented in Table 4 were economically and statistically significant. The evidence uncovered in this study indicates that the hypothesis posed earlier generally holds. Countries engaged in deeper types of EIA trade vertically superior goods, richer economies involved in EIAs trade higher-quality varieties.

5. Conclusions

This study aimed to analyze the effect of various types of economic integration agreements on the quality of exports among the world's main exporters between 2000 and 2017. On the whole, the outcome of this research collected evidence of a positive relationship between deeper types of EIAs and the quality of exports, indicating that more economically integrated countries tend to trade vertically superior goods. Moreover, this study mostly unveiled a positive association between shallower types of EIAs and quality. Nonetheless, for these types of trade arrangements a smaller effect on the quality of bilateral exports was observed.

It was possible to note, for instance, that PSAs did not show positive or significant coefficients towards quality upgrading. This result might relate to the fact that this type of EIA covers a limited set of goods and to the observation that most sampled economies involved in a PSA present a lower middle-income structure. For this reason, it was rational to consider that income wise, nations involved in PSAs might find it difficult to quality-upgrade and may reduce quality so as to fight foreign competition.

When it comes to other types of EIAs, the outcome of this study revealed that being involved in a CU impacts the quality of exports of the involved countries more than it does when two countries, for example, are mutual members of a FTA. These results were observed possibly because CUs represent a higher level of economic integration and provide their member countries with more benefits to trade, besides tariffs reduction, such as the establishment of a common external tariff (CET).

The analysis of coefficient estimates of CMMU exhibited a relatively minor impact on the quality of exports. To avoid the issue of double counting, this binary variable was built solely capturing the influence of CMMUs that surpasses that observed in a CU. For this reason, it was possible to infer that the effect of adjacent benefits of a common market or monetary union (in respect of CUs), such as international factor movements or even a common currency, is smaller than the effect of tariffs reduction and the adoption of a CET.

The investigation of the link between the gross domestic product and quality showed that as the GDPs of both exporting and importing countries increase, quality is positively affected. These results indicate that as the economic activity of exporting and importing economies grows, the quality of exports rises, possibly due to an increase in the productive capacity and via an intensification of the demand for better products, respectively.

Regarding limitations, this study faced the challenge of working with 4-digit product-level data. For instance, the use of information disaggregated at the firm level could provide

more precise estimates and capture product specifics. Another downside observed in the trade literature refers to the measurement of the variable quality. Given its subjective nature, there still exists room for future studies on the topic looking to explore the quality calculation more intensively and attempt to advance on it.

CHAPTER 2

IMPORT COMPETITION INDUCED QUALITY CHANGE? THE IMPACT OF IMPORTS ON BRAZILIAN WAGES

1. Introduction

In the past decades, world interactions have played an important role in the intensification of international trade. Countries have more and more engaged in strengthening foreign transactions aiming to provide their citizens with commodities they lack in exchange for those they produce in abundance. Global trade has become a key aspect of the development of modern economies, especially due to its relevance to national income generation and a nation's living standards.

When it comes to the participation of Brazil in the international market, the country has shown interesting changes along the years. For instance, from 1997 through 2000, the trade balance of the country registered negative figures, meaning that during the time, Brazil's import trade value surpassed its exports. From that time on, the country has altered this condition and has developed its commercial structure into becoming a net exporter. Nevertheless, imports showed, between 1997 and 2016, an average annual increase of 1.24% and nearly 138 billion dollars' worth of imported goods in 2016 (COMEXSTAT, 2019).

According to data from the *Ministério da Indústria, Comércio Exterior e Serviços* (2019), a closer outlook of the importing schedule of Brazil allows to draw some early assumptions. For instance, in 2016, the country mainly imported mineral, manufactured and pharmaceutical goods. Conversely, most products comprising its exporting schedule in that year related to agricultural commodities. Therefore, it is possible to note that the country's imports were predominantly concentrated on capital-intensive goods yet its exports were labor intensive.

Analyzing more aspects of a country's imports allows to better understand how import competition affects the domestic economy and the welfare of its population. For instance, from 1997 through 2016, various Brazilian products faced direct competition from foreign-made varieties (PIA, 2018; COMEXSTAT, 2019). In other words, Brazil both produced and imported a set of similar products, meaning that the local industry had the challenge of competing against internationally-made products.

In this context, other aspects of trade such as the quality of the output assumes importance. Among the countries that trade the same goods in the international market, a given

economy might have more incentives to respond to import competition by differentiating in terms of the quality of these products (AMITI, KHANDELWAL, 2013). Recent studies have observed a positive association between higher-end products and productivity, wages, prices of goods and income, resulting in a possible improvement in the terms of trade (BASTOS; SILVA, 2010; JAIMOVICH; MERELLA, 2015).

Brambilla and Porto (2016) note that countries exporting higher-end goods do pay higher wages. These authors observe that the production of quality is closely connected to skills and therefore conclude that skilled-workers produce higher-quality varieties and thus command a higher payment. Amiti and Khandelwal (2013) investigate how import competition affects a firm's decision to quality-upgrade. These researchers observe that industries facing international competition have an extra incentive to quality-upgrade in order to compete against foreign commodities.

The analysis of cross-sectional data from PIA (2018) and Comexstat (2018) combining information on wages paid in Brazil and the quality of imports (import trade value/quantity), respectively, allowed to identify those products facing direct foreign competition in Brazil. These data also shed light on a possible correlation between the quality of imports entering the Brazilian market and the wage levels paid in the country. The channel connecting these ideas imply that the quality of products destined to Brazil could put pressure on domestic firms to modify the production process, become more intensive in skilled labor, enhance product quality, and consequently pay higher wages.

As long discussed in Brambilla and Porto (2016), the production of higher-quality goods requires qualified workers who consequently earn higher wages. Hence, such a relationship between skills and wages could also produce an end effect in the importing country resorting to quality upgrading. In other words, importers might feel encouraged to attract skilled workers so they can enhance the quality of their output and compete with international higher-end goods.

Unlike the existing studies in the trade literature, this chapter aimed to explore the relationship between the quality of imports and wages paid in Brazil from 1997 to 2016. Specifically, this research examined how the quality of Brazilian imports originating in its main trade partners affects wages paid in the country. The analyses performed in this chapter considered the 60 main exporters to Brazil or approximately 90% of the country's total imports during the timeframe combining information on quality and wages at the product level.

This study mostly distinguishes from the related trade literature by conducting an investigation on the effects of quality on wages paid in the destination country. Brambilla and Porto (2016) and Verhoogen (2008), for instance, analyzed the effects of quality on wages paid

in the country of origin. Moreover, for a more disaggregated understanding, an additional analysis was carried out considering the income groups of Brazil's main trade partners. Hallak and Schott (2011), Hummels and Klenow (2005) and Schott (2004) note that richer countries tend to produce and export higher-quality goods. For this reason, imports coming from higher-income nations could affect Brazilian wages differently with respect to those shipped from poorer economies.

This research looks to contribute to shaping adequate policies with a focus on quality and career advancement in Brazil. A deeper understanding of the relationship between the quality of imports and wages paid in Brazil yields interesting implications. The results obtained in this research works in favor of the government efforts to protect Brazilian producers and to provide firms with the necessary means to quality-upgrade. Furthermore, results presented in this chapter allow lawmakers to evaluate the need for labor qualification incentives and technology adoption subsidies. To end, an increase in wages has the potential to have a marked effect on income gains for workers translated into higher purchasing power and welfare.

This chapter comprises four other sections, besides this introduction. The second section presents the theoretical framework. The third introduces the methodology and the fourth exhibits the results and discussion. Lastly, the fifth section shows the conclusions.

2. Theoretical framework

Previous studies devoted considerable attention to the investigation of the relationship between skill upgrading and wage inequality (BERNARD; JENSEN, 1997; JUHN; MURPHY; PIERCE, 1993). These researches have widely observed that wages and output rise steeply in skill, meaning that wage discrepancies are attributable mostly to rises in skill upgrading. Nonetheless, these studies have not taken into account the eventual effects of skill upgrading on the quality of the output.

Verhoogen (2008) advances on Bernard and Jensen (1997) and Juhn, Murphy and Pierce (1993) and proposes a quality-upgrading mechanism linking trade and wage inequality. The author considers that firms are heterogeneous in productivity and incur fixed costs to enter the export market in a way that only the most productive plants within each industry export. Verhoogen (2008) assumes that varieties are differentiated in quality and that consumers differ in income and in their willingness to pay for higher-quality goods. The author suggests that the production of higher-end varieties requires skilled workers, and that these high-quality workers must be paid higher-wages.

More recently, Brambilla and Porto (2016) have laid out a theoretical framework of export destinations, quality and wages. Their model relies on the mechanism that rich countries demand quality, and that the supply of quality is intensive in skilled labor and commands higher wages. A similar effect is expected in the case of the quality of imports. In this context, to become more competitive, domestic firms may pay higher wages to attract skilled professionals, produce higher-quality goods and compete against foreign-made varieties.

Brambilla and Porto (2016) also consider that firms differ in productivity, incur fixed costs to enter the export market and that countries value quality differently. The model presented by these authors consider a differentiated good k with quality θ_k and price p_k. The demand function for this good is $q(p_k\theta_k)$ and firms are in a monopolistic competition framework that faces this demand function. These authors assume that firms have to choose the quality of the physical units and its selling price. The total cost of producing good k depends upon quantities q_k as well as on the quality θ_k of the good, $C_k(q_k\theta_k)$. The authors consider that the production technology is such that varieties are produced under constant marginal costs. Thus, their model defines a marginal cost function $C_k(\theta_k)$ that depends on quality.

To better characterize the model, Brambilla and Porto (2016) felt the need to describe the function $C_k(\theta_k)$. The authors consider that the production of quality demands higher-end inputs (labor and intermediate goods), which are costly to obtain. For them, the production of one unit of physical output requires $1/l$ units of labor. Their model considers that workers are heterogeneous in skills. For this reason, higher-skilled workers are able to produce l units of higher-quality θ_k varieties. To model quality production, Brambilla and Porto (2016) follow Kugler and Verhoogen (2012) and Hallak and Sivadasan (2013) and assume that the production of quality represents a combination of skilled labor S and capability λ, as follows:

$$\theta_k = \lambda_k S_k^{\sigma} \tag{6}$$

where λ and σ both indicate positive parameters and determine the returns to skills in quality production. The authors suggest that Eq. (6) delivers a positive relationship between skills S_k and the production of quality θ_k, meaning that an increase in S_k results in an increase in θ_k.

To attract higher skilled workers, firms face an upward sloping wage schedule as in Verhoogen (2008). Brambilla and Porto (2016) provide a simple functional form:

$$S_k = w_k^{\xi} \tag{7}$$

where w_k represents the wage offered to skill level S_k and $\xi > 0$ governs the sensitivity of the skill level offered to wages. The authors suggest that Eq. (7) could be interpreted as a representation of an efficiency-wage model or a profit-sharing model.

Eqs. (6) and (7) illustrate the quality mechanism proposed by Brambilla and Porto (2016) in which the production of quality requires skills and higher-quality workers are paid higher wages. For a firm, the cost of producing one unit of output of quality θ_k is the cost of hiring $1/l$ workers of skill S_k at the wage w_k. Taking Eqs. (6) and (7), the marginal cost of producing a physical unit of good *k* is

$$C_k(\theta_k) = \frac{1}{l}\left(\frac{\theta_k}{\lambda_k}\right)^{\frac{1}{\xi\sigma}} \quad (8)$$

with $c' > 0$ e $c'' > 0$, provided that $\xi\sigma > 1$, that is, as long as quality does not rise too rapidly with skills, and skills do not rise too fast with wages.

Brambilla and Porto (2016) consider that quality is costly; in other words, to produce higher-quality goods, firms must attract skilled workers who are paid more. This mechanism could also occur when analyzing the effect of the quality of imports on wages. Foreign competition may encourage domestic firms to become more competitive against imports via quality upgrading. In order to fight international competition, firms resorting to enhancing the quality of the output might as well seek to attract skilled workers so as to produce better products. Consequently, these firms would need to respond to a higher-quality workforce by providing them with higher wages.

To end, this theoretical framework shows that firms choose to increase quality and this raises average wages. These worker-quality wage schedules can be justified on the basis of a couple of other complementary models besides Brambilla and Porto (2016). For instance, Kremer (1993) rationalizes such an idea through a model in which worker quality represents general skills, workers are heterogeneous in skill levels within each occupational category, and plants must pay high wages to attract skilled workers. Lastly, Akerlof (1982), Shapiro and Stiglitz (1984) and Bowles (1985) present a model in which worker quality represents effort and plants do offer efficiency wages to induce workers to supply it.

3. Methodology

This section is divided in four parts. The first of them expands on the proxy used to estimate the quality indicator of the Brazilian imports. The second subsection exhibits the empirical model used in the analysis of the quality of imports and wages paid in Brazil. The third part elaborates on the strategy used in the empirical estimations. Lastly, the fourth subsection shows the source of the data used in this chapter.

3.1.The quality indicator (unit value)

One common limitation of the existing trade literature is the difficulty in defining the quality of the output. Product quality variations represent a broad concept gathering varied features such as product performance, durability, reputation and origin country specific cultural aspects, which are tough to measure (PINHEIRO; MARKWALD; PEREIRA, 2002).

Some researchers have discussed the challenges to measure quality (SCHOTT, 2004, HUMMELS; KLENOW, 2005; HALLAK, 2006). Ramos Filho, Medeiros and Albuquerquemello (2017) note that data on the quality of internationally traded varieties are scarce, possibly due to the subjective nature of quality. These authors highlight that information on quality involves different nations, each with its specifics, making this measurement even harder.

Previous studies have attempted to infer the quality of the output indirectly, by observing, for instance, output prices or unit values[24]. The unit price (i.e., the total industry export/import value divided by the quantity exported/imported by the industry) indicates a common proxy variable to measure quality, meaning that higher unit prices result in higher-quality goods. Hence, this study used such a proxy to evaluate the relationship between the quality of imports and wages.

Schott (2004) argues that better-endowed nations use their endowment advantage to produce vertically superior varieties; in other words, goods that are relatively capital or skill intensive and demonstrate added features or higher quality, thereby commanding a relatively higher price. More recently, Anwar and Sun (2018) show that the industry export quality is directly related to the industry export price. These authors confirm that the effect of foreign direct investment on industry export quality can be identified from its impact on the industry export price, thus providing a theoretical justification for a number of empirical studies, where export unit value is used as a measure of product quality.

3.2.Empirical specification

The following model based on Brambilla and Porto (2016) sought to analyze the effect of import quality on wages paid in Brazil.

$$\ln(W_{k,t}) = \beta_0 + \beta_1 \ln(P_{ki,t}^{IM}) + \beta_2 \ln(GDPpc_t) + \beta_3 \ln(Output_{k,t}) + \vartheta_i + \gamma_k + \varepsilon_{k,t} \qquad (9)$$

[24]See Alcalá (2016), Bastos and Silva (2010), Brambilla and Porto (2016), Flach (2016), Hallak (2006), Hallak and Schott (2011); Hummels and Klenow (2005), etc.

where $W_{k,t}$ refers to the total wage[25] paid by a set of firms producing good k[26] in the importing country (Brazil) at time *t* (1997-2016), as in Brambilla and Porto (2016) and Flach (2016)[27].

One significant feature of Eq. (9) is a novel perspective regarding the analysis of quality. Unlike Brambilla and Porto (2016) and Verhoogen (2008), Eq. (9) looked to investigate the effects of the quality of the output on wages paid in the importing country. Contrarily, the aforesaid authors evaluated the impact of quality on wages paid in exporting countries.

In this model, the variable of interest $P_{ki,t}^{IM}$ corresponds to the quality indicator and is proxied as the import unit price (unit value) of product *k* from country *i*[28] to Brazil in *t.* Estimates for this variable could provide ambiguous coefficients since an increase in the import price might result in either higher wages (via demand for skilled workers) or unemployment/wage cuts. The theories in Aghion and Howitt (2005) and Aghion *et al.* (2009) and the findings in Amiti and Khandelwal (2013) support this assumption. On the one hand, these authors note that the escape-competition effect might induce a firm close to the quality frontier to invest in quality upgrading to survive competition from potential new entrants. On the other hand, the authors highlight that the "appropriability" effect discourages firms distant from the frontier from investing in quality upgrading because they are too far from being able to compete with potential new entrants.

$GDPpc_t$ refers to the *per capita* gross domestic product of Brazil in *t.* Estimates for this control variable were expected to generate positive and statistically significant coefficients, meaning that an increase in the Brazilian product could affect the average wages paid in that country positively. This assumption was based on the early findings shown in Brambilla and Porto (2016) in which the authors note a positive correlation between product level and wages.

$Output_{k,t}$ corresponds to the gross value of industrial production[29] of product *k* in the importing country (Brazil), in *t.* Coefficients for this variable, as found in Brambilla and Porto (2016), were expected to produce a positive and statistically significant effect on wages paid in

[25] Wages of workers with or without employment relationship and, of workers on holidays, medical leave, etc. Wages of members of the administrative, director or fiscal councils are not included. Wages of workers who did not develop any other activity in the company, who are self-employed, and the staff who work within the company, but is paid by other companies are not included.
[26] This study includes information on all products reported in the PIA database corresponding to the 8-digit level of the NCM.
[27] These authors use a slightly different approach, analyze average wages paid in the export country and rely on data at the firm level.
[28] The list of Brazil's main trade partners is included in Table 14 in Appendix. This list comprises 60 economies exporting to Brazil from 1996 to 2017 or nearly 90% of the total imports of Brazil.
[29] Sum of sales of industrial products and services (net industrial revenue), variation of inventories of finished products and in preparation, and own production made for fixed assets.

the importing country, suggesting that products generating higher revenue in a given sector or industry would have a positive impact on wages.

To end, ϑ_i and γ_k refer to exporter and product fixed effects, correspondingly, and $\varepsilon_{k,t}$ to an exogenous disturbance.

3.3.Empirical strategy

To identify the effects of quality upgrading on wages, Eq. (9) was first estimated using a fixed effects model, and then, the unconditional quantile regression approach proposed by Firpo *et al.* (2009). Based on an influence function, this method considers that regressors may have a contrasting impact across the quantiles of the distribution. Thus, this method allowed the investigation of the effects of the independent variables presented in Eq. (9) on different wage quantiles.

Along with the unconditional quantile regression method, this study also used the concept of Recentered Influence Function. The influence function $IF(w; \upsilon, F_w)$ consists of the relative effect (influence) of each observation on a distribution statistic $\upsilon(F_w)$. The incorporation of $\upsilon(F_w)$ in the influence function defines the so-called Recentered Influence Function or RIF. This method allowed to analyze the effects of a set of covariates on the statistical distribution of interest, in this case, the distribution of quantiles.

The τ-*th* quantile (q_τ) of the wage distribution is defined as $q_\tau = \upsilon_\tau(F_w) = inf_q\{q: F_w(q) \geq \tau\}$, and its influence function $IF(w; q_\tau, F_w)$ as:

$$IF(w; q_\tau, F_w) = \frac{\tau - 1\{w \leq q_\tau(F_w)\}}{f_w(q_\tau(F_w))} \quad (10)$$

where $1\{w \leq q_\tau(F_w)\}$ corresponds to an indicator function, which showed whether the variable $W_{k,t}$ (wage paid by a set firms producing product *k* in Brazil at time *t*) is less than or equal to the quantile q_τ, and $f_w(q_\tau(F_w))$ refers to the marginal density function of the distribution of $W_{k,t}$ evaluated in q_τ.

Then, the recentered influence function, which replaced the dependent variable $W_{k,t}$ in the unconditional quantile analysis, was defined by the sum of the distribution statistics and their respective influence function, $RIF(w; \upsilon, F_w) = \upsilon(F_w) + IF(w; \upsilon, F_w)$. For the τ-*th* quantile (q_τ), the RIF is given by:

$$RIF(w; \upsilon, F_w) = q_\tau + \frac{\tau - 1\{w \leq q_\tau(F_w)\}}{f_w(q_\tau(F_w))} = c_{1\tau}.1\{w \leq q_\tau(F_w)\} + c_{2\tau} \quad (11)$$

where $c_{1\tau} = \frac{1}{f_w(q_\tau)}$ and $c_{2\tau} = q_\tau - c_{1\tau}.(1 - \tau)$ and the conditional expectation is the distribution statistic $\mathrm{E}\lfloor RIF(w; \upsilon, F_w)\rfloor = \upsilon(F_w)$.

From that, the model assumed a covariate vector X and the conditional expectation of the RIF as a function of X, i.e. $\mathrm{E}[RIF(w;\upsilon,F_w)|X=x]$. Then, the function could be represented as a linear regression in function of $X, RIF(w;\upsilon,F_w) = X\beta + \varepsilon$. Considering $\mathrm{E}[\varepsilon|X] = 0$ and applying the Law of Iterated Expectations, the unconditional quantile regression was defined as follows:

$$\upsilon(F_w) = \mathrm{E}_x\left[\mathrm{E}[RIF(w;\upsilon,F_w)]\right] = \mathrm{E}[X].\beta \quad (12)$$

where w refers to the total wage paid by firms producing good k in Brazil at time t; $RIF(w;\upsilon,F_w)$ is the recentered influence function; X is the vector of explanatory variables (described in the section 3.2); and β refers to the coefficients. Finally, these coefficients were estimated by OLS.

The unconditional quantile regression approach proposed by Firpo *et al*. (2009) used in this essay is different from the conditional quantile regression proposed by Koenker and Basset (1978). While the latter approach solely allows within-group estimations, the unconditional quantile approach allows the analysis of both within- and between-group effects.

3.4.Data

This study was conducted with product-level annual data from 1997 to 2016. The timeframe comprises the years after the Brazilian trade openness, in which the country underwent many transformations and was able to develop its trade until recent years (IPEA, 2010).

The data in this study are merged from multiple sources. Data on wages are from the *Pesquisa Industrial Anual* (PIA) corresponding to the 4-digit level of the *Classificação Nacional de Atividades Econômicas* (CNAE). Information on wages was then converted into 8-digit product level data of the *Nomenclatura Comum do Mercosul* (NCM) through the correspondence tables from the *Instituto Brasileiro de Geografia e Estatística* (IBGE). The cross-country data on Brazilian import values (US$) and quantities (kg) are from the *Secretaria de Comércio Exterior* (SECEX). The classification of products in this database also followed the NCM. Data on GDP *per capita,* PPP (current international US$) of Brazil are from the World Bank. To end, data on gross value of industrial production (US$) are from PIA.

4. Results and discussion

This section is divided into two parts. The first of them shows the descriptive statistics of the variables used. The second part presents the results of the fixed effects and the

unconditional quantile regression models relating the quality of Brazilian imports and wages paid in the country.

4.1.Descriptive statistics

Prior to heading to the results of Eq. (9), a descriptive analysis is presented so as to provide a better perception of the sampled partner countries and the Brazilian product-level data. Table 5 shows averages, standard deviations and extreme values for wages paid in Brazil, the quality of the country's imports, import values between 1997 and 2016, import quantity, GDP *per capita*, output, and the number of observations of the baseline sample.

Table 5 - Summary statistics of the variables included in this study

Variable	Obs.	Mean	Std. Deviation	Min	Max
Wage (US$)	254,835	869 mi	1,37 bi	661,265.30	27,1 bi
Quality (log of unit price)	254,835	2.96	1.99	-7.31	15.43
Import value (US$)	254,835	1,4 mi	22,2 mi	1	4,72 bi
Net weight (tons)	254,835	1,478.53	57,200	000.1	9,56 mi
GDP per capita (US$)	254,835	12,103.12	2,666.99	8,547.34	16,195.87
Output (US$)	254,835	7,59 bi	13,9 bi	2,76 mi	352 bi

Source: Author's calculations.
Note: Quality refers to the logarithm of the unit price (import value divided by net weight). Numbers rounded to two decimal places.

The average wage paid by firms producing a given product *k* in Brazil was 869 million dollars. The highest wage was noted for 'Petroleum oils, oils from bituminous minerals' (NCM 27101999) reaching 27 billion dollars' worth of wages in 2016. The lowest value for this variable was 661 thousand dollars and refers to 'Coal gas, water gas, producer gas and similar gases, other than petroleum gases and other gaseous hydrocarbons' (NCM 27050000) in 1999.

Quality presented extreme values ranging from -7.31 to 15.43. The highest quality level was associated with imports of 'Hormones, prostaglandins, thromboxanes and leukotrienes; their derivatives and structural analogues' (NCM 29375000) exported from Canada in 2015. The lowest quality value corresponds to imports of 'Acids; saturated acyclic monocarboxylic acids; acetic acid' (NCM 29152920) shipped from Germany in 2016.

Table 5 also indicates that, between 1997 and 2016, exports to Brazil from its main trade partners reached, on average, 1,4 million dollars and 1,478.53 tons. The GDP *per capita* in Brazil varied from 8,547.34 dollars in 1998 to virtually 16 thousand dollars in 2014.

The variable output presented a mean value of 7,59 billion dollars and extreme values varying significantly with a high standard deviation of 13,9 billion dollars. This may indicate a large discrepancy between the production levels in Brazil. The lowest output level was for

'Precious metal ores and concentrates; excluding silver' (NCM 26169000); its output equaled 2,76 million dollars in 2006. The highest output was noted for 'Petroleum oils, oils from bituminous minerals' (NCM 27101999) totaling an amount of 352 billion dollars in 2016.

This analysis of Table 5 shows that the highest output was noted for 'Petroleum oils, oils from bituminous minerals' (NCM 27101999), which has also shown the highest figures for wages. The association between output and wages could certainly be noted given that higher levels of production requires a larger number of workers and therefore results in higher volumes of wages.

This preliminary analysis provides an indication of a positive correlation between output and wages. However, it yet does not deliver consistent basis to draw further conclusions regarding the relationship between the quality of imports and wages. This study considers solely the Brazilian products that face import competition. Therefore, the quality of imports may have a contrasting effect on the wages paid in Brazil regardless of how large the output level of that product is.

Table 6 presents descriptive statistics for the variable quality considering the income groups of Brazil's main trade partners[30]. A significant number of empirical papers studying trade prices predicts a positive relation between a country's income *per capita* and average trade prices, suggesting that high-income countries consume and produce goods of higher quality (HALLAK, 2006; HUMMELS; KLENOW, 2005; SCHOTT, 2004). In this context, having a deeper understanding of the income structure of the main countries exporting to Brazil between 1997 and 2016 allows to sketchily infer some traits of the quality of Brazil's imported goods.

Table 6 – Mean value and standard deviation of variable quality for income subsamples

		Quality (log of unit price)		Quality (unit price)	
Income group	Obs.	Mean	Std. Deviation	Mean	Std. Deviation
High income	203,753	3.08	1.98	300.29	14,576.85
Upper middle income	36,452	2.41	1.93	189.64	6,161.49
Lower middle income	14,630	2.63	1.91	293.29	19,981.75

Source: Author's calculations.

Table 6 allows to note that nearly 80% of the sampled countries have a high-income structure what may give an early indication that most of Brazil's imports are of higher quality. High-income origin countries also show the highest mean value for the variable quality suggesting that the countries in this grouping export, on average, higher-quality goods to Brazil.

[30] Lower middle-income economies are those with a gross national income (GNI) *per capita* between $996 and $3895; upper middle-income economies are those with a GNI *per capita* between $3896 and $12055; high-income economies are those with a GNI per capita of $12056 or more (WORLD BANK, 2019).

Lower middle-income economies represent only 5.7% of the baseline sample. Although these countries present a slightly similar (in comparison to high-income countries) mean value for the quality of their exports, the standard deviation for this grouping is relatively high and the number of observations is drastically smaller, suggesting that the subsample is rather heterogeneous.

Figure 3 complements the previous analysis and shows the distribution of the variable quality for the income subsamples presented in Table 6. The top-left panel refers to the quality of imports originated in the main trade partners of Brazil. The remaining panels analyze the distribution of the variable quality for high-, upper middle-, and lower middle-income origin countries.

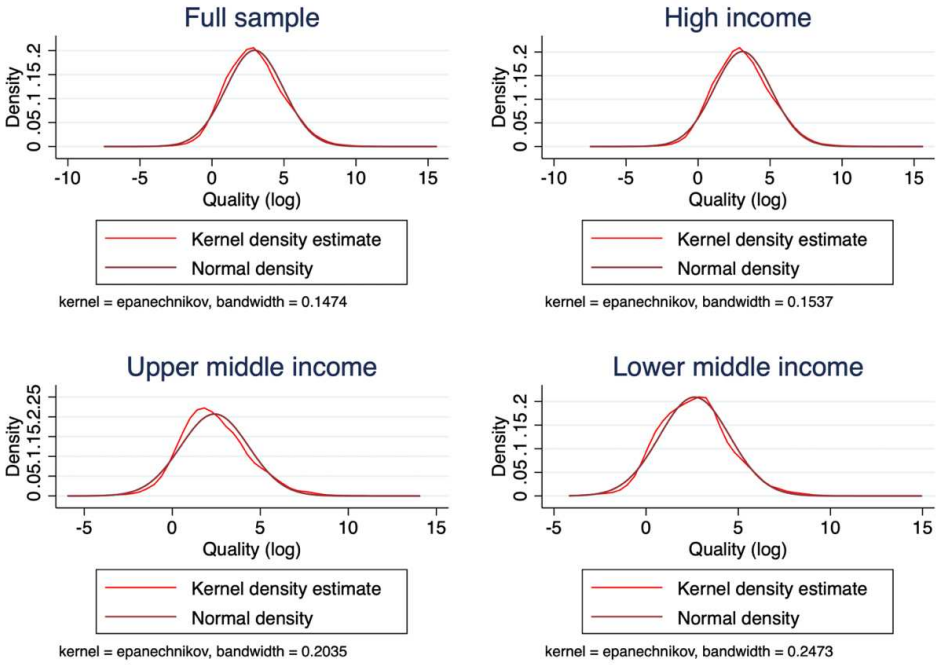

Figure 3 – Density distribution of the variable quality divided by partner income groups
Source: Author's calculations.

It is possible to note in Fig. 3 that the variable quality is distributed similarly to a normal distribution for all income groupings. However, slight differences might be observed among them. Most observations in the panels representing both the full sample and high-income partners lie in a higher-density region when comparing with the bottom panels. Such a finding is not surprising whatsoever given that most of Brazil's imports originated in countries with a high-income level, as shown in Table 6.

The most apparent discrepancies are noted for the quality of imports shipped to Brazil from upper middle- and lower middle-income countries. Comparing these two subsamples, it is possible to notice that the mean value for upper middle-income exporters leans a bit towards the left tail showing moderately lower quality levels. On the other hand, the bottom-right panel implies a lower density or a higher variation among quality levels. Such variability may be related to a more limited capacity of lower middle-income economies to quality upgrade their exports homogeneously. In other words, some of these countries may not have the necessary productive means to enhance the quality of certain goods.

Table 7 displays the mean value of the quality of exports destined to Brazil for fifteen selected industries (HS02) along with their origin countries and income groups[31]. The industries presented in Table 7 are those registering the highest quality levels between 1997 and 2016. Therefore, these industries comprise those imports with the highest quality levels, which might stimulate competition in the Brazilian market.

Table 7 - Average quality of Brazilian imports for selected industries between 1997 and 2016.

HS02	Industry	Quality	Exporter	Income group
88	Aircraft, spacecraft, and parts thereof	5.89	FIN	High income
90	Optical, photo, technical, medical, etc. apparatus	5.00	CHE	High income
30	Pharmaceutical products	4.99	IRL	High income
71	Pearls, precious stones, metals, coins, etc.	4.67	DNK	High income
43	Furskins and artificial fur, manufactures thereof	4.44	DNK	High income
91	Clocks and watches and parts thereof	4.30	TWN	High income
85	Electrical, electronic equipment	4.17	FRA	High income
50	Silk	4.12	ESP	High income
75	Nickel and articles thereof	4.11	JPN	High income
81	Other base metals, cermets, articles thereof	4.04	GBR	High income
93	Arms and ammunition, parts and accessories thereof	4.04	USA	High income
62	Articles of apparel, accessories, not knit or crochet	3.85	USA	High income
61	Articles of apparel, accessories, knit or crochet	3.64	ROM	Upper middle
84	Nuclear reactors, boilers, machinery, etc.	3.51	CHL	High income
65	Headgear and parts thereof	3.26	TWN	High income

Source: Research data.

Table 7 allows a better picture of the product groupings that most promote high-end import competition in Brazil. The list presented in Table 7 encompasses varied industries and consequently a large number of products. From the analysis of Table 7, it is possible to notice that the highest quality levels are observed for 'Aircraft, spacecraft, and parts thereof', 'Optical,

[31] The classification of products in this analysis followed the NCM whose first four digits correspond with the HS. Therefore, the analysis of average industry (HS02) quality was possible without any correspondence tables.

photo, technical, medical, etc. apparatus', and 'Pharmaceutical products'. The quality figures for these industries were not unexpected given that these imply capital- and skill-intensive goods.

Most high-end selected industries presented in Table 7 originate from high-end income countries with the exception of 'Articles of apparel, accessories, knit or crochet' imported from Romania, confirming the analysis presented in Table 6. Among the fifteen highest-quality industries, 'Articles of apparel, accessories, not knit or crochet', 'Articles of apparel, accessories, knit or crochet', 'Nuclear reactors, boilers, machinery, etc.', and 'Headgear and parts thereof' were those with lower average quality levels, originated in the United States, Romania, Chile, and Taiwan, respectively.

The analyses performed in this section aimed to better perceive the data used in this chapter as well as augment the understanding of Brazilian products competing against foreign-made goods. Nevertheless, for more conclusive evidence, the following subsection leads to the results of the econometric estimations, which allow for more precise verification of the assumptions and analyses here presented.

4.2. The quality of imports and wages paid in Brazil

This subsection shows the estimations regarding the relationship between wages paid in Brazil and the quality of the country's imports between 1997 and 2016. First, Table 8 introduces the results of the OLS fixed effects model. Then, Table 9 displays the estimates of the RIF regressions for the unconditional wage distribution quantiles of the logarithm of annual wages. Table 10 advances a little on the results displayed in Table 9 and considers the income groupings of Brazil's main trade partners.

Results presented in Table 8 provide a more general analysis of the effects of the quality of imports entering the Brazilian market on wages paid in the country. Alternatively, the analysis presented in Table 9 uncovered the effect of import quality upgrading on different wage quantiles. The estimated coefficients of the RIF regressions have shown variations along the wage distribution quantiles with respect to the estimated coefficients obtained for the mean. Therefore, these results reinforce the need to use the unconditional quantile regression approach.

Table 8 allows to infer that, for most OLS-FE regressions, there exists a positive and statistically significant relationship between the quality of Brazilian imports and local wages, meaning that as the quality of imports increases, wages paid in Brazil are affected positively. Similarly, Brambilla and Porto (2016) also found a positive association between these two

variables. Nevertheless, these authors investigated whether the quality of a country's exports affected the average wage paid in the exporting country.

As noted in Table 8, from the perspective of import competition, the quality of imports penetrating the Brazilian market has shown to produce a positive effect on local wages. The probable channel causing such an increase relates to the need of the workforce to skill-upgrade, and consequently, be more capable of enhancing the quality of domestically produced goods.

Table 8 - OLS-FE estimations

Variables	(1)	(2)	(3)	(4)	(5)
Quality	0.1238129***	0.001371^{NS}	0.0186283***		0.0029925***
	(0.0015069)	(0.0009826)	(0.0006214)		(0.0005881)
Per capita GDP		3.767584***		1.037244***	1.0332860***
		(0.0062015)		(0.0054438)	(0.0054988)
Output			0.8668912***	0.7189751***	0.7189973***
			(0.0007686)	(0.0010668)	(0.0010688)
Intercept	-21.48137***	-13.839778***	0.0072567^{NS}	-6.04996***	-6.0162730***
	(0.2826747)	(0.1895349)	(0.1168124)	(0.113853)	(0.1140398)
Observations	254,835	254,835	254,835	254,835	254,835
R-squared	0.4297	0.7677	0.9052	0.9168	0.9168
Adj. R-squared	0.4270	0.7666	0.9047	0.9164	0.9164

Source: Research results

Note: Dependent variable is wages. Controls in all columns: exporting country effects, product effects (HS04). Standard errors in parentheses. Significance at 1% level indicated by *** and non-significant indicated by NS.

Like Brambilla and Porto (2016), this study considers that the production of high-end goods requires skilled professionals who subsequently are paid higher wages. Thus, via the skill-upgrading mechanism, local firms producing the most varied products *k* are able to produce higher-quality goods and compete against imported higher-end products, as noted in Maia (2013).

Estimates for the variable quality, shown in columns (1), (3) and (5) in Table 8, indicate that such a variable has a rather small effect on wages paid in Brazil. This order of magnitude could be due to the fact that import quality upgrading affects Brazilian wages indirectly via skill upgrading. Hence, results in Table 8 suggest that as the quality of Brazilian imports increases, there might exist domestic pressure for local firms to enhance the quality of their product. In order to do so, Brazilian firms might respond to this pressure by hiring qualified professionals who earn higher wage levels.

Exploring Table 8 also allows to verify other variables producing a positive effect on Brazilian wages across those products facing import competition. Coefficients for the variable *per capita* GDP confirmed throughout regressions (3), (4), and (5) the assumption presented in

subsection 3.2 that such a variable would deliver positive and statistically significant coefficients. These results reveal that an increase in the Brazilian product causes a rise in the country's average wage. The idea behind this relationship relates to the fact that an increase in the domestic product may be the result of a rise in the number of workers, which consequently has a ripple effect on the overall wage level. As noted by Gremaud *et al.* (2008), as the economic activity grows, unemployment reduces and wage rates tend to raise.

Coefficients for the variable output also exhibited a positive association with the dependent variable. This finding shows that an increase in the output results in a rise in wages paid in Brazil. This relationship could be explained by the fact that as firms producing variety *k* increase their total production level, they require a larger number of workers and for this reason the overall wage raises. As noted in Brambilla and Porto (2016), such a relationship insinuates that a group of higher performance firms producing product *k* would have the necessary means to pay higher wages.

Table 8 showed that there exists a positive relationship between this study's variable of interest – quality – and wages paid by firms producing the most varied products in Brazil. What still remains uncovered is the possibility of import quality upgrading having contrasting effects on different wage levels. Therefore, Table 9 displays the results of the unconditional quantile regression, which tackles this possible issue, and delivers more consistent estimates.

Table 9 - Unconditional quantile regression estimation

Variables	q10	q30	q50	q70	q90
Quality	0.0158882***	0.0104357***	-0.0059146***	-0.0051266***	-0.0069043***
	(0.0028322)	(0.0017108)	(0.0016840)	(0.0016493)	(0.0021595)
Per capita GDP	0.2822422***	0.6477333***	2.0650870***	2.376012***	0.5293485***
	(0.0319692)	(0.177594)	(0.0175474)	(0.0171632)	(0.0189508)
Output	0.7477799***	0.8227827***	0.7812522***	0.6080472***	0.6676340***
	(0.0077477)	(0.0036831)	(0.0035410)	(0.0034683)	(0.0047137)
Intercept	-2.241158***	-5.833741***	-16.70304***	-13.76878***	1.9880340***
	(0.3441127)	(0.2468109)	(0.2842881)	(0.2734008)	(0.6832195)
Observations	254,835	254,835	254,835	254,835	254,835
R-squared	0.5030	0.6558	0.6806	0.6233	0.4353
Adj. R-squared	0.5006	0.6542	0.6790	0.6215	0.4326

Source: Research results

Note: Dependent variable is wages. Controls in all columns: exporting country effects, product effects (HS04). Standard errors in parentheses. Significance at 1% level indicated by ***.

Similarly to Table 8, results displayed in Table 9 suggest a relatively small effect of the quality of imports across the wage distribution quantiles. More specifically, coefficients for the variable quality reveal a positive correlation with the dependent variable for the first two wage

quantiles, q10 and q30. These results indicate that lower wage levels suffer an increase of 1.58% and 1.04% for the q10 and q30 quantiles, respectively, as the quality of imports rises.

Brambilla and Porto (2016) uncover that wages and skills are closely intertwined and that skilled workers are paid higher wages. For this reason, goods produced by lower-paying firms are more likely to be comprised of low-skilled workers. The positive association between quality and the lower bands of the wage distribution could be comprehended by the fact that low-skilled workers show greater potential for skill upgrading given that, as opposed to skilled workers, they are more distant from the skill frontier. In other words, low-skilled workers have a wider spectrum for skill upgrading. Thus, they are more apt to respond (via skill upgrading) to the pressure caused by the quality of international goods.

These results are in line with Aghion and Howitt (2005) and Aghion *et al.* (2009) and the findings in Amiti and Khandelwal (2013) who noted that import competition might cause higher wages (via demand for skilled workers). These authors stressed that the escape-competition effect might induce firms to invest in quality upgrading to survive competition from potential new entrants.

The analysis of higher quantiles discloses an opposing relationship between quality and wages with respect to lower quantiles. Negative and statistically significant coefficients were observed for all upper quantiles, i.e. q50, q70 and q90. Estimates for these quantiles suggest that as the quality of Brazilian imports increases, there exists a decrease in wages paid by firms producing those corresponding goods. Comparing q70 and q90, it is possible to observe that the expected wage reduction is even higher for the extreme quantile. For instance, results in Table 9 imply that the quality of foreign goods entering the Brazilian market would cause a wage reduction of nearly 0.69% for the q90 quantile.

The negative relationship between quality and upper wage quantiles could be better perceived from the probable skill endowment of the workers comprising higher-paying firms. The upper band of the wage distribution encompasses those firms paying the highest wage levels for a given product *k*. Hence, these are the firms whose workers tend to be highly skilled. Given that high-skilled workers have a narrower range for skill upgrading or, in other words, are closer to the skill frontier, enhancing the quality of the domestic output might not be feasible.

These findings follow Amiti and Khandelwal (2013) who also note that import competition discourages those firms distant from the possibility of investing in quality upgrading because they might simply be unable to compete against potential new entrants. Then, a worst-case scenario could be imagined where firms may terminate their operations and

workers are likely to lose their jobs. Thus, firms most likely to close down induce an increase in the supply of skilled workers, causing employment in that industry to inevitably decline, and wages to face cuts, as noted by Chamon (2015).

Per capita GDP and output showed a positive relationship with the dependent variable across the wage distribution quantiles, as shown in Table 9. The magnitude of such a relationship, however, has varied as different quantiles were considered. Estimates for the *per capita* GDP showed a larger impact on wages for the q50 and q70 quantiles. Gremaud *et al.* (2008) confirm that as the product grows, unemployment rates fall and wages tend to increase. A possible explanation for this specific upward movement could be that as the economic activity of Brazil grows, the set of firms paying the wage bands considered in the q50 and q70 quantiles are those demanding the highest number of workers. Consequently, these firms hire more and the wage level in those quantiles face a more significant rise. Output did not show a great discriminatory effect across the quantiles analyzed, implying that the effect of the output onto contrasting wage levels is reasonably homogenous.

Even though results shown in Table 9 reveal that there exist differences in the way the quality of foreign goods interact with wages paid across Brazilian products, it is possible to also notice (as shown in Table 8) that the magnitude of all coefficients are fairly small. This outcome gathers evidence that import quality upgrading has a minor effect on wages paid in the destination country probably because such an effect works its ways indirectly through the skill upgrading mechanism.

Recent literature on quality upgrading has noted that richer countries demand and produce higher-quality goods (BRAMBILLA; PORTO, 2016; CARON; FALLY; MARKUSEN, 2014). In an attempt to advance on the analyses presented so far, Table 10 displays the results of the RIF regressions for three origin country income groups: high-, upper middle- and lower middle-income economies. These results aimed to provide an additional analysis and verify whether the quality of Brazilian imports originated in richer countries had a contrasting impact on wages paid in Brazil.

By reducing the sample to high-income origin countries exporting to Brazil between 1997 and 2016, it is possible to note that coefficients for quality varied insignificantly with respect to the full sample (Table 9). Such slight alterations could be explained by the fact that most of the sampled origin countries are high-income economies, as shown in Table 10. Consistently, the effect of the quality of imports on wages paid in Brazil is small. These results suggest that the quality of products exported to Brazil from rich economies affects lower quantiles of the wage distribution positively and that higher bands of the wage distribution, as

noted for the full sample, are negatively affected by the quality of imports.

Turning now to the comparison among income groups, estimates for high- and upper middle-income countries were expected to deliver higher coefficients for the variable quality when compared to those observed for lower middle-income origin countries. This relationship relates to the income structure of the richer exporting country that, in theory, is better-endowed in terms of capital and skilled labor and consequently has the necessary means to produce higher-quality products (BRAMBILLA; PORTO, 2016).

Nevertheless, results presented in Table 10 for lower middle-income countries show that as the quality of imports sent to Brazil increases, its effect on wage is higher than when these goods come from richer nations. The outcome of this estimation could be understood from the possible lower quality scope of imports produced in poorer economies penetrating the Brazilian market. As Caron, Fally and Markusen (2014) noted, richer countries have the potential to produce higher-end varieties. For this reason, it is sensible to affirm that products originating in lower middle-income economies are of lower-quality in respect of richer nations. These imports are believed to allow a more substantial effect onto wages paid in Brazil given that the quality gap between the domestic and foreign products is narrower. Hence, in this scenario, local firms are capable of responding to import competition faster through the skill upgrading mechanism, which results in a rise in local wages.

These results are consistent with the distance-to-the-frontier models discussed in Amiti and Khandelwal (2013), in which the authors observe that the relationship between import competition and quality depends on the distance of the product to the quality frontier. In their research, the authors drew on the model by Aghion and Howitt (2005), that allows the relationship between competition and innovation to depend on the distance of the product to the quality frontier. Their model highlights two forces. First, for firms far from the frontier, an increase in competition reduces incentives to innovate because *ex-post* rents from innovation are eroded by new entrants. Alternatively, as firms approach the frontier, however, competition can increase incentives to innovate because it reduces firms' pre-innovation rents by more than it reduces their post-innovation rents.

Therefore, imports shipped from lower middle-income countries to Brazil might be closer in quality to domestic products in comparison to foreign-made varieties coming from richer nations. These goods, in turn, offer local firms an incentive to enhance the quality of domestically produced goods and thus compete against international products. To enhance the

Table 10 - Unconditional quantile regression estimations for origin country income groups.

	High-income origin countries				
Variables	q10	q30	q50	q70	q90
Quality	0.0143911***	0.0114447***	-0.010529***	-0.0058554***	-0.0082992**
	(0.0030282)	(0.0024827)	(0.0019377)	(0.0014781)	(0.0033266)
Per capita GDP	0.083083**	0.4077167***	2.078283***	2.129300***	0.80497228***
	(0.0347389)	(0.025852)	(0.020196)	(0.0160187)	(0.0291589)
Output	0.7493854***	1.118331***	0.8232761***	0.4961158***	0.9313234***
	(0.1575168)	(0.0054893)	(0.0041443)	(0.0032362)	(0.0071466)
Intercept	-0.6133238*	-10.59408***	-17.82733***	-9.613629***	-5.384259***
	(0.3299779)	(0.3056079)	(0.3081361)	(0.248899)	(1.118669)
Observations	203,753	203,753	203,753	203,753	203,753
R-squared	0.5072	0.6596	0.6830	0.6345	0.4419
Adj. R-squared	0.5043	0.6576	0.6811	0.6323	0.4386
	Upper middle-income origin countries				
Variables	q10	q30	q50	q70	q90
Quality	0.002316^{NS}	0.105025**	0.0052033^{NS}	-0.0067092^{NS}	-0.0123411***
	(0.0078215)	(0.0043243)	(0.0038833)	(0.0066294)	(0.004282)
Per capita GDP	0.8642831***	0.5624953***	1.867296***	2.829645***	0.3163844***
	(0.0833165)	(0.0429168)	(0.0392787)	(0.0598727)	(0.0343756)
Output	0.6226924***	0.7777757***	0.6301289***	0.8487639***	0.494301***
	(0.0197665)	(0.0086493)	(0.0077118)	(0.0121225)	(0.0087244)
Intercept	-4.010176***	-3.56098***	-10.56553***	-25.80314***	6.769600***
	(0.5449129)	(0.373731)	(0.3596365)	(0.8365792)	(0.5877155)
Observations	36,452	36,452	36,452	36,452	36,452
R-squared	0.5086	0.6767	0.7054	0.6128	0.4850
Adj. R-squared	0.4933	0.6666	0.6962	0.6007	0.4689
	Lower-middle income origin countries				
Variables	q10	q30	q50	q70	q90
Quality	0.0452689***	0.0327605***	0.0082805^{NS}	-0.0093592^{NS}	-0.0238114***
	(0.0135469)	(0.0066298)	(0.0084358)	(0.0086681)	(0.0060079)
Per capita GDP	0.8878566***	0.0986888^{NS}	1.782532***	1.274969***	0.2859052***
	(0.1421637)	(0.0666606)	(0.0821905)	(0.0758205)	(0.0460345)
Output	0.7213897***	0.7880526***	0.9196413***	0.8101934***	0.4667745***
	(0.0330733)	(0.0122096)	(0.0152694)	(0.0151353)	(0.0112877)
Intercept	-11.56723***	0.8365503^{NS}	-16.41474***	-7.827658***	9.787451***
	(1.013298)	(0.5131405)	(0.6137687)	(0.5837989)	(0.365335)
Observations	14,630	14,630	14,630	14,630	14,630
R-squared	0.5208	0.6944	0.7083	0.6315	0.5057
Adj. R-squared	0.4885	0.6737	0.6886	0.6067	0.4724

Source: Research results

Note: Dependent variable is wages. Controls in all columns: exporting country effects, product effects (HS04). Standard errors in parentheses. Significance at 1%, 5% and 10% levels indicated by ***, ** and *. Statistically non-significant indicated by NS.

quality of the output, local firms feel the need to hire qualified professionals who are paid higher wages.

Another possible reason why the quality of goods sent to Brazil from all the varied income groupings behaves towards the results presented in Table 10 is the demand-side driver. For instance, Brambilla and Porto (2016) and Caron, Fally and Markusen (2014) discuss the intensity of trade among rich nations. For the authors, given the fact that richer economies demand and produce higher-quality goods, as a consequence, trade between rich economies is more intense, especially in higher-end varieties. According to the World Bank (2019), Brazil is considered an upper middle-income country, meaning that its population consists of consumers that are moderately demanding when it comes to quality but still not as demanding as those from developed richer economies. These perceptions could explain why the quality of imports produces a rather small effect on wages paid in Brazil from the demand-side perspective.

The analysis of Table 10 also allows to observe that for all income groups *per capita* GDP affects wages positively across all wage distribution quantiles. Coefficients did not allow for the observation of a clear pattern among income groups. Similarly, output did not show any strong evidence that such a variable may affect wages differently when considering contrasting income groupings.

5. Conclusions

This study aimed to investigate the relationship between the quality of Brazilian imports and wages paid in the country from 1997 to 2016. On average, results denote a positive effect of the quality of imports on Brazilian wages, suggesting that as the quality of imported goods increases, the average wage in Brazil also rises. Nevertheless, when the analysis was conducted for contrasting wage quantiles, it was possible to observe that the quality of foreign products in the Brazilian market affects wage bands differently. The outcome of this analysis revealed that the quality of imports has a positive effect on lower band wage quantiles. Contrarily, the upper band quantiles of the wage distribution exhibited a negative relationship with the variable of interest – quality.

This study also provided an additional analysis and observed whether quality affected differing wage quantiles when considering the income levels of the exporting country shipping its products to Brazil. Results indicated that the quality of imports originated from poorer economies affects wages paid in Brazil slightly more in respect of richer countries (high- and upper middle-income nations).

This study unveiled that the effect of the quality of Brazilian imports on wages is rather

small. This outcome was observed in the analysis of the full sample regressed on average wages, and along the wage distribution quantiles for the whole sample and also when taking into account the origin country's income differentials, regardless of their relationship: positive or negative. The magnitude of the coefficients might narrate the indirect association between the quality of foreign goods in competition with locally produced varieties and their effects onto wages paid in Brazil between 1997 and 2016.

Throughout the all the analyses conducted in this research, it was possible to also gather evidence of other variables affecting the wage levels in the Brazilian economy. The investigation of the connection between the national product and wages paid by firms producing goods that face import competition as well as the association between output and wages showed that as the average *per capita* product and output increase, wages are positively affected. This outcome was also observed along differing wage quantiles and for different origin country income groups.

With respect to limitations, this study faced the challenge of working with product-level data. In other words, information on wages referred to the total wage paid by a set of firms producing a given product *k.* The use of more disaggregated information, at the firm level, for instance, would have the potential to allow for capturing the differentiating components of goods exported to Brazil within each firm. This means that each firm could export differing variations of products in terms of quality and direct them to different markets. Data at the firm level could also allow for more precise information on wages paid by each firm facing import competition instead of the sum of wages paid by a whole set of local organizations.

Another limitation to this study is the proxy for the quality of imports. Although it has been long addressed in several papers in the trade literature (BASTOS; SILVA, 2010, BRAMBILLA; PORTO, 2016; FLACH, 2016, HALLAK, 2006), the most recent studies have not yet found a common ground when it comes to an ideal measurement of such a variable. Future studies on the topic might as well explore the quality calculation more intensively and strive to improve it, in order to approximate as much as possible to a more realistic quality measure.

FINAL REMARKS

Global trade has shown to play an important role in raising living standards, providing employment and enabling consumers to enjoy a wider variety of products. International trade allows to expand the domestic market for both goods and services that otherwise would not have been available. As a result, internationally traded products promote greater competition and therefore might represent an incentive for firms to enhance the quality of their output. Furthermore, countries engaged in international transactions benefit from higher income generation and more rapid economic development. For these reasons, a better understanding of the variables affecting and being affected by foreign trade became timely.

This master's thesis comprised two chapters on international trade and quality upgrading. The first chapter related various types of EIAs and the quality of bilateral exports between 2000 and 2017. More recently, in numerous trade agreements, negotiations go beyond tariffs to cover multiple policy areas that impact trade and investments in goods and services. These policies might include behind-the-border regulations such as competition policy, government procurement rules, and intellectual property rights. Therefore, the investigation of differing stages of EIAs delivered a more consistent analysis regarding their impacts onto the quality of exported goods.

The outcome of the first chapter showed the importance of EIAs in determining the quality standards of exported goods. Regardless of the sampled countries' income differentials, the analyses conducted in this study mostly uncovered a positive relationship between shallower and also deeper EIAs and the quality of their member countries' exports. However, the magnitude of such a relationship varied according to the exporter and importer incomes and also the type of trade agreement. This study also unveiled that deeper levels of EIAs, such as a CU, impact the quality of exports more than shallower agreements, such as a PSA or FTA.

The first chapter also found that there exists a positive link between the GDP and the quality of exports. This association indicated that as the economic activity of exporting and importing economies grows, the quality of exports rises, probably because of an increase in the productive capacity and via an intensification of the demand for better products, respectively.

The investigations documented in the first chapter provided thorough analyses on the most varied types of EIAs. Moreover, it advanced on Baier, Bergstrand and Feng (2014) by investigating the effects of EIAs on the quality of exports. It also added to Bas and Paunov (2018) by considering other aspects of agreements, besides trade liberalization, that too influence the quality of internationally traded goods. When it comes to policy implications, the

first chapter of this thesis discloses that economies focusing on quality upgrading might as well consider that the participation or even efforts to the formation of deeper EIAs result in higher-quality trade. On the other hand, policymakers concentrating on reducing or eliminating barriers to trade should consider that trade agreements might have an end effect on the quality of a country's output.

The second chapter of this master's thesis aimed to examine the relationship between the quality of imports and wages paid in Brazil between 1997 and 2016. This study showed a positive impact of the quality of imports on wages paid by firms producing goods facing import competition. The outcome of this study revealed that the magnitude of this association is rather small. Such a finding probably relates to the fact that the quality of imports affects wages indirectly via the skill-upgrading mechanism.

The second chapter also uncovered additional results by taking into account the income levels of the exporting country shipping its products to Brazil. This analysis disclosed that the quality of imports sent from poorer nations seemed to affect Brazilian wages slightly more than that observed for goods originated in richer economies. This finding possibly links with a narrower quality gap between national and imported varieties. This, in turn, facilitates the quality upgrading of the domestic product (via the skill-upgrading mechanism) and thus, results in higher wages.

The outcome of the second chapter presented the prominence of import competition to quality upgrading and wages paid in Brazil. Besides, the analyses carried out in this study, unlike Brambilla and Porto (2016), explored the relationship between quality and wages from a novel perspective – the destination country. In the matter of policy propositions the evidence gathered in the second chapter allows the conduct of better shaped trade policies in favor of Brazilian producers. Also, this study acknowledges the need for labor qualification incentives and technology adoption subsidies so that firms are able to enhance the quality of their output when facing import competition.

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APPENDIX

Table 11 - Main world exporters (selected countries) and average share of global exports between 2000 and 2017.

Exporter	Share	Exporter	Share
China	11,76%	Sweden	1,22%
United States	10,35%	Poland	1,19%
Germany	10,04%	Austria	1,16%
Japan	5,56%	Indonesia	1,09%
France	4,13%	Czechia	1,00%
Italy	3,69%	Ireland	0,99%
Netherlands	3,68%	Norway	0,98%
United Kingdom	3,64%	Turkey	0,90%
South Korea	3,41%	Denmark	0,78%
Canada	3,31%	Vietnam	0,71%
Belgium	3,27%	Hungary	0,71%
Russian Federation	2,80%	Finland	0,58%
Singapore	2,54%	South Africa	0,57%
Mexico	2,46%	Slovakia	0,48%
Spain	2,05%	Chile	0,48%
Switzerland	1,75%	Argentina	0,47%
India	1,60%	Israel	0,45%
Malaysia	1,50%	Philippines	0,42%
Australia	1,41%	Portugal	0,42%
Brazil	1,41%	Kazakhstan	0,40%

Source: Author's calculations.

Table 12 - List of selected countries by income structure.

High income		Upper middle income	Lower middle income
Argentina	Italy	Brazil	India
Australia	Japan	China	Indonesia
Austria	Netherlands	Kazakhstan	Philippines
Belgium	Norway	Malaysia	Vietnam
Canada	Poland	Mexico	
Chile	Portugal	Russian Federation	
Czechia	Singapore	South Africa	
Denmark	Slovakia	Turkey	
Finland	South Korea		
France	Spain		
Germany	Sweden		
Hungary	Switzerland		
Ireland	United Kingdom		
Israel	United States		

Source: Author's calculations

Table 13 - List of economic integration agreements considered in the analyses of the first essay.

Economic integration agreement	Entry into force	Economic integration agreement	Entry into force
Argentina - Brazil	01-Jul-16	China - Singapore	01-Jan-09
Argentina - Mexico	01-Jan-87	Common Economic Zone	20-May-04
ASEAN - Australia - New Zealand	01-Jan-10	European Community Treaty	01-Jan-58
ASEAN - China	01-Jan-05	EFTA - Canada	01-Jul-09
ASEAN - India	01-Jan-10	EFTA - Chile	01-Dec-04
ASEAN - Japan	01-Dec-08	EFTA - Israel	01-Jan-93
ASEAN - Korea, Republic of	01-Jan-10	EFTA - Korea, Republic of	01-Sep-06
ASEAN Free Trade Area	01-Jan-93	EFTA - Mexico	01-Jul-01
Asia Pacific Trade Agreement	17-Jun-76	EFTA - SACU	01-May-08
Australia - Chile	06-Mar-09	EFTA - Singapore	01-Jan-03
Australia - China	20-Dec-15	EFTA - Turkey	01-Apr-92
Brazil - Mexico	02-May-03	EU - Canada	21-Sep-17
Canada - Chile	05-Jul-97	EU - Chile	01-Feb-03
Canada - Colombia	15-Aug-11	EU - Israel	01-Jun-00
Canada - Israel	01-Jan-97	EU - Japan	01-Feb-19
Canada - Korea, Republic of	01-Jan-15	EU - Korea, Republic of	01-Jul-11
Chile - China	01-Oct-06	EU - Mexico	01-Jul-00
Chile - Colombia	08-May-09	EU - Norway	01-Jul-73
Chile - India	17-Aug-07	EU - SADC	10-Oct-16
Chile - Japan	03-Sep-07	EU - South Africa	01-Jan-00
Chile - Malaysia	25-Feb-12	EU - Switzerland - Liechtenstein	01-Jan-73
Chile - Mexico	01-Aug-99	EU - Turkey	01-Jan-96
Chile - Viet Nam	01-Jan-14	EAEU	01-Jan-15
China - Korea, Republic of	20-Dec-15	EAEU - Vietnam	05-Oct-16

(continues)

Economic integration agreement	Entry into force	Economic integration agreement	Entry into force
EFTA	03-May-60	Malaysia - Australia	01-Jan-13
GSTP	19-Apr-89	NAFTA	01-Jan-94
India - Japan	01-Aug-11	Pacific Alliance	01-May-16
India - Malaysia	01-Jul-11	Protocol on Trade Negotiations	11-Feb-73
India - Singapore	01-Aug-05	Russian Federation - Belarus - Kazakhstan	03-Dec-97
Israel - Mexico	01-Jul-00	Singapore - Australia	28-Jul-03
Japan - Australia	15-Jan-15	Mercosur	29-Nov-91
Japan - Indonesia	01-Jul-08	Mercosur - Chile	10-Mar-17
Japan - Malaysia	13-Jul-06	Mercosur - India	01-Jun-09
Japan - Mexico	01-Apr-05	Mercosur - Israel	23-Dec-09
Japan - Philippines	11-Dec-08	Mercosur - Mexico	28-Dec-16
Japan - Singapore	30-Nov-02	Mercosur - SACU	01-Apr-16
Japan - Switzerland	01-Sep-09	Switzerland - China	01-Jul-14
Japan - Viet Nam	01-Oct-09	CIS	20-Sep-12
Jordan - Singapore	22-Aug-05	Turkey - Chile	01-Mar-11
Korea, Republic of - Australia	12-Dec-14	Turkey - Israel	01-May-97
Korea, Republic of - Chile	01-Apr-04	Turkey - Malaysia	01-Aug-15
Korea, Republic of - India	01-Jan-10	Turkey - Singapore	01-Oct-17
Korea, Republic of - Singapore	02-Mar-06	United States - Australia	01-Jan-05
Korea, Republic of - Turkey	01-May-13	United States - Chile	01-Jan-04
Korea, Republic of - United States	15-Mar-12	United States - Israel	19-Aug-85
Korea, Republic of - Viet Nam	20-Dec-15	United States - Singapore	01-Jan-04
LAIA	18-Mar-81		

Source: Author's calculations.

Note: ASEAN: Association of Southeast Asian Nations. CIS: Treaty on a Free Trade Area between members of the Commonwealth of Independent States. EFTA: European Free Trade Agreement. EU: European Union. EAEU: Eurasian Economic Union. GSTP: Global System of Trade Preferences among Developing Countries. LAIA: Latin American Integration Association. SACU: Southern African Customs Union.

Table 14 - Main trade exporters to Brazil and average share of Brazilian imports between 1997 and 2016.

Exporter	Share	Exporter	Share	Exporter	Share
United States	16,74%	Malaysia	0,92%	Egypt	0,09%
China	12,33%	Thailand	0,88%	Tunisia	0,06%
Argentina	8,19%	Uruguay	0,87%	Slovakia	0,06%
Germany	7,14%	Indonesia	0,72%	Ecuador	0,05%
Japan	3,79%	Australia	0,63%	New Zealand	0,05%
South Korea	3,57%	Peru	0,63%	Latvia	0,03%
Italy	3,09%	Austria	0,62%	Oman	0,02%
France	2,87%	Venezuela	0,61%	Sri Lanka	0,02%
Mexico	2,09%	Colombia	0,52%	Lithuania	0,01%
Chile	2,06%	Finland	0,47%	Croatia	0,01%
India	2,03%	Hong Kong	0,46%	Guatemala	0,01%
Spain	1,75%	Morocco	0,45%	Iceland	0,01%
United Kingdom	1,75%	Norway	0,41%	Cyprus	0,01%
Algeria	1,58%	Portugal	0,39%	Honduras	0,00%
Canada	1,50%	Denmark	0,34%	Jordan	0,00%
Switerland	1,44%	Ireland	0,33%	El Salvador	0,00%
Saudi Arabia	1,42%	Poland	0,26%	Mauritius	0,00%
Bolivia	1,30%	Hungary	0,17%	Madagascar	0,00%
Netherlands	1,11%	Costa Rica	0,14%	Central African Rep.	0,00%
Sweden	1,00%	Romania	0,10%	Belize	0,00%

Source: Author's calculations.